NATIONAL BUREAU OF STANDARDS REPORT

8375

REPORT ON INTERNATIONAL TRAVEL TO EUROPE

1) TO ATTEND THE INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO) MEETING ON THE CHEMICAL ANALYSIS OF TEXTILES
2) TO DISCUSS STANDARDIZATION, TEST METHODS, RESEARCH AND EDUCATION AT VARIOUS EUROPEAN LABORATORIES

April 23 - May 13, 1964

by

Emanuel Horowitz
Polymer Characterization Section
Polymers Division

NBS

U.S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

THE NATIONAL BUREAU OF STANDARDS

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A B S T R A C T

This report summarizes the activities connected with the meeting of ISO/TC 38/WG 5: Chemical Testing of Textiles which was held in Budapest, Hungary and also gives an account of technical visits to various European government, industrial and academic laboratories working in the fields of standardization, test methods, testing, research and education.

S U M M A R Y

In discussions with European scientists and administrators and in visits to government, industrial and university laboratories one is impressed by the recognition of the importance of the role of modern science and technology in the affairs of these countries. Almost without exception programs covering a wide spectrum of technical activities are being strongly supported, new laboratories are under construction or in the planning stage and emphasis is being given to the training of new scientists and technologists. Scientific activity is of high quality and there appears to be a great deal of industrial vitality and growth.

One cannot escape the questions relating to the present and future status of American science and technology and to a comparison of the effort being expended in this country and abroad on programs of an academic and non-military nature. In addition, one is forced to think about these questions in terms of their impact on the United States with respect to our scientific, economic and political posture in the world.

First, it is important for the Department of Commerce through its scientific agencies to participate actively in international technical and standardization organizations so that we may keep abreast of current developments and be in a position to shape the standards that are developed. By not being sufficiently active in these organizations the United States is neglecting an opportunity of scientific and economic importance. For example, the United States is not a member of BISFA, the International Bureau for the Standardization of Man-Made Fibers which develops rules, definitions, sampling procedures and standards for synthetic fibers as a basis for international commercial transactions.

Another observation deals with the communication that exists between government, university and industrial laboratories. For example, at the Institute for Textile Engineering and Textile Industries in Zurich, technological problems of mutual interest to the institute and the textile industry are being studied, using commercial manufacturing equipment and textile

testing equipment. At EMPA, the Institute for Materials Testing and Research in Dübendorf, Switzerland, where approximately 40 percent of the program is supported by industry, the properties of materials are investigated and products are evaluated. In other government, industrial and university laboratories there is also evidence of overlapping interests and cooperation. Is there a similar awareness in the United States of the mutual problems, both scientific and technological, that exists in government, industry and at the university? If not, we need to take greater advantage of fellowship programs, exchange of guest workers, establishment of research associates, and other means of communication between the various segments of our scientific and industrial community.

In all these areas which touch government, industry and university activities we need to be concerned with the new problems that are emerging as a consequence of scientific and technological developments in other nations. We also need to assure ourselves that, in the years that lie ahead, enough is done in the United States to enable us to meet this competition.

In the academic area abroad one sees the obvious competence of the staff and the high standards that are maintained for the students. At the technical universities there is, of course, a deep involvement with problems related to industries engaged with production and manufacture of civilian consumer goods.

PART I. TEXTILES

1. British Standards Institution, London, England, Mr. A.F.B. Nall, April 24, 1964

In a meeting with Mr. Nall, the program of the British Standards Institution (BSI) and its relationship with standardization actitivies in the United Kingdom and the International Organization for Standardization were discussed.

The BSI is a private institution with a staff of about 450 and is engaged in the preparation of standards for government, industry and professional associations. The Institution supports a laboratory at Haverford which performs tests on a variety of materials and also develops performance criteria for use in specifications. For example, at present, work is being done on plastic helmets and seat belts. BSI derives its funds from three sources; 1/3 from the sale of its publications, 1/3 in the form of donations from industry and the remainder from the government.

The problem of establishing standards based on modern instrumental methods of chemical analysis for textiles and other polymeric materials was discussed in considerable detail. In fact, a review of the test methods under the jurisdiction of ISO/TC 38/WG 5 disclosed that there were no methods based on modern instrumental techniques. Several schemes based on spectroscopic and thermal methods of analysis were discussed as alternate procedures for the classical wet methods. For example, questions dealing with the chemical analysis of fiber mixtures were reviewed including the qualitative and quantitative methods for samples containing binary and tertiary mixtures of synthetic and natural fibers. Two other important problems dealt with the sampling procedures to be employed for the analysis of mixtures of fibers and the elimination of non-fibrous matter from the sample. It was suggested that these questions be raised at the Budapest meeting with Mr. Richardson, Chairman of ISO/TC 38/WG 5.

2. Meeting of ISO/TC 38/WG 5: Chemical Testing of Textiles, Budapest, Hungary, April 27-May 1,1964

a) Delegates

Delegates from eight countries participated in the ISO meeting: Belgium, Bulgaria, France, West Germany, Hungary, Switzerland, United Kingdom and the United States. Two of the countries, Bulgaria and the United States, were represented for the first time since the group had begun meeting on an annual basis eight years ago. The delegates were, for the most part, chemists who were professionally employed in government, industrial and institute laboratories. Dr. Emanuel Horowitz of the National Bureau of Standards, who was accredited by the American Standards Association, was the delegate representing the United States.

b) Agenda

The following topics were discussed at the ISO/TC 38/WG 5 meeting:

Document	Title
101	Draft Recommendation for a Method for Determining the Fluidity in Cuprammonium Hydroxide Solution of Cotton, Linen and Regenerated Cellulose Rayon Textile Materials
117	Experimental Comparison of Solubility of Cottons
118	Quantitative Chemical Analysis of Mixtures of Polyester Fibres with Cotton or Regenerated Cellulose
119	Hungarian Proposal for Quantitative Chemical Analysis of Binary Mixtures of Cotton and Polyester Fibres
120	Hungarian Proposal for Quantitative Chemical Analysis of Binary Mixtures of Regenerated Cellulose and Polyester Fibres

b) Agenda (continued)

Document	Title
121	Hungarian Proposal for Quantitative Chemical Analysis of Binary Mixtures of Acrylic and Certain Other Fibres
122	German Proposal for an ISO Recommendation on the Quantitative Chemical Analysis of Mixtures of Certain Regenerated Cellulose Fibres and Cotton
123	4th Draft-Methods of Sampling for Chemical Testing
124	Test for the Fluidity of Cotton, Rayons and Cellulose Acetate in Cupriethylenediamine Solution
125	Comments on 'Analysis of Mixtures of Polyester and Cotton'
126	Sampling
128	Interlaboratory Tests - Polyester/Wool in Accordance with DIR 479
129	Comments on Methods of Analysis of Fiber Mixtures
130	Comments on Fluidity of Cotton, Rayons and Cellulose Acetate in Cupriethylenediamine Solution
132	The Modified Cuoxam-Method for Determination of the D.P. of Cellulosic Fibres
133	Determination of the Degree of Thermofixation by Measuring the Time of Dissolution
ITF	Draft Recommendations for Determining the Intrinsic Viscosity of Cellulose in Aqueous Cupri-Di-Ethylenediamine Hydroxide Solution - Institut Textile de France

c) Accomplishments

1) Three documents, 118, 122 and 123 were amended and were forwarded to TC 38 for letter ballot.

2) Three proposals submitted by the Hungarian delegation, documents 119, 120 and 121, were withdrawn because of certain limitations. For example, the results obtained with the $AlCl_3 \cdot 6H_2O$ method (Doc. 119) were shown to be variable and too dependent on the technique of the operator. The cuprammonium solvent method (Doc. 120) was more complicated and no more accurate than the existing H_2SO_4 method. The potassium rhodanide method (Doc. 121) was withdrawn because it was demonstrated that acrylic fibers were not completely soluble in the KSCN solution.

3) Document 133 was withdrawn for additional review and revision by the Hungarian delegation and will be recirculated.

4) Tests made in five countries on the solubility of cotton showed that the Marschall Method and Zincate Method could be used in the fluidity range of 14 to 20 rhes. The Zincate Method gave results that were low by 1-2 percent while the Marschall Method gave results that were high by 3-4 percent. In the Zincate Method low results are obtained when the fibers have been treated with resins and these are not completely removed prior to analysis. The high values in the Marschall Method are attributed to reaction between the fibers and the solvent.

5) An interlaboratory experiment was designed to evaluate the procedure for elimination of the formylization reaction which occurs under certain conditions in the Marschall Method (Analysis of Mixtures of Regenerated Cellulose and Cotton) resulting in high results for the analysis.

6) Confidence limits were established for the approved methods.

d) Technical Visits

1. Textile Research Institute, Budapest, Hungary, April 29, 1964.

Dr. V. Dischka and Staff

Dr. Dischka first translated the welcoming address by the Administrator of the Textile Research Institute. He said that prior to World War II there was no organized textile research program in Hungary. Work at the Textile Research Institute was started in 1950 and the center is the only one of its kind in Hungary. It contains work dealing with every sector of the textile industry rather than having separate institutes for cotton, wool, synthetics, etc.

There are 400 people on the staff of the Institute, with 70 possessing university degrees and the remainder being supporting personnel. The organization of the Institute includes the following major divisions: 1) spinning, 2) weaving, 3) ready-made fabrics, 4) chemistry, 5) glass fibers, 6) experimental machinery, 7) instruments, and 8) fundamental research. A small economic analysis group was also attached to the Institute. Great emphasis is placed on programs connected with developments in the textile industry. Also, close connections are maintained with the textile industry in order to identify existing problems and problems that might arise in the future. Programs that are proposed by the Institute are reviewed by a Technical Advisory Council and if they are approved, work is started on the project.

The budget of the Institute is allocated to the following programs:

a) 25% - Development of Products

Designed to raise the quality level of textile products. Utilization of synthetic fibers in existing or new products. Development of textile terminology.

b) 20% - Development of Technology. Introduction of modern methods in textile industry.

Technical staff was provided to industry for the calibration of testing machines and setting and calibration of manufacturing machines.

c) 15% - Automation and Development of Apparatus.

d) 15% - Design of New Machinery for Finishing Textiles.

e) 18% - Standardization and Material Testing. (This has just been increased to 22%.)

f) 5% - Fundamental Research. Physical and Chemical Properties of Textiles.

g) 2% - Economic Analysis - Some current problems are: 1) Conversion to modern machinery in the textile industry and 2) Utilization of textiles.

Dr. Dischka then conducted the delegates on a tour of the Institute. The following work was in progress: 1) Relaxation behavior of fibers in the temperature range 20°C to 150°C, 2) Effects of winding filaments under tension, 3) Stress-strain characteristics of filaments in different environments; 30%-85% relative humidity, -20°C to 90°C, using apparatus made by Brabender, West Germany, and 4) Fiber length studies of natural fibers, 5) Abrasion of textiles, 6) Thermal conductivity of textiles, 7) Measurement of creep in fibers, 8) Chemical analysis of textile fibers, 9) The effect of temperature on synthetic fibers as determined by chemical methods, and 10) Determination of viscosity of cellulose.

2. <u>Hungarian Technical and Scientific Society of the Textile Institute, Budapest, Hungary, April 29, 1964.</u>

Mr. P. Fusti, General Secretary

One evening was devoted to a visit to the office of the General Secretary, Mr. P. Fusti, where the delegates to the ISO Meeting and representatives from the Hungarian textile industry and members of the Hungarian Office of Standardization engaged in technical discussions. A variety of textile topics were discussed including standardization activities, development of test methods, technological problems, and research. The problems related to the training of technical personnel, the modernization of plant facilities and the expansion of synthetic fiber production are being studied in Hungary. The Technical and Scientific Society published a journal, Magyar Textiltechnika, which featured technical papers on textiles which were written by members of the Society. The Society also sponsored technical meetings and conferences and the program of the forthcoming Hungarian Textile Technical Conference to be held in Budapest, June 9-12, 1964, was distributed. Sixteen nations including the United States were participating in the Conference at which more than 60 papers on textile engineering, physics and chemistry were to be presented. Some of the work of the Society dealt with the dissimenation of scientific and technical information and the coordination of technical and industrial activities in the textile field.

3. Swiss Federal Institute of Technology, Institute for Textile Engineering and Textile Industries, Zurich, Switzerland, May 4, 1964.

Professor H. Krause, Director

Professor Krause, a former student of Professor Honegger, became Director of the Institute upon the retirement of Professor Honegger at the age of 70. About 400 students were enrolled at the Institute and were working for engineering degrees in twelve fields such as textiles, plastics, aerodynamics, architecture, etc. Very few of the students continued their formal studies after graduation with the equivalent of a Masters Degree in Engineering, mostly because of the demand for trained engineers by Swiss industry. Almost all the work is of a practical nature and related to technological problems in industry and very little effort is devoted to basic research. The Institute is supported by the government and the student tuition fee is nominal, about $90.00 per semester.

The facilities included 1) a small wind tunnel for aerodynamic studies and 2) the usual type of electrical and mechanical engineering student laboratory equipment. The textile machine laboratories were viewed in detail and these contained textile manufacturing equipment and apparatus for studying various problems related to spinning, weaving, processing and finishing.

The textile laboratories were well equipped with textile machines of all types. There was a Sutzer loom having shuttle guides 85 inches, 100 inches and 130 inches and capable of operating at 280 picks per minute for the 85 inch guide and 220 picks per minute for the 130 inch guide. This loom operated with a small, flat metal shuttle which performed at twice the speed of the normal shuttle. Ruti looms were used by students in the design of fabrics and the study of loom performance under various conditions. Professor Krause expressed the opinion that these looms were the most extensively sold looms in the world. These looms were equipped with strain gauges to measure the tension on the yarns. The characteristics of the shuttle in flight were also being investigated. The acceleration, position-time relationship, etc. of the shuttle were being evaluated with a Loepfe photoelectric cell and accessory equipment manufactured in Zurich. In addition, a shadowgraph technique employing a photoelectric system was used to record the geometry of the spool and automatically introduce corrections into the yarn feeding process. The laboratory was also equipped with a Rieter cording machine, drawing frames and roving frames. In addition there was a large array of textile testing machines including 1) Vibrascope (Custom Scientific Company, USA), 2) Rockbank Twist Counter (British), 3) Uster Automatic Tensile Tester, 4) Digital Fibrograph (Spinlab Company, Knoxville, Tennessee), etc.

4. EMPA (Institute for Materials Testing and Research), Dübendorf, Switzerland, May 4, 1964.

Professor Ed. Amstutz, Director,
Professor E. Honegger, Former Director,
Swiss Federal Institute of Technology, and
EMPA Staff

Professor Honegger, who had arranged the visit to EMPA, was also present during the meeting with Professor Amstutz and the tour of the Institute. The laboratories were new and impressive having been completed within the past few years at a cost of about $17 million. The physical arrangement of the building and of the services within each building were excellent and the design of the laboratories attested to the careful and detailed planning that went into this facility. The Institute was divided into three departments. Department A under Professor Amstutz consisted of eight sections which dealt with building materials, cement and concrete, metals, wood, sound, fire, non-destructive testing and techniques of measurement. Department B under Professor E. Brandenburger consisted of ten sections; chemistry of metals and inorganic physical chemistry, paints and varnishes, chemistry of building materials, organic chemistry, plastics, fuels, road and insulating materials, corrosion, industrial dusts and gases. The third department located at St. Gallen has sections working in the following fields: textiles, leather, fats and oils, paper, physical-chemical-biological investigations.

Approximately 40 percent of the budget of the Institute was derived from the Swiss government, another 40 percent came from industry and about 20 percent was collected in the form of test fees. Industry as well as government agencies could obtain technical assistance from the Institute and most of this work dealt with the solution of practical or technological problems. Professor Amstutz said that work at the Institute on building materials had led to the development of a new type of load-bearing brick that was now in wide use in the industry. In textiles, investigations were in progress on natural and synthetic fibers, twine, apparel, non-woven fabrics and technical problems of concern to the textile industry.

Physical and chemical tests were made to evaluate the quality of textile products. Work was being done on the chemical analysis for textile fibers, non-fibrous materials, moisture content, etc. and new methods of test were being developed and evaluated.

5. Ciba Limited, Basel, Switzerland, May 5, 1964.

Dr. G. Dürig, Associate Director
Development and Applications Department

The headquarters for Ciba Limited located at Basel employed about 8,000 people who were engaged in chemical manufacturing, research, development and testing. The four divisions at Basel were Administration, Color, Pharmaceuticals and Synthetics. Each division was divided into departments and in the Color Division these were Engineering, Research, Manufacturing, Development and Applications, and Sales. About 750 scientists, technicians and supporting personnel were employed in the Development and Applications Department in sections dealing with textile testing, microscopy, paper, plastics, technical products and product development. More than 250 people were working on chemical and physical problems in the field of plastics. The laboratories were equipped with the most modern equipment in use in the plastics industry for manufacturing, extruding, milling, coating, dyeing and printing. In addition, the latest physical and testing equipment was available for characterizing and evaluating the finished products and their constituents. The laboratory was equipped with apparatus for producing fibers on an industrial scale. Here many of the factors pertaining to fiber formation, dyeing, etc. were studied in detail. More than 2,000 new dyes were synthesized each year in the organic synthesis laboratories and many of these were incorporated into the fibers produced in this department. Later the dyes were evaluated in terms of their light fastness and their effect on the chemical and physical properties of the fibers. Dr. Dürig pointed out that in this way the company was able to evaluate its own products and maintain competence in areas of interest to its fiber producing and dye customers. An extensive fading test program was in progress and in one laboratory more than 20 German Xenon Lamps were in operation on a 24-hour basis under carefully controlled conditions. Fading tests were also conducted using 14 late model Atlas Electric Fade-ometers. In one laboratory the entire ceiling consisted of a skylight equipped with easily accessible panels for use in sunlight exposure tests. A great deal of testing and evaluation work was in progress in many areas of textiles, plastics and paper. The results of a study on the abrasion characteristics of textiles was discussed (Schweizer Archiv 25, 8-15, 1959).

Dr. Dürig compared the Swiss system of developing standards with the procedures used in other countries. In Switzerland the government interests in standards are represented by scientists working at EMPA in Dübendorf and St. Gallen. The Swiss Standardization Office is responsible for establishing technical committees and members are selected from EMPA, industry, and to a lesser extent from university laboratories. These members review, circulate and recommend the adoption of standards. Thus there is a single set of standards acceptable to industry, government and academic institutions. Within this framework standards that are used specifically by the government for military and civilian procurement and testing are established on a more rigid basis while the those which are used in non-government business may be less severe. The Swiss standardization activity was govermed by a Central Office of Standardization and the standards had one format. Dr. Dürig complained that there were many different standards and formats in the United States and that Swiss industry had to be cognizant of all of them and that this was often difficult or impossible. Frequently, a variety of testing equipment was required under the different standards and personnel had to be trained to conduct tests under the different standards. He said that where possible Swiss industry was dealing with German companies because they felt that the German standards were under the jurisdiction of a Central Office of Standardization and therefore were more uniform and self-consistent than those found in the United States.

6. <u>Fabenfabriken Bayer, A.G., Physikalischen Forschungs Laboratorium, Leverkusen, Germany, May 8, 1964</u>

Dr. O. Koch, Director
Dr. G. Hentze
Dr. W. Hoffman

Dr. Koch said that the plant at Leverkusen employed about 35,000 people and was both a chemical manufacturing, research and testing center. Perhaps 3,000-4,000 people were engaged in research, development and testing. Dr. Koch's laboratory was concerned with the physical and chemical evaluation of polymers, and other chemicals particularly textiles, dyes, and organic intermediates. He expressed an interest in the Bureau's work on coordination polymers, chemical analysis and testing and these activities were described.

During the tour the physical chemistry laboratory was visited. It contained many analytical instruments such as: Perkin-Elmer 221, Cary Model 31, Raman Spectrometer, recording ultraviolet spectrometer, Varian's 1956 model and 1962 model, A60 NMR and a Varian EPR instrument. Other equipment included gas chromatographic equipment, emission spectroscopic equipment, and the usual analytical instruments.

One laboratory was devoted to the analysis and characterization of polymers and chemicals by thermal methods and other techniques. Differential thermal analysis and thermogravimetric analysis equipment, designed and built in the laboratory, was in use on various polymer and chemical samples. An adaptation had been incorporated in the DTA apparatus which made it possible to record, concurrently, the endotherms and exotherms as well as the evolution or absorption of gases. In several DTA runs the phase transitions were accompanied by gas evolution or absorption.

In another laboratory, the rheological and fatigue properties of textile filaments were being studied. A new technique for determining and evaluating the hysteresis loop of textile filaments had been developed (Rheologica Acta <u>1</u>, 549-560(1961).

7. Institute Textile de France, Paris, France, May 11, 1964.

Dr. A. Parisot, Director
Chemistry Laboratory
Dr. M. Kassenbeck, Director
Physics Laboratory

Dr. Parisot and his staff described the work of the chemistry laboratory which involved the chemical analysis of textile fibers mixtures, analysis of non-fibrous materials, and the measurement of viscosity of cellulose by a variety of procedures including the cupriethylenediamine and cuprammonium hydroxide methods. A new procedure for measuring the intrinsic viscosity of cellulose in aqueous cupriethylenediamine solution had been prepared and submitted to ISO/TC 38 as a draft recommendation. The method appears to be less rigid and more easily applied than the existing methods. Some problems related to the analysis of textiles and the possible use of instrumental methods was discussed with the staff. Infrared spectroscopic methods of analysis for fiber mixtures was being studied but no completely acceptable procedures had been developed.

Dr. Kassenbeck and his group were engaged in studies of the macro and molecular structure of natural fibers. Dr. Kassenbeck has developed a novel technique for the differentiation of ortho and para cortex in keratin by treatment with thallium carbonate. Contrary to silver salts that give a weak color for optical microscopy purposes, the treatment of wool with thallium carbonate produces a very important contrast which permits the differentiation of ortho and para fractions of cortex by simple examination of the material by optical microscopy in normal light. The thallium reagent reacts with the sulfur in wool and this method is also used in the identification and qualitative analysis of keratin fibers.

8. <u>UCB Division Fabelta, Central Textile Laboratory, Tubize, Belgium, May 12, 1964.</u>

Dr. A. Lüde and Staff

The mechanical properties of rayon and nylon tire cord were under study at the Textile Laboratory. In examining the effect of spinning conditions on the properties of tire cords, it had been demonstrated that cracks and fissures were developed in the individual fibers under certain spinning conditions. Such factors as non-uniform application of lubricant during spinning as well as speed of processing, tension, and the geometry of the hardware were evaluated. Tests were made on the tensile strength, elongation, fatigue characteristics and abrasion resistance of tire cords. The results of this work are due to be published later in the year.

Dr. Lüde discussed his work on synthetic textile fibers dealing with the molecular structure, crystallinity and density. A tour of the physics laboratory revealed many instruments for measuring the physical properties of textile fibers. For example, the flex fatigue of tire cords was investigated using specially prepared tubular rubber samples containing incorporated tire cords. Subsequently, the cords were excised from the rubber, examined microscopically for damage and the physical properties were evaluated.

Equipment designed at the laboratory was in use for studying the flex fatigue of fibers. To overcome the problem of specimen failing in the clamps of the testing machine during the flex test, the apparatus was modified so that the fibers were flexed over a smooth, taunt metal wire until failure occurred in the free length. The results of this test gave good correlation with the fatigue life of fibers evaluated by other means. There was also a variety of abrasion testing machines designed to test textile fibers and fabrics including a Fabelta fabric-to-fabric abrasion tester.

The adhesion of tire cords to rubber tire stock was being studied and two different coatings were employed in this investigation. A resorcinol-formaldehyde-latex was being applied to rayon tire cords while nylon cords were coated with a vinyl-pyridine-polystyrene:poly-butadiene (SBR) mixture. Dr. Lüde was also doing work on the molecular structure of synthetic fibers using optical and electron microscopic techniques as well as X-ray analysis.

Standardization activities in Belgium were discussed and Dr. Lüde explained that all such activities in government and industrial laboratories, associations and universities were coordinated by the Institute for Belgium Normalization. In the field of textiles, BISFA (International Bureau for the Standardization of Man-Made Fibers), was responsible for standardization work on synthetic fibers. Fourteen countries were members of BISFA and cooperated in establishing methods of testing man-made fibers, drawing up definitions and developing sampling procedures. The United States has never been a member of BISFA. Thus, BISFA members were able to establish rules and develop standards for synthetic fibers in Europe and Asia without the United States having the opportunity to express the interests of American industry.

Until 1963 the lack of standard test methods for dipped tire cords permitted the development of different practices for evaluating the weight of deliveries and led to confusion and difficulty in verifying the weight of purchased yarns. Through BISFA agreement was reached which set the basis for the calculation of the commercial weights of dipped yarns. In Belgium, BISFA delegates report directly to the Institute for Belgium Normalization which in turn deals with ISO. Recommendations on synthetic fibers which are passed on to the ISO have the strong support of BISFA members and are usually accepted as international standards.

9. TNO(Central Organization for Applied Research in The Netherlands), Fiber Institute, Delft, Holland, May 13, 1964.

Mr. H. Westenberg
Dr. P. Scheltus

The Central Organization for Applied Scientific Research in The Netherlands, TNO, had constructed a new laboratory on the outskirts of

Delft and members of the staff had begun moving into the new facilities in February. Although several buildings were still under construction a number of the Institutes, including the Fiber Research Institute, were settled in completed laboratories. The mission of the Fiber Research Institute was to provide technical advice and information to the textile and paper industries, manufacturers of synthetic fibers as well as merchants and consumers of textile and paper fibers and products. The fields of work included: testing on behalf of the textile and paper industries, research on the mechanical and chemical technology of textiles and paper, new developments pertaining to machines for textile and paper industries including testing and controlling equipment, and fundamental and applied research on physical and chemical properties of fibers and products.

The program included work on the preparation of fibers, spinning, weaving, knitting, scouring, bleaching, dyeing, printing, sizing, and finishing. A number of large rooms contained commercial equipment for spinning, weaving and processing textiles. The Institute was concerned with the problem of abrasion tests on textile fibers and was cooperating with industry in studying abrasion resistance of carpets, upholstery, and clothing.

In the Analytical Research Institute work was concerned with the development of special and routine methods of analyses for other TNO institutes and industry. These included inorganic analysis and instrumental analysis of paints, varnishes, plastics and rubber.

PART II. POLYMER CHEMISTRY AND COORDINATION CHEMISTRY

1. Hungarian Academy of Science, Budapest, Hungary, April 28, 1964.

Dr. J. Szőke

Dr. Szőke was conducting research dealing with the theory and structure of complex compounds. Thermal analytical investigations in air on uranyl chelates indicated that the thermal stability appeared to be closely related to the ligand incorporated in the complex. In coordination number 6 complexes of UO_2 containing 8-hydroxyquinoline or acetylacetonate ligands, heat treatment of the sample resulted in successive loss of the ligands. Thus, for the uranyl acetylacetonate complex the following decomposition mechanism was found to prevail:

$$UO_2\ acac_3 \xrightarrow{\sim 150°C} UO_2\ acac_2 \xrightarrow{\sim 250°C}$$

$$UO_2\ acac \xrightarrow{\sim 350°C} U_3O_8$$

A similar general mechanism was also postulated for the UO_2-8-hydroxyquinoline complexes.

Dr. Szöke was already familiar with the Bureau's work on the thermal stability of coordination polymers of bis-8-hydroxyquinoline containing some first row transition metals (J. Inorg. Nucl. Chem. 26, 139-159, 1964) and expressed interest in the more recent data on the Schiff-base coordination polymers of Mn(II), Co(II), Ni(II), Cu(II) and Zn(II). Dr. Szöke indicated that a considerable amount of work dealing with coordination chemistry was in progress at the University of Szeged, about 100 miles from Budapest. Much of this work has been reported in the literature.

2. University of Eötvös Loránd, Chemistry Department, Budapest, Hungary, April 29, 1964

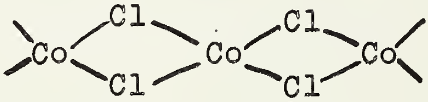
Professor E. Körös and Staff

Approximately 6,000 students were enrolled at the University and the majority of them attended day classes although some courses were given at night for people who worked during the day. Students were accepted on a scholarship basis depending on their high school record and competitive examinations.

The Chemistry Building was about 80 years old, modeled somewhat on the style of Professor Bunsen's original laboratory in Germany. Professor Körös was teaching inorganic and analytical chemistry and was conducting research in the fields of analysis and coordination chemistry. Although in the past he used mainly German text books he was now using British texts for reference and lecture material.

Undergraduates were required to submit a thesis in their senior year and a number of Professor Körös' students were working on isotope analysis. Other research laboratories equipped with absorption and emission spectrographic equipment were being used by graduate students in their research investigations.

Professor Körös has also been interested in the transmission of electronic effects in transition metal complexes, the thermodynamics of some tetrahedral-octahedral configuration equilibria in solution and the thermal decomposition of some Co(II)-pyrazine complexes. In the Co(II)-pyrazine complexes he found that the reaction of $CoCl_2$ and methylpyrazine or 2,5-dimethylpyrazine yielded polymers in which the pyrazine ligand crosslinked neighboring



chains through adjacent Co atoms. In studies of the thermal decomposition mechanism of these polymers in a N_2 atmosphere it was found that as the temperature of the sample increased the Co-N bonds connecting the metal and the ligand were ruptured. Differential thermal analysis data showed strong endotherms which closely corresponded with the accelerated weight loss of the polymers as measured by thermogravimetric analysis. No ligand remained after heating at 400°C and the residue was identified as $CoCl_2$.

3. <u>Swiss Federal Institute of Technology, Chemistry Department, Zurich, Switzerland, May 4, 1964.</u>

Professor H. Hopff, Director,
Organic Chemistry Laboratory
Professor H. G. Elias

Professor Hopff briefly discussed some of his work on dyestuffs, organic intermediates, reaction kinetics and organic synthesis which spanned a period of more than 30 years. He mentioned that in the last few years virtually all the chemistry undergraduates at the Hochschule were remaining after graduation to complete their Ph.D. requirements. He said that this was due to two main factors, the great demand for Ph.D. chemists in Switzerland and in other countries and the almost total financial support (free tuition plus $80 per month) of Ph.D. graduate students at his Institute by the Swiss government.

Professor Elias had come to the Hochschule about five years ago to establish a polymer research program. He mentioned that he had received all the money he had requested for the purchase of new equipment and supporting activities. Professor Elias stated that this amounted to about $500,000 which was provided by the Swiss government. At the present time he was directing the research of 16 Ph.D. students, principally in the field of polymer chemistry, and some of his publications described the behavior of polymers in solution. One study was on the solution properties of nylon and another investigation concerned polyethyleneoxide in various solvents from 25°C to 130°C. Professor Elias had recently published a comprehensive table listing the refractive index and density of more than 600 isorefractive and isopycnic solvent pairs. He was also engaged in light scattering and molecular structure studies and was very optimistic about his program continuing to receive substantial support.

Additional investigations involved the analyses, characterization, structure and properties of polymers using a wide variety of instrumental techniques.

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