The National Bureau of Standards\(^1\) was established by an act of Congress on March 3, 1901. The Bureau’s overall goal is to strengthen and advance the Nation’s science and technology and facilitate their effective application for public benefit. To this end, the Bureau conducts research to assure international competitiveness and leadership of U.S. industry, science and technology. NBS work involves development and transfer of measurements, standards and related science and technology, in support of continually improving U.S. productivity, product quality and reliability, innovation and underlying science and engineering. The Bureau’s technical work is performed by the National Measurement Laboratory, the National Engineering Laboratory, the Institute for Computer Sciences and Technology, and the Institute for Materials Science and Engineering.

### The National Measurement Laboratory

Provides the national system of physical and chemical measurement; coordinates the system with measurements systems of other nations and furnishes essential services leading to accurate and uniform physical and chemical measurement throughout the Nation’s scientific community, industry, and commerce; provides advisory and research services to other Government agencies; conducts physical and chemical research; develops, produces, and distributes Standard Reference Materials; provides calibration services; and manages the National Standard Reference Data System. The Laboratory consists of the following centers:

- Basic Standards\(^2\)
- Radiation Research
- Chemical Physics
- Analytical Chemistry

### The National Engineering Laboratory

Provides technology and technical services to the public and private sectors to address national needs and to solve national problems; conducts research in engineering and applied science in support of these efforts; builds and maintains competence in the necessary disciplines required to carry out this research and technical service; develops engineering data and measurement capabilities; provides engineering measurement traceability services; develops test methods and proposes engineering standards and code changes; develops and proposes new engineering practices; and develops and improves mechanisms to transfer results of its research to the ultimate user. The Laboratory consists of the following centers:

- Applied Mathematics
- Electronics and Electrical Engineering\(^2\)
- Manufacturing Engineering
- Building Technology
- Fire Research
- Chemical Engineering\(^3\)

### The Institute for Compuer Sciences and Technology

Conducts research and provides scientific and technical services to aid Federal agencies in the selection, acquisition, application, and use of computer technology to improve effectiveness and economy in Government operations in accordance with Public Law 89-306 (40 U.S.C. 759), relevant Executive Orders, and other directives; carries out this mission by managing the Federal Information Processing Standards Program, developing Federal ADP standards guidelines, and managing Federal participation in ADP voluntary standardization activities; provides scientific and technological advisory services and assistance to Federal agencies; and provides the technical foundation for computer-related policies of the Federal Government. The Institute consists of the following divisions:

- Information Systems Engineering
- Systems and Software Technology
- Computer Security
- Systems and Network Architecture
- Advanced Systems

### The Center for Materials Science

Conducts research and provides measurements, data, standards, reference materials, quantitative understanding and other technical information fundamental to the processing, structure, properties and performance of materials; addresses the scientific basis for new advanced materials technologies; plans research around cross-cutting scientific themes such as nondestructive evaluation and phase diagram development; oversees Bureau-wide technical programs in nuclear reactor radiation research and nondestructive evaluation; and broadly disseminates generic technical information resulting from its programs. The Institute consists of the following divisions:

- Ceramics
- Fracture and Deformation\(^3\)
- Polymers
- Metallurgy
- Reactor Radiation

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\(^1\) Headquarters and Laboratories at Gaithersburg, MD, unless otherwise noted; mailing address Gaithersburg MD 20899

\(^2\) Some divisions within the center are located at Boulder, CO 80303.

\(^3\) Located at Boulder, CO; with some elements at Gaithersburg, MD.
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CATALOG STRUCTURE AND USE

Full bibliographic citations including keywords and abstracts for National Bureau of Standards papers published and entered into the National Technical Information Service (NTIS) collection are cited in the "NBS Publications Announcements" section of this catalog. (Also included are NBS papers published prior to 1986 but not reported in previous supplements of this annual catalog.) Entries are arranged by NTIS subject classifications which consist of 38 broad subject categories (see back cover) and over 350 subcategories. Within a subcategory, entries are listed alphanumerically by NTIS order number.

Four additional abbreviated indexes are included to allow the user to identify NBS papers by personal author, keywords, title, and NTIS order/report number. Each entry lists the appropriate title, the NTIS order number, and the abstract number.

NBS papers may also be identified by searching the NTIS database either online via the commercially available DIALOG system or in the issues of NTIS's Government Reports Announcements and Index and its Government Reports Annual Index.

AVAILABILITY AND ORDERING INFORMATION

The highest quality and least expensive copies of NBS publications published as Government documents are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Publications cited with stock numbers (SN) and purchase orders should be cited by these numbers. GPO will accept payment by check, money order, VISA, Mastercharge, or deposit account. For availability and price, write to the GPO or telephone (202) 783-3258. Should an NBS publication be out of print at the GPO, its continued availability is assured at NTIS which sells publications in microfiche or paper copy reproduced from microfiche.

If an entry has a price code, such as PC A04/MF A01, the publication may be ordered from NTIS in paper copy (PC) or microfiche (MF) or both if both codes are given. Order from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. A copy of the latest price code schedule is available from NTIS. NTIS will accept payment by check, money order, VISA, American Express, Mastercharge, or deposit account, NTIS is the sole source of Federal Information Processing Standards (FIPS), NBS Interagency Reports (NBSIRs), and Grant/Contract Reports (GCRs).

Sometimes, papers noted "Not Available NTIS" may be obtained directly from the author or from the external publisher cited. Such papers are not for sale by either the GPO or NTIS.

Two other sources for NBS publications are depository libraries (libraries designated to receive Government publications) and Department of Commerce District Offices. The depository libraries listed in Appendix A receive selected NBS publications (see inside back cover for a description of the various NBS publication series). While not every Government publication is sent to all depository libraries, certain depositories designated as Regional Depositories receive and retain one copy of all Government publications made available. Contact the depository library in your area to obtain information on what is available and where.

Department of Commerce District Offices listed in Appendix B provide ready access at the local level to publications, statistical data and summaries, and surveys. Each District Office serves as an official sales agency of the Superintendent of Documents, U.S. Government Printing Office. A wide range of Government publications can be purchased from these offices. In addition, the reference library of each District Office contains review copies of many Government publications.
Sample Entry

Computer Software
500,320
PB86-167830
PC A03/MF A01
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Integrated Software for Microcomputer Systems
NBS/SP-500/135
Contract F-000000

Keywords: Microcomputers, *Computer software, *Integrated systems, ...

Integrated software products combine several applications within a single program and enable information to be shared between the applications.

Abstract

The survey of personal computer network technology in today's office presents the point of view of the end user. It characterizes the capabilities of personal computer networks and the services which they provide the user in terms of generic features. As a result, technical management and end users will have an understanding of how personal computer networks can fit into an overall office automation strategy. The document does not discuss or evaluate alternatives for the sharing of data, such as, the manual exchange of floppy disks between personal computers.


This directory is a guide to mandatory and voluntary standards activities in the United States at Federal and state levels and by nongovernment (trade associations, technical and other professional societies). It excludes proprietary (company standards) and local levels of government (i.e., county and municipal). It supersedes the 1975 edition (NBS SP 417), "Directory of United States Standardization Activities" and, for the first time, includes standards distributors, libraries, and information centers, and union lists of standards repositories by regional areas. It also lists organizations that no longer develop standards or have become defunct since the previous directory was issued. Over 750 current descriptive commentaries are formatted, with subject headings to facilitate access to specific information. The main sections cover nongovernment; Federal Government; state procurement offices; sources of standards documents and information; a subject index and related listings covering acronyms and initials, defunct bodies, and those organizations with name changes. Organizations have been included if they develop standards or contribute to the standardization process, whether voluntary or mandatory, or are sources of standards documents or information.
An introductory section provides general information on Federal (including military) standards activities, a list of 20 major nongovernment standards developers, some historical notes, and an overview of U.S. (national) standardization activities.

Advantages of the Adjusted Internal Rate of Return

Final rep., H. E. Marshall, Feb 86, 6p
Published in the American Association of Cost Engineers, 28, n2 p32-37 Feb 86.

Keywords: *Budgeting, Economic analysis, Building, Project management, Reprints, Economic impact, Adjusted internal rate of return, Internal rate of return.

The internal rate is used frequently in evaluating the economic impacts of construction and other capital budgeting projects. Two versions of the internal rate of return are used. The first is the unadjusted internal rate of return (IRR), which has been most commonly used. It measures over the life of the project the return on the original investment, leaving the same return on reinvestments of project cash flows as that earned on the original investment. The second less commonly used version is the adjusted internal rate of return (AIRR). It measures over the life of the project the combined return on the original investment and on the reinvested earnings, allowing for the reinvestment rates(s) to differ from the rate earned on the original investment. The article defines IRR and AIRR; describes computational considerations with which measure is better; compares methods for computing them; discusses assumptions implicit and explicit in their calculation; and describes advantages of using AIRR instead of IRR. Appropriate applications of the AIRR and its limitations are also discussed.

Due Date Based Scheduling in a Flexible Manufacturing System (The ATS)

P. V. Rachamadugu, N. Raman, and F. T. Talbot
Mar 86, 73p NBS/GCR-86/514
See also PB86-232402. Sponsored by National Bureau of Standards, Gaithersburg, MD.

Keywords: *Scheduling, Production planning, Automation, Optimization, Flexible manufacturing systems, Computer aided manufacturing.

The paper is part of an ongoing project to develop a real-time scheduling system for the Automated Manufacturing Facility (AMRF) at the National Bureau of Standards in Gaithersburg, Maryland. It investigates the dynamic scheduling of the Automatic Turning Station (ATS) at the AMRF. The manufacturing characteristics of the ATS include processing of jobs in batches, and changeover times between jobs of different part types. The performance of the ATS is measured by mean flow time, mean tardiness, proportion of tardy jobs and standard deviation of tardiness.

The designer and suggests criteria and approaches that might be used in automated office design. Technological, ergonomic and organizational factors are all considered from the standpoint of the design implications. The present document is a major revision of the earlier study, including more than twice the number of reference documents than its predecessor.

Personnel Management, Labor Relations & Manpower Studies

AD-P002 923/1
PC A02/MF A01
National Bureau of Standards, Washington, DC.

Vigilance Performance of Security Force Personnel

A. Ramo-Smith, and S. T. Margulis
1 Jun 81, 9p

Keywords: *Personnel, *Performance(Human), *Behavioral science, Training, Vigilance, Management light friendly, and control, Perception(Psychology), Response, Component Reports.

The research being performed by the National Bureau of Standards (NBS) for the Defense Nuclear Agency (DNA) involves two tasks. Overall, its goal is to assess those factors that influence the individual state of vigilance in an effort to identify methods to improve this aspect of guard force performance on a daily and long term basis. The first task in achieving this goal is an investigation of the influences of the work environment on performance. That is, an evaluation will be performed of the factors related to the physical characteristics of the task that affect human behavior. This will involve a human engineering study of the vigilance task of security force personnel. The second task of this project is to study the influences of the social environment on a guard force performance. This aspect of the project will involve a social psychological and environmental study of the vigilance task. These two aspects of vigilance performance, that is, human engineering and social/environmental, are related. Both interact to define the ultimate effectiveness of the guard's performance in a watchkeeping task. However, each is very broad in nature.

Implementation of Internal Revenue Service Strategic Initiatives ERR-9 and ERR-11

Rept. for Aug-Dec 85, 16p E. Schroeder, Mar 86, 47p NBSIR-86/3336
Sponsored by Internal Revenue Service, Washington, DC.

Keywords: Implementation, Interviews, Recruiting, *Internal Revenue Service, Data collection, *Human resources, *Strategic planning.

The Internal Revenue Service (IRS) Strategic Plan is comprised of 55 Strategic Initiatives selected to propel the Service for effective and efficient operation in the 1990's. Strategic Initiative ERR-9 addresses the development and use of a trend-analysis monitoring system for human resources planning. ERR-11 utilizes these data in development of recruitment plans for the Internal Revenue Service. The Phase I Report presents the results of a review of human-resources planning requirements and a review of current research and development projects which impact human resources planning in the Internal Revenue Service. A ten-step plan for building and implementing a trend monitoring system for human resources planning is presented. This plan also can be used to analyze operational issues which frequently must be addressed by the Personnel Division of IRS. The only project of similar field collection of data pertains to a sample of exit interviews of departing employees and some interviews of first-line supervisors to measure attitudes. A bibliography is presented in the Appendix of the Report.

Public Administration & Government

PB87-114641

National Bureau of Standards (NBS) Policy on the Use of Its Name in Advertising

Final rep., L. J. Kieffer, 1982, 2p
Pub. in NCSCL Newsletter 22, n1 p12-13 Mar 82.

Keywords: *Advertising, Policies, Reprints, *National Bureau of Standards.

The information contained in NBS Letter Circular 1128, 'NBS Policy on Use of Its Name in Advertising,' is quoted. Additional information and discussion are presented to help explain and clarify the policy.

Research Program Administration & Technology Transfer

PB86-195211
Not available NTIS National Bureau of Standards, Gaithersburg, MD. Office of the Director.

Technology Policy Experiment as a Policy Research Tool

1985, 14p

Keywords: *Research projects, *Policies, *Technology, Regulations, Reprints, Industrial development.

The roles of the policy experiment are described and characterized as an important step in the industrial policy research process. The elements of the policy experiment are identified and the steps described by which an experiment is conducted and the results integrated into the overall policy research process. The importance of experimentation is emphasized for the effective development, implementation, and evaluation of industrial growth policies for technology-based industries. A case study of a policy experiment with new analytical and institutional procedures for monitoring the impacts of venture capital market regulations is used to show how the policy experiment can provide the necessary iterative learning loop, least costly approach to policy change. Equally important, institutionalization of the procedures for monitoring existing policies and the provision of decision-relevant information are shown to be important benefits from policy experimentation in the context of the overall policy change process.

PB86-196383
PC A03/MF A01

Implementation of Internal Revenue Service Strategic Initiatives ERR-9 and ERR-11

Rept. for Aug-Dec 85, 16p E. Schroeder, Mar 86, 47p NBSIR-86/3336
Sponsored by Internal Revenue Service, Washington, DC.

Keywords: Implementation, Interviews, Recruiting, *Internal Revenue Service, Data collection, *Human resources, *Strategic planning.

The Internal Revenue Service (IRS) Strategic Plan is comprised of 55 Strategic Initiatives selected to propel the Service for effective and efficient operation in the 1990's. Strategic Initiative ERR-9 addresses the development and use of a trend-analysis monitoring system for human resources planning. ERR-11 utilizes these data in development of recruitment plans for the Internal Revenue Service. The Phase I Report presents the results of a review of human-resources planning requirements and a review of current research and development projects which impact human resources planning in the Internal Revenue Service. A ten-step plan for building and implementing a trend monitoring system for human resources planning is presented. This plan also can be used to analyze operational issues which frequently must be addressed by the Personnel Division of IRS. The only project of similar field collection of data pertains to a sample of exit interviews of departing employees and some interviews of first-line supervisors to measure attitudes. A bibliography is presented in the Appendix of the Report.

PB86-196383
PC A03/MF A01

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Rept. for Aug-Dec 85, 16p E. Schroeder, Mar 86, 47p NBSIR-86/3336
Sponsored by Internal Revenue Service, Washington, DC.

Keywords: Implementation, Interviews, Recruiting, *Internal Revenue Service, Data collection, *Human resources, *Strategic planning.

The Internal Revenue Service (IRS) Strategic Plan is comprised of 55 Strategic Initiatives selected to propel the Service for effective and efficient operation in the 1990's. Strategic Initiative ERR-9 addresses the development and use of a trend-analysis monitoring system for human resources planning. ERR-11 utilizes these data in development of recruitment plans for the Internal Revenue Service. The Phase I Report presents the results of a review of human-resources planning requirements and a review of current research and development projects which impact human resources planning in the Internal Revenue Service. A ten-step plan for building and implementing a trend monitoring system for human resources planning is presented. This plan also can be used to analyze operational issues which frequently must be addressed by the Personnel Division of IRS. The only project of similar field collection of data pertains to a sample of exit interviews of departing employees and some interviews of first-line supervisors to measure attitudes. A bibliography is presented in the Appendix of the Report.
AERONAUTICS & AERODYNAMICS

Aerodynamics


Keywords: *Vortices, *Jets, Acoustics, Shear layers, Instability.

The early development of a circular jet issuing into a conflowing stream has been examined by hot-wire measurements and smoke-wire visualization. Linear stability theory has been found adequate to predict the response of the early shear layer to upstream disturbances. Knowing the exact nature of these disturbances (acoustic modes in the present case) is of utmost importance in understanding the character of oscillations in the shear layer and their subsequent evolution into vortical motions. It has been found that the conflowing stream has little influence on the stability characteristics of the early shear layer. On the other hand, the inner shear layer (the remains of the inner boundary layer) strongly influences the stability characteristics. The response of the vortex development to controlled excitation has been found to be quite similar to that of the plane mixing layer provided that acoustic effects are taken into account.

Agriculture & Food

Food Technology


Keywords: *Food irradiation, Food processing, Radiochemistry, Radiation dose.

The role of radiation chemistry in irradiation processing of foods is discussed in detail. A few examples demonstrating the relevance of radiation chemistry of model systems to the Food Irradiation Technology are given. The importance of irradiation parameters such as dose, dose rate, temperature, atmosphere, physical state and additives in achieving acceptable and high quality of irradiated foods are emphasized. A few examples of radiation-induced free radical reactions in model compounds relevant to foods are also discussed.

Astronomy & Astrophysics

Astrophysics


Keywords: *Cool stars, *Giant stars, Magnetic flux, Stellar coronas, Stellar magnetic fields, Stellar radiation, A stars, Dwarf stars, Microwaves, Plasmas (Phyics), Stellar rotation, Stellar supergiant, Stellar temperature, Supergiant stars, Stellar coronas.

Major advances in our understanding of non- radiative heating and other activity in stars cooler than T sub eff = 10,000K has occurred in the last few years. This observational evidence is reviewed and the trends that are now becoming apparent are discussed. The evidence for non- radiative heating of the outer atmospheric layers (chromospheres, transition regions, and coronae) in dwarf stars cooler than spectral type A7 or B, with pre-main sequence stars, and close binary systems is ammounigous, as is the evidence for chromospheres in the K and M giants and supergiants. The existence of non-radiative heating in the outer layers of the A stars remains undetermined despite repeated searches at all wavelengths. Two important trends in the data are the decrease in plasma emission measures with age on the main sequence and decreasing rotational velocity. Variability and atmospheric inhomogeneity are commonly seen, and there is considerable evidence that magnetic fields define the geometry and control the energy balance in the outer atmospheric layers. In addition, the microwave observations imply that nonthermal emissions are confined in electron magnetic flux tubes in at least the cool dwarfs and RS CVn systems. The chromospheres in the K and M garners are geometrically extended, as are the coronae in the RS CVn systems and probably also in other stars.


Keywords: *Radio sources, Astronomy, *Radio stars, Hertzspring-Russell diagram, Early stars, Late stars, flare stars, Supergiant stars.

It is found that nonthermal radio emission is associated with stars in very specific locations on the HR diagram. The four classes of objects are typified by early-type mass-loss stars (O5/W5), late-type giants and supergiants (M2I), subgiant K stars (K0 IV-III), and flare stars (DMe). The members of each class exhibit the same maximum radio luminosities, log (LR/L bol), and flaring timescales, spectra, and polarizations. Membership in a binary system is not found to be a necessary condition for detectable nonthermal emission.


Keywords: *Stars, Ultraviolet spectra, Radio astronomy, Reviews, Stellar chromospheres, Stellar coronas, Cosmic x-ray sources.

Major advances in the acquisition of evidence for and the understanding of nonradiative heating and other activity in stars cooler than T eff = 10,000K have occurred in the last few years, primarily as a result of the IUE and Einstein spacecrafts and the VLA microwave facility. In the paper, the author critically reviews the evidence, and comments on the trends that are now becoming apparent.

PB86-162096 Not available NTIS National Bureau of Standards (NLM), Boulder, CO. Quantum Physics Div.

AERONAUTICS & AERODYNAMICS

Aerodynamics
Observations of Interstellar C2 toward Three Heavily Reddened Stars.  
Final rept., B. L. Lutz, and R. M. Crutcher. 1983, 45p  
Grants NSF-AST81-14867, NSF-AST78-50131  
Sponsored by National Science Foundation, Washington,  

Keywords: *Interstellar matter, *Carbon, Molecules,  
Abundance, Reprints.  

Observations have been made of the 2-0 band of the Phillips system of interstellar C2 toward the heavily  
reddened early-type stars Cygni No. 12, HD 92647,  
and BD +66 deg 1675. The first direct proof that the  
rotational line temperatures of interstellar C2 are  
not nonthermal was obtained. Toward Cygni No. 12,  
the rotational distribution cannot be characterized by  
a simple unique excitation temperature; the distribution  
is consistent with radiative pumping models. A very  
strong linear correlation was found between C2 and  
E(B-V), which are also in close agreement with those  
obtained by Cherpashchuk et al. 

600.019  
PB86-163573  
Not available NTIS  
National Bureau of Standards (NML), Boulder, CO.  
Quantum Physics Div.  
Sponsored by National Aeronautics and Space Admin-  
istration, Washington, DC.  
Pub. in Astrophysical Jnl. 148, pL1-L4  
1985.  

Keywords: *Stellar atmospheres, Binary stars, Reprints,  
*Wolf-Rayet stars, Stellar winds.  

Using the stellar parameters of the WNS component  
of the eclipsing binary V 444 Cyg determined by Cher-  
pashchuk et al. (1984) from multi-color light curves,  
and employing an assumed theoretical model for  
interstellar winds, the authors have calculated models  
which yield an extended, supernovally expanding  
photosphere, with values close to those observed for  
the photospheric radius, the mass-loss rate and the  
terminal velocity. The radial distributions of velocity  
and density are in good agreement with those  
obtained by Cherpashchuk et al.  

600.020  
PB86-189172  
Not available NTIS  
National Bureau of Standards (NML), Boulder, CO.  
Quantum Physics Div.  
Sponsored by National Aeronautics and Space Adminis-  
tration, Washington, DC.  
Pub. in Solar Physics 100, p333-362  
1985.  

Keywords: *Stars, Ultraviolet spectra, X ray spectra,  
Identifying, Sun, Reprints, Stellar chromospheres,  
Stellar coronas, Hertzsprung-Russell diagram.  

The author concludes that dwarf stars of spectral type  
G-M and presumably rotating subgiants and giants of spec-  
tral type F-K in spectroscopic binary systems are defi-  
nitely solar-like. Dwarf stars of spectral type A-F are  
also certainly solar-like, and T Tau and other pre-  
Main-Sequence stars are probably solar-like. Slowly  
rotating single giants of spectral type F to early K are  
also probably solar-like, and the helium-rich hottest  
BP stars are actively rotating, with K.K.  
Main-Sequen elements show that the O and B stars  
exhibit some aspects of activity but probably have weak and fields, and are not solar-like. Finally,  
the A dwarfs and the cool giants and supergiants  
show no evidence of being solar-like.  

600.021  
PB86-193174  
Not available NTIS  
National Bureau of Standards (NML), Boulder, CO.  
Quantum Physics Div.  
Ion-Molecule Reaction Probabilities Near 10 K.  
Final rept., J. A. Luine, and G. H. Dunn. 1985, 4p  
Contract NSF-PHY72-00805  
Sponsored by National Science Foundation, Washing-  
ton, DC.  

Keywords: *Interstellar matter, Chemical reactions,  
Molecules, Ions, Nitrogen, Hydrogen, Ammonia, Cryo- 
gens, Stellar winds.  

Reaction probabilities have been measured near 11 K  
using an ion trap technique for some processes impor- 
tant for molecule formation in interstellar clouds.  
Processes were determined at 11 K or < T < 30 K and at  
100 K for the abstraction processes N(1)+ + H2 ->  
NH(1)+ + H and NH(3)+ + H2 -> NH(4)+ + H.  
Two additional upper limits were determined at 11  
K for the radiative reaction C(1)+ + H2 ->  
H(3)+ + hnu and HCO(1)+ + H2 ->  
HCO(3)+ + H. Reaction rate coefficients were  
deduced from the probabilities.  

600.022  
PB86-193216  
Not available NTIS  
National Bureau of Standards (NML), Boulder, CO.  
Quantum Physics Div.  
Sponsored by National Aeronautics and Space Adminis-  
tration, Washington, DC.  
Pub. in Applied Optics Jnl. 9, n3  
p602-607, 1 Mar 64.  

Keywords: *Interstellar matter, *Radio sources(Astronomy),  
Reprints, *Supergiant stars, Stellar chromospheres,  
Stellar coronas, Stellar winds, Late stars.  

In the paper the authors present the results of a semi- 
annual survey of the 10 cm continuous survey at 6 cm of 13  
leading, single coool giants and supernovae with spec- 
tral types in the range GO-M5. The findings are dis- 
cussed in the context of the various mechanisms that  
might be producing radio emission in these stars.  

600.026  
PB86-212326  
Not available NTIS  
National Bureau of Standards (NML), Boulder, CO.  
Quantum Physics Div.  
Sponsored by National Aeronautics and Space Adminis-  
tration, Washington, DC.  
Pub. in Applied Optics Jnl. 9, n3  
p602-607, 1 Mar 64.  

Keywords: *Interstellar matter, *Radio sources(Astronomy),  
Reprints, *Supergiant stars, Stellar chromospheres,  
Stellar coronas, Stellar winds, Late stars.  

In the paper the authors present the results of a semi- 
annual survey of the 10 cm continuous survey at 6 cm of 13  
leading, single coool giants and supernovae with spec- 
tral types in the range GO-M5. The findings are dis- 
cussed in the context of the various mechanisms that  
might be producing radio emission in these stars.  

600.056  
PB86-212883  
Not available NTIS  
National Bureau of Standards (NML), Boulder, CO.  
Quantum Physics Div.  
Sponsored by National Aeronautics and Space Adminis-  
tration, Washington, DC.  
Pub. in Applied Optics Jnl. 9, n3  
p602-607, 1 Mar 64.  

Keywords: *Interstellar matter, *Radio sources(Astronomy),  
Reprints, *Supergiant stars, Stellar chromospheres,  
Stellar coronas, Stellar winds, Late stars.  

In the paper the authors present the results of a semi- 
annual survey of the 10 cm continuous survey at 6 cm of 13  
leading, single coool giants and supernovae with spec- 
tral types in the range GO-M5. The findings are dis- 
cussed in the context of the various mechanisms that  
might be producing radio emission in these stars.  

Astronomy & Astrophysics
Keywords: Stellar evolution, Binary stars, Mass, Reprints, *Cepheid variable stars.

Existing mass determinations for Cepheids with different periods are examined. Wesenheit masses are independent of the adopted distance scale. For short periods (< 6 days) they follow the sequence of evolutionary masses. For periods longer than 10 days they are lower by a factor of 2. The lower mass branches join up with the bump masses. The new pulsational masses agree with the Wesenheit masses for periods longer than 6 days. The Wesenheit masses determined by means of their giant companions also agree with the Wesenheit masses and the new pulsational masses. While the masses are large, the derived dynamical masses determined for S Mus and V636 Sco also agree with the low Wesenheit and giant companion masses.

Final rept.
M. C. Beeman, and C. L. Sarazin Mar 86, 46
Grant NSF-AST83-51997 Sponsored by National Science Foundation, Washington, DC.

Keywords: *Supernovae, Reprints, *Wolf-Rayet stars, Supernova remnants, Cobalt 56, Nucleosynthesis.

From an analysis of the optical spectrum of SN 1985f, the authors show that the supernova ejecta contain about 4.5 solar masses of oxygen and very little hydrogen. They suggest that the explosion resulted from the pair-instability supernova of a about 50 solar masses WO Wolf-Rayet star. The optical luminosity of the supernova is powered by the radioactive decay of (56)Co synthesized in the explosion. From the rate of decay of the optical emission, the authors estimate that the explosion occurred about 350 days before it was discovered in 1985 February.

600,030 PBB6-229275 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div. IUE Observations of Interstellar Hydrogen and Deuterium toward Alpha Centauri B.
Final rept.
Grant NAG8-54, NGL-06-003-057 Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 303, p791-796, 15 Apr 86.

Keywords: *Interstellar matter, Hydrogen, Deuteration, Ultraviolet spectra, Reprints, Alpha Centauri B, IUE.

A profile is presented of the Ly alpha emission line of alpha Cen B (K1Vd = 1.3 pc), obtained by addition of two IUE small-aperture, high-dispersion images.

600,031 PBB6-229283 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div. Outer Atmosphere of Procyon (alpha CMi FSIV-V): Evidence of Supergranulation or Active Regions.
Final rept.,
Grant NAG8-477 Sponsored by National Aeronautics and Space Administration, Washington, DC.

Keywords: Ultraviolet spectra, X rays, Granulation, Reprints, *Procyon star, Stellar chromospheres, Stellar coronas, X-ray astronomy, Stellar activity.

Observations made with the Einstein X-ray observatory and EXOSAT have shown Procyonalpha (CMi) to have a measurable X-ray flux. The flux observed is similar to the upper limits previously reported. The authors discuss the interpretation of the X-ray data in the context of models developed previously by Brown & Jordan based on spectra obtained with the IUE satellite.
Observations of Interstellar Hi toward Nearby Late-Type Stars.

Keywords: *Interstellar matter, Ultraviolet spectra, OAO 3, IUE.

High-dispersion Copernicus and IUE observations of chromospheric Ly alpha emission are used to study the distribution of HI in the interstellar medium. Interstellar parameters are derived toward 3 stars within 5 pc of the sun, and upper limits are given for the Ly alpha flux from 9 other stars within 10 pc.

Final rep., J. L. Linsky, and M. C. Weisskopf, 1986, 3p
Sponsored by National Aeronautics and Space Administration, Washington, DC.

Keywords: X-ray spectra, X-ray astronomical facility, Stellar corona.

AXAF, the next major step in NASA's program for X-ray astronomy, is presently in its Phase B definition and design phase and could be launched as early as 1993. The AXAF will be a long duration (> 15 years) national observatory with a majority of the observing time set aside for guest investigators. AXAF will have a grazing incidence telescope consisting of six nested Wolter type I paraboloidal-hyperboloid mirror pairs ranging in diameter from 0.6 to 1.2 m, and a complement of photometric, spectroscopic instruments. The telescope will have an angular resolution of 0.5 arcsecond, collecting area of 1700 sq cm, and significant energy response up to 10 keV.

These characteristics and the modern instruments result in AXAF being a far more powerful observable than HEAO-2 (Einstein) for probing stellar corona.

Keywords: Dwarf stars, Stellar magnetic fields

In previous studies, about 20 detections of field strengths (B) and surface area coverages (f) on some 35 stars have been made, using techniques pioneered by Robinson and Marcy. Surface averaged fields for the active G and K stars are typically about 700 G. Recent discoveries of fields on very chromospherically active flare and BY Draconis stars, however, reveal that these stars generate substantially more magnetic flux (B-Gapprox<2,3000 G). Extending this work, the authors present here photospheric magnetic field measurements for five more very active dwarfs.

HR 5110: An Algol System with RS CVn Characteristics.
Grant NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.

Keywords: *Binary stars, Ultraviolet spectra, IUE.

HR 5110 (HD 118216 = BH Cyn) is a close binary system which is viewed nearly pole-on (i=13 degrees). A comparison of the characteristics of Algol and RS CVn systems to those of HR 5110 shows that HR 5110 can also be considered an Algol system. Because the primary star is relatively cool (FIV) and there is no apparent emission from an accretion disk, the authors are able to detect in IUE spectra the emission of an active chromosphere and transition region of the cooler secondary. HR 5110 is the only known Algol system for which the properties of the secondary star can be studied in detail.

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Cosmic Ray Research

The report presents a simple procedure for estimating cloud base winds. The data are then analyzed to determine the mean wind direction and speed for each cloud base layer. The results are used to evaluate the performance of a new technique for estimating cloud base winds using microwave data. The technique is based on the measurement of the microwave radiation emitted by the cloud. The results show that the technique is able to estimate cloud base winds with an accuracy of ±1 m/s.

Physical Meteorology

The physical processes that govern meteorological phenomena are described in this chapter. The following are some of the key processes:

1. Heat transfer: The transfer of heat by conduction, convection, and radiation is discussed.
2. Moisture transport: The transport of moisture by wind and precipitation is described.
3. Radiation: The role of radiation in the heating of the atmosphere is discussed.

The chapter also discusses the role of human activities in the climate system, including the greenhouse effect and the potential for climate change.

Aeronomy

Aural Implications of Recent Measurements on O(1S) and O(1D) Formation in the Reaction of N(+) with O2

This paper presents new data on the formation of O(1S) and O(1D) in the reaction of N(+) with O2. The results are compared with theoretical predictions and previous experimental data. The implications of these findings for atmospheric chemistry are discussed.

Dynamic Meteorology

Directional Hurricane Wind Speeds

This paper presents new data on the directional wind speeds associated with hurricanes. The results are used to improve the accuracy of hurricane forecast models.

Meteosat Data Collection, Analysis, and Weather Forecasting

This chapter describes the Meteosat data collection, analysis, and weather forecasting system. The Meteosat system is used to provide real-time weather information to forecasters around the world. The chapter also discusses the benefits of using Meteosat data for weather forecasting.
ATMOSPHERIC SCIENCES
Physical Meteorology

set as a standard test bed for defining the performance of candidate methods. Generation of the data set was accomplished through the use of the RAM dispersion model with real meteorological data, reasonable chemical source profiles for up to 13 source types, and random profile and measurement errors for nineteen elements and one isotopic ratio (14C/12C). Geographic placement of the sources and emissions rates were adjusted to yield an interesting level of complexity at the (single) receptor site.


Keywords: Ozone, Absorption cross sections, Ultraviolet absorbers, Atmospheric attenuation, Temperature dependence, Atmospheric transmissivity. 

Absorption cross-sections of ozone have been measured over the range 230 to 350 nm, and for temperatures of 200K to 300K, with improved photometric accuracy and spectral resolution. These measurements are referred to the cross-section at the 253.65 nm mercury line, 1147 x 10 to the 25th power cc cm, and show an internal consistency of +/- 1%.


Keywords: Ozone, Absorption cross sections, Ultraviolet absorbers, Atmospheric attenuation, Temperature dependence, Atmospheric transmissivity. 

Tables of ozone absorption cross-section in the ultraviolet have been prepared for intervals of 0.05 nm over the range 245 to 340 nm. At each wavelength entry in the table a set of coefficients has been derived that permits the cross-section to be computed as a function of temperature, between 200K and 300K, with an accuracy of 1%.


Keywords: Dental materials, Cobalt alloys, Nickel alloys, Stainless steels, Titanium alloys, Reprints, Casting alloy.

Composition, properties and microstructure of nonpre-cious dental casting alloys are reviewed. Relevance to needs for clinical performance is discussed and clinical applications for each class of alloy is presented. Alloys include Cobalt-Chromium-Molybdenum, Nickel-Chromium, Ferritic and Austenitic Stainless Steels and Titanium Alloys.

BIOMEDICAL TECHNOLOGY & HUMAN FACTORS ENGINEERING

Biomedical Instrumentation & Bioeengineering


Keywords: *Medical equipment, Responses, Tests, Procedures, Reprints. "Hearing aids, Veterans Administration, National Bureau of Standards."

The methods used by NBS for testing hearing aids for the Veterans Administration are described. Several possible methods of measuring the acoustic response of hearing aids are discussed, with emphasis on the measurement of the insertion response, which is the method used by NBS. The measurement method for determining the saturation sound pressure level, gain, harmonic distortion, and impulse response level, frequency response, telephone coil sensitivity, and characteristics of special-purpose hearing aids are discussed.


Keywords: Chemical analysis, Electrodes, Fabrication, Bioinstrumentation, Reprints. "Chemically modified electrodes."

The review gives a brief summary of the types of chemically modified electrodes, their fabrication, and some examples of their uses. One especially promising area of application is that of selective chemical analysis. In general, the approach used is to attach to the bare electrode chemically reactive molecules which have electrocatalytic activity toward specific substrates or analytes. In addition, the incorporation of chemically systems should greatly extend the usefulness of these devices for analytical purposes.


Keywords: Bone cements, Curing, Composite materials, Temperature, Mechanical properties, Composition, Reprints.

Commercial bone cements usually contain hydroquinone as the polymerization inhibitor and N,N-dimethyl-p-toluamide as the accelerator in the benzoyl peroxide initiated redox polymerization. The former compounds have certain shortcomings in their biocompatibility profile. Measurements of the setting times, polymerization exotherms, and postpolymerization strengths of the cured monomer-comonomer compositions show that the hydroquinone can be replaced by food grade di-t-tert-butyl-p-cresol (BHT). The more reactive 4,N,N-dimethylaminophenol can replace 4,N,N-dimethyl-p-toluamide, yielding cements with shorter setting times and increased strengths. Exhaustive heat liberated on polymerization can be reduced by partial substitution of more molecular-weight methacrylates, e.g., cyclopentenylmethacrylate for methyl methacrylate, but there is a decrease in strength of the resulting polymer.


Keywords: *Dental materials, Cobalt alloys, Nickel alloys, Stainless steels, Titanium alloys, Reprints, Casting alloy.

Composition, properties and microstructure of nonprecious dental casting alloys are reviewed. Relevance to needs for clinical performance is discussed and clinical applications for each class of alloy is presented. Alloys include Cobalt-Chromium-Molybdenum, Nickel-Chromium, Ferritic and Austenitic Stainless Steels and Titanium Alloys.

Bionics & Artificial Intelligence


Keywords: *Planning, Intelligence, Behavior, Objectives, "Artificial intelligence, "learning machines, Goals, Computer architecture.

A hierarchical architecture which has the ability to generate and control an intelligent behavior is presented. Three parallel cross-coupled hierarchies are proposed of (1) a task or goal decomposition hierarchy, (2) a sensory processing hierarchy, and (3) a world modeling hierarchy. The upper levels of these hierarchies have the ability to select goals, evaluate results, and generate plans. Intelligence is defined to be the set of computing mechanisms that enable an organism or a machine: (1) to select good goals, and (2) to act in a manner which tends to optimize the probability of success in achieving the selected goals.


Keywords: *Robots, Metrology, Instruments, Reproducibility, Kinematics, Dynamics, Accuracy, Tests, Laboratories, Research projects.

In response to industrial needs, performance measures for robots are being developed in laboratories around the world. Although as yet no universally accepted tests for robots have been adopted, researchers have developed or are developing procedures in instrument for examining robot kinematics, dynamics, and positioning accuracy of industrial robots.

Human Factors Engineering


Keywords: *Ergonomics, "Area security, "Data bases, Man-machine systems, Human factors engineering, Warning systems, Intrusion detection, Behavioral science, Component Reports, Physical security.

The National Bureau of Standards has been exploring the possibility of developing an ergonomic data systems since 1976. We summarize some of our preliminary findings and outline our future plans to extend this work to benefit the multidisciplinary field of physical security.
Prosthetics & Mechanical Organs

600.067
PB86-201407 Not available NTIS National Bureau of Standards (IMSE), Gaithersburg, MD. Metalurgy Div.
Mechanical Properties and Structure of Ti-6Al-4V with Graded-Porosity Coatings Applied by Plasma Spraying for Use in Orthopedic Implants.
Final rept., H. Hahn, R. J. Lare, R. H. Rowe, A. C. Fraker, and F. Ornday. 1985, 13p
Keywords: Titanium alloys, Aluminum containing alloys, Vanadium containing alloys, Coatings, Mechanical properties, Corrosion fatigue, *Surgical implants, Titanium alloy 6 Al 4 V.

The object of the work was to determine mechanical properties of implants with graded porous coatings without reference to the properties of the ingrown bone. Optimum strength of a bone/implant interface consisting of porous metal and ingrown bone requires a gradation from base metal to the original bone. The composite metal-bone interface can be obtained by applying a metal coating of graded porosity, varying from near zero at the substrate surface to more than 50% at the outermost layer on the original implant. Graded porous coatings of titanium or Ti-6Al-4V were obtained by plasma spraying of selected particle size fractions in three layers of successively decreasing density the top coat being made with 300 to 850 pm powder. Tensile and shear strengths of the coatings were determined by cutting coated samples face to face with an adhesive resin to simulate ingrown bone. Data from these tests are given. Shear strength values ranged from 5.6 to 9.9 MPa (815 to 1430 ps) and tensile strength values were 5.1 to 25.5 MPa (745 to 3700 ps). Failure occurred within the porous coating and not at the interface between the substrate and the coating. Corrosion fatigue tests in Hanks' solution at 37 deg. C (98.6 deg. F) and a pH of 7.4, with a cyclic, fully reversed, peak torsional shear strain of plus or minus 0.01, gave lifetimes comparable to or better than those reported for mill- annealed Ti-6Al-4V, except for the samples that had been sintered.
Applications of Aerial Thermography for Residential Energy Analysis.

Final rep.,

S. J. Treado, and D. M. Burch. 1983, pt 1
Sponsored by Department of Energy, Washington, DC.
Office of Building and Community Systems


The effectiveness of aerial infrared thermography as a residential energy analysis procedure is investigated. Factors affecting the accuracy and utility of the technique are identified and analyzed, including the effects of location microclimate and different thermostat setpoints. Guidelines are presented concerning the recommended use of aerial thermography as a procedure for assessing the thermal performance of residences.

600.074

Keywords: *Sky, Luminance, Daylighting, Irradiance, Illumination, Measurement, Beams(Radiation). Measurement of sky luminance, sky illuminance, direct beam illuminance and direct beam irradiance are analyzed and discussed. The database consisted of an annual collection of hourly data from six measurement sites within the National Bureau of Standards, Gaithersburg, Maryland. The relationship between diffuse sky luminance and luminance of selected portions of the sky dome is measured. Measured sky luminances are compared to luminance calculated using equations for three standard sky types-clear, partly cloudy and overcast. The results indicate that the luminance distribution of actual skies varies considerably from the standard skies.

600.075
PB86-203593 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div. Low-Cost Measurement of the Air Leakage in Homes

Final rep.,

G. T. Linteris, and A. K. Persily. 1984, 2p
Sponsored by Department of Energy, Washington, DC.
Office of Buildings Energy R and D

Keywords: *Residential buildings, Air, Leakage, Presurizing, Tests, Measurement, *Air infiltration.

Simultaneous air infiltration measurements were performed in a group of fourteen nominally identical wood frame houses located in New Jersey, for three test periods. The results of the measurements indicate that there was more than a two to one variation in infiltration between the houses. The fourteen houses were pressure tested using the Blower Door apparatus, and these results are also presented. Comparisons are made between the two measurement techniques. Several state-of-the-art air infiltration predictive models are used to predict the air infiltration rates in the houses and these are compared with the measured infiltration rates.

600.076

Final rep.,

B. Hamilton, B. Sachs, J. Duffy, and A. Persily. 1983, 10p
Sponsored by Department of Energy, Washington, DC.

Keywords: *Residential buildings, Fluid infiltration, *Solar energy.

Low-cost, measurement-based techniques for calculation of infiltration as a variable in passive solar performance analysis are suggested as an improvement over the use of an assumed constant air-change rate. Results of infiltration measurements and calculations are compared for seven residences. Coefficients of correlation are made between two infiltration estimation techniques for 41 of these monitored buildings.

600.077
Sponsored by Electric Power Research Inst., Palo Alto, CA.

Keywords: *Heating loads, Cooling loads, Residential Buildings, Energy use.

Hourly sensible heating and cooling loads for six test buildings were predicted using two computer programs, called TARP and EMPS. The predicted loads and the measured loads are compared for the winter heating season, spring heating, and summer cooling periods. Both computer programs predicted the general trends of the measured data.

600.078

Final rep.,

D. R. Clark, C. R. Hill, and C. W. Hurley. 1985, 10p
Sponsored by Department of Energy, Washington, DC.
Office of Building Energy Research and Development

Keywords: Computerized simulation, Mathematical models, Heat exchangers, Ducts, Pipes, Tubes, Reprints, *Space Heating systems.

A method for representing transport delays is presented, and dynamic models for a pipe or duct and for a hot water coil are derived. Briefers descriptions of models for several other components of an air handler are given. Comparisons between experimental data and simulation results are provided to support the validity of the models. Detailed simulations of a complete heating coil control loop serve as the basis for experimental verification of the component models and their interactions.

600.079

Final rep.,

L. Katzman, G. E. Kelly, and M. E. Kuklewicz. 1978, 7p
Sponsored by Department of Energy, Washington, DC.


A field study involving the installation of twenty-one automatic oil-fired, residential furnaces and boilers in the New England area is described. Good agreement is shown to exist between the predicted and observed furnace and boiler efficiencies, comparing test periods before and after modification, and the percent fuel savings predicted using an NBS recommended procedure for determining the part load and seasonal efficiency of such equipment. The NBS procedure is then used to generalize the results to an expected modification of the fixed heating systems, over sizing of 70 percent. Information is also presented on various problems encountered during the study with the installation of automatic vent dampers on oil-fired residential furnaces and boilers.

600.080

Final rep.,

M. E. McCabe, and M. van Migmom. 1983, 8p
Sponsored by Department of Energy, Washington, DC.
Passive and Hybrid Solar Energy Div.


Solar energy absorption in a sunspace having a south-facing glazing and a row of parallel, uniformly spaced, vertical, cylindrical solar absorbers is considered. The opaque cylindrical absorbers might be a part of a passive solar heating system which contains features of both a direct-gain and a collector-storage wall system. Considerable control over the gain of direct solar energy and thermal energy storage within a building is achieved by varying the diameter and spacing of the cylindrical tubes. A two-dimensional model is formulated for a horizontal, planar enclosure in which the cylindrical absorber tube is subdivided uniformly into a number of surface elements and the glazing and sunspace surfaces are each represented as a collection of surface elements. The results are presented as dimensionless ratios of absorbed-to-incident solar flux. Plots of the spatial distribution of absorbed solar flux are presented for hourly time increments for a winter day.

600.081

M. E. Ellingson, and M. O'Roivre. 1985, 9p
Pub. in Structural Safety 2, n 2 p291-298 1985

Keywords: *Buildings, *Loads(Forces), Climatology, Snow, Building codes, Design standards, Statistical analysis, Reprints, Probability distribution functions, Reprints.

Snow loads provide the governing load requirements for the structural design of roofs in many northern cities or mountainous regions. Current design practice in most countries is to calculate the roof snow load at a point of a given design frequency by a dimensionless ground-to-roof conversion factor. Both parameters are random variables, and appropriate fractiles of their distribution must be modeled. The results of many statistical studies are presented on the ground snow obtained from analysis climatological data, and on the roof load conversion factors measured for surveys of snow accumulation on roofs. These data are proving valuable in structural code development.

600.082

Final rep.,

A. H. Smith, and R. Fadermacher. 1984, 6p
Sponsored by Department of Energy, Washington, DC., and Oak Ridge National Lab., TN.

Keywords: *Heat pumps, *Air conditioners, Absorption, Degradation, Loads(Forces), Testing, Reprints.

A series of laboratory performance tests were conducted on absorption chillers and heat pump. The part-load performance was compared to the full-load capacity and coefficient of performance. Beat load performance degradation with shorter operating times are speculated upon with partial substantiation resulting from tests on the chillier after it had been modified to prevent off cycle fluid migration.

600.083
PB87-120234 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div. Archtectural Design & Environmental Engineering
Thermal bridges are highly conductive heat flow paths within the building envelopes. The effects of thermal bridges on the energy efficiency of a building envelope are described. Thermally deficient areas caused by thermal bridges were found and their sizes ascertained by three-dimensional heat flow models. The use of infra-red thermography, quantification of the heat loss caused by thermal bridging was achieved using field data obtained with heat flux transducers, along with a detailed analysis of the exterior thermographies and architectural drawings of the buildings involved. Field data were compared with the predictions obtained using a two-dimensional heat transfer model of the transient heat conduction within the exterior wall-floor system.

**Building Equipment, Furnishings, & Maintenance**

The purpose of the paper is to present a risk-consistent approach for the design of glass cladding facades subjected to wind loads. The procedure is applicable to buildings with specified orientation, and accounts in a probabilistic rigorous manner for the dependence upon wind direction of both the extreme wind speeds and the pressure coefficients. In addition, the procedure is consistent and both probabilistic and deterministic in nature. These results presented here can lead to significant reductions in the cost of glass cladding facades while ensuring safety levels at least as high as those inherent in current practice.
Controller sensitivity to line voltage variation tests were also performed at ambient conditions and included a 10 to 100% change in voltage. The controller test fixture is also described along with the use of a computer controlled power supply to simulate disturbances. The overall test plan is also included as an appendix to the report.

800.092  
PB86-210721  
Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Fire Research Div.  
Evaluation of Furniture Fire Hazard Using a Hazard-Assessment Computer Model.  
Pub. in Fire and Materials 9, n4 p159-166 1985.  
Keywords:  *Furniture, Fire hazards, Fire resistant coatings, Furniture, Residential buildings, Toxicity, Burning rate, Smoke, Reprints.*

The Center for Fire Research Fire (Toxic) Hazard-Assessment computer model was used to evaluate the potential for hazard reduction by the modification of the composition properties of upholstered furniture items in a residential occupancy. The potential benefits of these modifications are compared with the effects of modifications in room size and construction to determine if they would be realized across a range of housing sizes and types. The results demonstrate the greatest environmental benefit by the modification of the mass loss (burning) rate of the item regardless of room size and even if the means used to reduce the burning rate results in an increase in smoke production and material toxicity.

800.093  
PB87-101002  
PC A04/MF A01  
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.  
Relative Propensity of Selected Commercial Cigarettes to Ignite Soft Furnishings Mockups.  
Sponsored by Consumer Product Safety Commission, Washington, DC.  
Keywords:  *Furniture, Fabrics, Ignition, Upholstery, Tests, Cigarettes.*  

The report covers the first project undertaken under the Cigarette Safety Act of 1984, the determination of whether and to what extent commercial cigarettes have different propensity to ignite upholstered furniture substrates. For this purpose, a test was developed under which 12 types of commercial cigarettes were placed on 18 substrates varying in fabric, padding, and configuration. It was found that there were statistically significant differences in ignitability propensity among the cigarettes on three substrates. No significant differences were noted among the six different substrates. However, no one of the packings consistently showed low ignition propensity on all three substrates. The mass loss rate of both the cigarette and substrate during the tests was recorded and did not appear to be a reliable predictor of ignition propensity.

800.094  
PB87-128138  
Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Fire Research Div.  
New Approach to Fire Toxicity Data for Hazard Evaluation.  
Pub. in American Society for Testing and Materials Standardization News 14, n9 p28-33 Sep 86.  
Keywords:  *Fires, Toxicity, Combustion products, Tests, Hazards, Models, Reprints, Cone calorimeters.*

An N-Gas model involving a reduced dependence on animal testing is proposed both for obtaining fire toxicity data for building materials and for the premarketing screening of commercial products and materials. Current toxicity measures rely almost exclusively on animal testing. The proposed new approach is based on obtaining the time-dependent generation rates of a limited number of important toxic species using a suitable combustion apparatus. One such apparatus has a 1.5 liter chamber with a 1000 watt heater. The new approach will not entirely eliminate the need for animal testing, since a check-test will still be necessary, but promises to substantially reduce the need for animals.

800.095  
PB87-128153  
Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.  
Quarter-Scale Room Fire Tests of Interior Finishes.  
Keywords:  *Finishes, Fire hazards, Building, MD, Flashover, Ignition, Reprints.*

A technique for modeling fire buildup in rooms with combustible interior finish is discussed. Use of the technique resulted in good agreement between fires conducted in a single room doorways and those performed in full-scale rooms. The effects of burner location and heating rate on convection and radiation are also used to help select a suitable ignition source size and placement for testing of interior finish materials.

800.096  
PB87-128161  
Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.  
Standard Room Fire Test Development at the National Bureau of Standards.  
Keywords:  *Finishes, Fire tests, Buildings, Plywood, Polystyrene, Gypsum, Evaluation, Flashover, Three radiation, Calorific value, Heat of combustion, Reprints.*

Research results with the proposed ASTM standard room fire test for interior finish materials are presented. The materials selected for the study were two untreated plywood, a fire-retarded plywood, polystyrene, polycarbonate, and gypsum board. Three 900 s duration test scenarios were considered. The test demonstrated that all three scenarios could adequately differentiate material fire behavior, in terms of the maximum degree of fire buildup and the time it takes to reach the maximum, for the materials tested. Thermal radiation incident on the floor and doorway air temperature were found to be the most consistent parameters for determining room fire buildup including room flashover. Surface flame spread and rate of heat release are presented for the room fires. Unit area rate of heat release from these fires were found to correlate closely with calorimeter data for the same materials.

800.097  
PB87-134292  
PC A08/MF A01  
Casino Reserv Uni, Cleveland OH. Dept. of Mechanical and Aerospace Engineering.  
Contract N822-NADA-3926  
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.  
Keywords:  *Fire safety, Sprinklers, Droplets, Computer programs, Graphs(Graphs), Performance, Models, Water sprays.*

A nondimensional description of spray discharge distribution performance of fire sprinkler heads is developed. The description emphasizes the sprinkler's ability to distribute the spray over the maximum available floor area. Illustrations are provided by data obtained from an apparatus developed to study the axisymmetric jet impingement on a flat surface. The design of the apparatus employs the dielectric breakdown of an axisymmetric film to produce the droplet spray. Sheet breakup radius varies as the inverse one third power of the Weber Number based on jet diameter, in agreement with data obtained by Huang. Variable discharge distribution performance is achieved by controlled variations in the supply pressure. The method of data presentation is tabular, in graphical form, or in interactive computer program. The data are presented in the form of nozzle discharge distributions are obtained at a frequency ratio defined as the ratio of the driving frequency to the frequency of fundamental mode oscillations of the nozzle rounded to the nearest integer. A spray modelling procedure is developed to give analytical discharge distributions. An investigation of the resulting patterns indicates a volume mean droplet diameter in agreement with a predicted value obtained from a correlation given by Dunias and Huang.

Building Standards & Codes

800.098  
PB86-195583  
Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.  
Expressing Standards for Computer-Aided Design.  
Keywords:  *Buildings, *Building codes, Design, Standards, Reprints, Computer-aided-design.*

The article discusses a set of techniques for expressing and organizing the contents of building design standards, and suggests that application of these techniques, in conjunction with a restructur ing of data in computerized building design (CABD) software systems, are needed to reduce the effort and cost required to maintain CABD systems applicable and current. The article stresses application of these techniques to analyzing the clarity, consistency, and completeness of existing building design standards, and to developing new standards.

800.099  
PB86-199924  
Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.  
Probability-Based Load Criteria for Structural Design.  
Sponsored by American Society of Civil Engineers, New York.  
Keywords:  *Building codes, Structural design, Loads(Forces), Design standards, Structural engineering.*

Load criteria for use in limit states design of structures are developed using probabilistic methods. Statistical description of load and strengths are integrated by the reliability analysis to yield criteria that are consistent with a prescribed measure of reliability. The load criteria, while providing a conventional appearance, lead to more uniform reliability and performance than is possible with existing specifications. The load criteria have been included in American National Standard ASR 1-1982. Minimum Design Loads for Buildings and Other Structures, and provide a focus for material specifications on which limit states design standards are developed for different construction materials.

800.100  
PB86-199940  
Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.  
Pub. in Proceedings of Conference on Computing in Civil Engineering (3rd), San Diego, CA., April 2-6, 1984, p965-967.  
Keywords:  *Building codes, *Design standards, Structural design, Structural engineering, *Computer aided design.*

Building quality can be improved and building costs reduced through more effective computer utilization in design and construction. To accomplish these objectives improved interfaces are needed between building project databases and computer-based procedures for applying design and, between computer-based engineering procedures and applicable design standards. The report examines the hypotheses that: (1) the ability to easily maintain design standards data is fundamental to CAD system effectiveness; (2) the config-
uration of presently available computer-aided structural design (CASS) system software inhibits efficient design standards data modification, requiring costly maintenance to avoid software obsolescence and limiting the overall usefulness of these systems; and (3) methods to enhance the efficiency of criterion checking and standards data maintenance are required to increase the utilization of CAD technology.

600.101

Keywords: "Building codes, Renovations, Regulations, Reconditioning, Maintenance.

The purpose of the paper is to provide an overview of building regulations applied to rehabilitation. Discusses are (1) requirements due to regulation, (2) recent technical activity to improve rehabilitation regulation, and (3) needed research to permit more effective use of our existing building stock.

600.102

Keywords: "Buildings, Regulations, Rehabilitation."

No abstract available.

Construction Materials, Components, & Equipment

600.104

Keywords: "Fires, Flame propagation, Estimates, Smoke, Reprints, Fuel models, Compartment fires."

A series of prediction methods has been assembled to provide an analytical basis for estimating fire growth in compartment fires. Solutions for each prediction method can be made using programmable scientific calculators. Prediction methods are presented for: fire size and growth rates, mass loss rates, radiant heat flux, flame height, radial flame impingement, heat flux to a ceiling, smoke filling of a room, carbon monoxide hazard with smoldering fires, temperature rise in a compartment, ventilation flow rate, flashover occurrence, corridor smoke transfer and filling, smoke concentration, visibility, flame spread rates, and fire burn time.

600.105

Keywords: "Roofing, Thermal stresses, Finite element analysis, Stress analysis, Reprints."

A linear finite-element method of analysis was used to calculate strains induced in a single-ply roofing membrane by heat from the roof system. The roofing system in the analysis consisted of a totally adhered or loose-laid EPDM membrane, two layers of fibrous glass insulation board, and a metal deck.

600.106

Keywords: "Fires, Mathematical models, Laminar flow, Walls, Flammability testing, Fire models, Fire studies, Compartment fires."

A comprehensive mathematical model is presented for understanding the characteristics of a burning vertical wall immersed in a quiescent ambient atmosphere having a nonuniform vertical distribution of temperature and oxidizer mass fraction. Such a stratified atmosphere occurs, for example, in the interior of a room or a aircraft's cabin on fire. A set of partial differential equations and suitable boundary conditions describing a laminar flow of exothermically reacting species is solved using the Keller Box finite difference scheme. Results of burning rate and flow parameters (such as the maximum vertical velocity, flame position, etc.) are presented for many different cases of stratified atmosphere.

600.107

Keywords: "Thermal resistance, Buildings, Insulation, Thermal insulation, Heat flux, Calorimeters, Thermal measurements, Field tests."

A series of field and laboratory tests were conducted to determine the accuracy of in-situ thermal resistance measurement techniques. The results of thermal performance evaluation of the external walls of six thermal mass test houses situated in Gaithersburg, Maryland are presented. The wall construction of these one-room houses includes insulated lightweight wood frame, insulating Masonry with outside mass, uninsulated masonry, log, and insulated Masonry with inside mass. In-situ measurement of heat transfer through building envelops were made with heat flux transducers and portable calorimeters.

600.109

Keywords: "Cements, Diffusion, Porosity, Microstructure, Calcium silicates, Permeability, Reprints."

The diffusion properties of hydrated alite cement have been compared with measurements of the degree of hydration and of pore structure for a range of ages. Durations of 3600, 600, and 1200 hr followed the hydrated alite were progressively filled with a porous calcium silicate hydrate gel. At early stages of hydration the larger pores were more quickly interconnected and the diffusion rates were consequently rapid. At later stages of hydration the hydrate shells around adjacent alite grains began to intergrow continously and the larger pores is reduced. Diffusion rates through thin square membranes was made by using small amounts of additional hydration. Quantitative microscopy, thermographic analysis, calorimetry, quantitative x-ray diffraction and buanty adsorption were used to study the microstructural development in the hydrated alite. Geometric and special characteristics of the pores in the hydrated alite were investigated by microscopic examination of resin replicas.

600.110

Keywords: "Chairs, Flammability testing, Fire safety, Fire tests, Seats, Upholstery, Furniture, Calorimeters, Fire studies."

In an earlier study a full-scale furniture calorimeter was used to determine the heat release rates for upholstered chairs containing various construction materials. Samples of these same material combinations have now been tested in a bench-scale calorimeter, with a cone calorimeter. A correlation was established between bench-scale and full-scale data. Thus, it appears that the prediction of fire danger potential of a single upholstered item may be possible by using bench-scale results.

600.111

Keywords: "Fires, Convection, Heat transfer, Plume-driven ceiling jet, Compartment fires, Fire models, Fire studies."

In previous works, convective heat transfer from buoyant plume-driven ceiling jets to unconfined ceilings has been estimated using a formula for the temperature distribution below an adiabatic ceiling.
Keywords: Construction materials, Buildings, Degradation, Durability, Deterioration, Service life, Tests, *Foreign technology.

The need to advance the state of knowledge of service life predictions of building materials and, thereby, reduce a barrier to innovation and improved cost effectiveness has stimulated a number of internationally sponsored activities. The purpose of the present paper is to identify some of the primary technical barriers and research opportunities that are presented to international groups, and to meet the need for improved service life predictions.

600.112 PB86-202488 PC A04/MAF A01 National Bureau of Standards (NEL), Gaithersburg, MD.
Suggested Approaches for Revisions of Preliminary Performance Criteria for Tensile and Tensile Fatigue Strength Tests of Bituminous Membrane Roofing.

Prepared in cooperation with Clemon Univ., SC, Dept. of Civil Engineering. Sponsored by Du Pont de Nemours (E.I.) and Co., Old Hickory, TN. Textile Fibers Div.

Keywords: *Roofing, *Bitumens, Tensile strength, Tensile properties, Evaluation.

Alternative approaches are reviewed for revision of the original NBS preliminary performance criteria for tensile strength and tensile fatigue strength of bituminous membrane roofing. Reviews of five approaches - elastecgy theory, brittle fracture, viscoelasticity theory, strain energy and finite element techniques - were completed. Advantages and limitations of these approaches are discussed. The strain energy approach for both tensile strength and tensile fatigue strength preliminary performance criteria was recommended.

600.113 PB86-203585 PC A04/MF A01 National Bureau of Standards (NEL), Gaithersburg, MD, Building Physics Div.
Effect of Wall Mass and Insulation on Energy Consumption in Residential Buildings: An Experimental Study.

Final rept.
D. M. Burch, 1983, 11p
Sponsored by Conseil International du Batiment pour la Recherche l'Etude et la Documentation, Rotterdam (Netherlands).

Pub. in Proceedings of CIB Congress to Build and Take Care of What We Have Built with Limited Resources (8th), Stockholm, Sweden, August 15-19, 1983, v4/5, p33-45.

Keywords: *Residential buildings, Walls, Thermal insulation, *Energy consumption.

The paper investigates the effect of wall mass on the space heating and space cooling requirements of residential buildings. Six test buildings were extensively instrumented and subsequently exposed to outdoor climatic conditions near Washington, D.C. No reductions in space heating requirements attributed to wall mass were observed during the winter heating season when some space heating was provided each hour of the test. However, during the intermediate heating season and the summer cooling season, when the heating/cooling plant did not operate during a portion of the day, significant reductions in space heating/cooling requirements attributed to wall mass were observed.

600.114 PB86-203801 PC A04/MF A01 National Bureau of Standards (NEL), Gaithersburg, MD, Building Physics Div.

Final rept.
Sponsored by American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA.


Keywords: *Thermal measuring instruments, *Thermal insulation, Thermal resistance, *Guarded hot plate.

The use of higher R-value and thicker thermal insulation materials required NBS to produce a new apparatus for absolute measurements of thick materials that can be used as transfer standards. These standards are used for calibration of guarded hot-plate (ASTM C-177) or heat flux meter (ASTM C-518) in user laboratories across the country. The paper gives a technical description of the as-built apparatus including dimensions and a summary of the rational used for the selection of the apparatus material, the control instrumentation and the data logging equipment.

600.115 PB86-203999 PC A04/MF A01 National Bureau of Standards (NEL), Gaithersburg, MD, Center for Building Technology.
Methodology for Revision of the Thermal Performance of Low-Sloped Roofing Systems.

Sponsored by Department of Energy, Washington, DC.

Keywords: *Roofs, *Thermal analysis, Heat transmission, Moisture, Thermal resistance, Thermal efficiency, Energy conservation.

A methodology was developed to estimate the thermal performance of existing low-sloped roof systems. The methodology was based on a review of available information and experience. Roof system thermal resistance is used as the thermal performance parameter. The procedure for determining total roof thermal resistance is described, including measurement and calculation methods, and adjustments for moisture intrusion, insulation gaps and fasteners.

600.116 PB86-229515 PC A03/MF A01 National Bureau of Standards (NEL), Gaithersburg, MD, Center for Fire Research.
NBS (National Bureau of Standards)/Harvard Mark VI Multi-Room Fire Simulation.

J. A. Rockett, and M. Monta. May 1986, 30p NBSIR-85/3292
Sponsored by American Society for Testing and Materials, Philadelphia, PA.

Keywords: *Fire tests, Fires, *Compartment fires, Fire models, Fire studies.

The NBS/Harvard Mark VI multi-room fire simulation program structure is discussed and compared with Harvard V. In addition to the current, operating version of Mark VI, a development version is being used to test refinements which can be readily moved into the operational version as they mature.

600.117 PB86-245719 PC A03/MF A01 National Bureau of Standards (NEL), Gaithersburg, MD, Building Materials Div.

J. H. Pielert, Jun 1986, 28p NBSIR-86/3397
Sponsored by American Society for Testing and Materials, Philadelphia, PA.

Keywords: *Construction materials, *Materials specifications, *Meetings, Materials tests, Standards.

The Conference was structured to consider: The status of existing laboratory evaluation and accreditation programs; current trends in the accreditation process; and the need for and nature of a coordinated accreditation system. Included the presentation of invited papers and four workshop sessions.

600.118 PB86-247889 PC A03/MAF A01 Factory Mutual Research Corp., Norwood, MA.
Spray Coating in Room Fires. Technical rept.
Contract NBSA-724-74045
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD, Center for Fire Research.

Keywords: *Fire tests, Ceilings(Architecture), Sprinklers, Cooling, Spraying, *Compartment fires, Room fires, Fire studies.

A series of 25 fire tests were conducted to investigate cooling in room fires by sprinkler spray. The tests were conducted in a temperature-conditioned room in one of the 3.66 m walls. The fire source was a spray fire with constant heat release, located op-
guage programming, interactive systems, high level languages, Data analysis, Case studies.

A brief description of DATAPLOT(TM), a Fortran-based interactive, high-level language for data analysis and graphics, is presented. Capabilities of the most recent version (63/6) of DATAPLOT are described and illustrated with two examples. The use of DATAPLOT as an `expert' system for 'advanced' data analysis, as implemented in a new version (64/6), is introduced through a case study involving the analysis of some microstructural data for use in the quality control of a rear axle housing casting of nodular cast iron. A discussion of the significance of the enhanced version of DATAPLOT is included.

600.123
PB87-134839 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.


Final rept., W. P. Goss, and M. E. McCabe. 1986, 7p

Sponsored by Department of Energy. Washington, DC.


Keywords: *Windows, Thermal conductance, Measurement, Thermal properties, Test methods, Transmittance, U-values.

Recently, there has been significant interest in developing a standard test procedure for determining the thermal transmittance (U-value) and thermal conductance (C-value) of transparent and window treatment products. Currently, several test methods are used to measure these quantities, and the proponents of these methods do not agree on a standard procedure for measurement. As a result, it is difficult to compare the U-values and overall thermal performance of different windows and window treatment products. The paper discusses the specific research needed to address the above problem, as well as a detailed two-phase program to perform that research.

600.124
PB87-138376 PC A04/MF A01 National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.

Strain Energy of Bituminous Built-Up Membranes: An Alternative to the Tensile Strength Criterion.

W. J. Rosenthal, and D. P. Benz. Sept 6 1986 NTIS:

86-3418

Prepared in cooperation with Du Pont de Nemours (El.) and Co. Old Hickory, TN. Textile Fibers Dept.


The study was conducted to revise the performance criterion for tensile strength of bituminous-built-up membranes. Bituminous membrane samples, fabricat-ed from polyester fabric, polyester-glass composite fabric, and single plies of APP- and SBS-modified bitumen, were tested in tension to determine their load-elopation properties and to measure their strain energy. The results of the tensile tests of the new bitu-minous membranes indicated wide variability of load and elongation among the different types of materials.

Structural Analyses

600.125
PB86-164506 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.

Interdependence between Dynamic Surge Motions of Ship Structures for a Deep Water TLP (Tension Leg Platform).

Final rept., E. Smila, and A. Carasso. 1985, 6p

Sponsored by Minerals Management Service, Reston, VA.


Keywords: *offshore structures, Dynamic response, *Dynamic structural analysis, *Tethers.

The tethers of tension leg platforms (TLPs) undergoing surge motions are subjected to inertia and hydrodynam-ic loads. The purpose of the paper is to present an investigation into the effects of the tether curva-ture caused by these loads. The investigation is conducted by solving the coupled equations of surge motion of the tethers and of the platform.

600.126
PB86-189065 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.


Final rept., S. T. Wu, and E. V. Leyendecker. 1984, 10p

Pub. in Earthquake Engineering and Structural Dynam-ics 12, n5 621-628 Sep/Oct 84.

Keywords: *Dynamic structural analysis, Structural eccentricity, Seismic waves, Dynamic response, Reprints.

The paper presents the analytical result of a parametric study for a coupled lateral-torsional structural system subjected to seismic waves. Dynamic eccen-tricity is used as an index to represent the level of structural response. Comparisons are made to show the effects of a few parameters related to the characteristics of the structural systems. These pa-rameters include the size of the foundation mat. Accidental eccentricities due to seismic waves for the corresponding cases are also found and com-pared.

600.127
PB86-192200 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.

Wind-Induced Motion of Tall Buildings.

Final rept., A. Tallin, and B. Ellwooding. 1985, 8p


Keywords: *Buildings, Skyscrapers, Wind pressure, Loads, Forces, Vibration, Reprints.

Modern buildings that are designed so that their lateral stiffness under statically applied wind loads are less than some fraction of building height may vibrate excessive-ly during winds and cause building occupants alarm. Methods are presented for evaluating the vibration characteristics of buildings using random vibration theory to relate the fluctuating wind forces to structural response.

600.128
PB86-195013 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.

Analysis of Torsional Moments on Tall Buildings.

Final rept., A. Tallin, and B. Ellwooding. 1985, 5p


Keywords: *Buildings, Skyscrapers, Torsional strength, Torque, Reprints, Wind tunnel tests.

Spectra of fluctuating wind forces on tall buildings can be determined experimentally from wind tunnel model tests either by measuring base torques using a force balance or by integrating the pressures measured on the sides of the model. The force balance technique is less costly, but may substantially overestimate the actual generalized forces. This study is provided to relate the spectra of base torques and gener-alized forces excited by tall buildings.

600.129
PB86-195203 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.

Wind-Induced Lateral-Torsional Motion of Buildings.

Final rept., A. Tallin, and B. Ellwooding. Oct 85, 16p


Fluctuating wind forces on tall buildings can cause ex-cessive building motion which may be disturbing to the occupants. A method to assess motion sensitivity of square isolated buildings is developed using random vibration theory to relate dynamic along-wind, across-wind, and torsional forces to building accelerations. Wind tunnel test data are analyzed to determine the spectra of force components and correlations among components of force and mechanical coupling of compo-nents of motion introduced by eccentricities of the centers of mass and rigidity from the building centroid are examined. Comparisons are made with more common building analyses, where the forces are assumed to be statistically uncorrelated and the components of motion are assumed to be uncoupled.

600.130
PB87-108635 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.

Wind Tunnel Simulation of Along-Wind Tall Building Response: Micrometeorological and Similarity Considerations.

Final rept. E. Simiu. Jun 78, 1p

Pub. in Colloquium on Industrial Aerosodynamics (3rd), Aachen, West Germany, June 18-20, 1978.


A discussion is presented of the implications of recent results of atmospheric boundary layer research for the wind tunnel simulation of the along-wind response of tall structures. It is shown that the present basis of similarity considerations and of recently developed models of the atmospheric flow structure, that the turbulent fluctuations which cause resonant excitation effects in tall buildings are not similar in long wind tunnels to the corresponding fluctuations in atmospheric flows. The question is discussed of the corrections that should be applied to the along-wind response measurements obtained in the wind tunnel in order to account for differences between turbulence spectra in the atmosphere and in the laboratory.

General

600.131
PB86-166105 PC A07/MF A01 Factorization Research Corp., Norwood, MA. Experimental Fires in Multiroom/Corridor Enclo-sures.

Final rept. G. Heskstad, and J. P. Hill. Jan 86, 132p NBS/ GCR-86/502

Contract NBSA-NADA-4046


In cooperation with Conseil International du Batiment for la Recherche l'Etude et la Documentation, Rotterdam (Netherlands). Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Fires, Fire tests, Buildings, Flashpoint, *Fire studies, Fire models.

A series of 60 fire tests have been conducted in an enclosure consisting of a corridor and three attached rooms, one of which served as a burn room. The purpose was to assess the performance of fire models of multi-room fire situations with particular emphasis on health care facilities. Fire sources were propane gas burners, producing steady fires at 5ft and 522 kW as well as fires growing with the square of time at several growth rates up to a maximum output of 2MW.

600.132
PB86-193166 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Fire and Fire Technology Div.

Assessing Toxic Hazard as It Relates to Overall Fire Hazard.

Final rept. A. J. Howell. 1985, 14p

BUILDING INDUSTRY TECHNOLOGY

General

Keywords: *Fires, Buildings, Fire hazards, Toxicity, Combustion products, Furniture, Reprints, Fire models.

A framework is proposed for assessing hazards associated with the spread of smoke and hot gases from fires in buildings, and the current predictive capabilities for each component of that framework are described. Particular attention is given to the significance of the toxicity of the combustion products of a material in relation to its other fire properties.

600.133
PB86-203049
PC A06/MF A01
National Bureau of Standards, Gaithersburg, MD.
"Fireform" - A Computerized Collection of Convenient Fire Safety Computations.
H. E. Nelson, Apr 85, 101p NBSIR-86/3308
Sponsored by Department of Health and Human Services, Washington, DC, and Air Force Engineering and Services Center, Tyndall AFB, FL.

Keywords: *Fires, *Fire safety, Buildings, Computer programs, Smoke, Fire detection systems, Sprinkler systems, *Fire models, Fire studies.

A computized system of convenient fire safety computing was developed. The A.currentUser includes smoke filling in a room, sprinkler/Not激活ator detection, smoke flow through (small) openings, temperatures and pressures developed by fires, flashover and for severity prediction, fire propagation (in special cases), and simple egress estimation. All programs are based on established formulations and are programmed in BASIC for microcomputers.

600.134
PB86-209996
Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research. Data on Room Fire Models.
Final rept., J. A. Rockett, 1984, 15p

Keywords: *Fires, *Fire tests, Data, Reprints, *Room fires, Five models.

Data needs for state-of-the-art single room fire models are discussed using several examples. Three types of data are needed: geometric, thermal and chemical. Needed geometric data generally present no problem and are not discussed. Under thermal data those quantities which determine the transient surface temperature of objects in the room are considered.

600.125
PB86-210705
Not available NTIS
Final rept., J. H. Kiete, 1984, 6p

Keywords: *Smoke, Smoke abatement, Fire safety, Buildings.

For many years smoke has been recognized as a major killer in fire situations. In response to the problem, the concept of controlling smoke movement in buildings has developed. The American Society of Heating, Refrigeration, and Air-Conditioning Engineers and the U.S. Veterans Administration have sponsored a design manual for smoke control systems. The paper provided engineers with a detailed manual of the manual with emphasis on the principles of smoke control, stairwell pressurization, zone smoke control, and computer analysis.

600.136
PB86-223104
PC A05/MF A01
National Bureau of Standards, Gaithersburg, MD.
S. R. Petersen, May 86, 91p NBS/TN-1222, NBS/ SWDK-86/007A
Contract DE-A01-86CE73041
For system of diskette, see PB86-223112. Sponsored by Department of Energy, Washington, DC.

Keywords: *Buildings, National government, Prices, Computer programs, *Energy conservation, "Life cycle cost, Energy use, FBLCC computer program, User manuals.(Computer programs).

The FBLCC Computer Program and the User's Guide provide computational tools and energy price data for Federal building life-cycle cost (LCC) analyses of Federal buildings and related subsystems. Two kinds of Federal building projects can be evaluated with FBLCC: (1) LCC analysis of projects directly related to energy conservation and renewable energy, and (2) LCC analysis of projects not directly related with energy conservation or renewable energy.

600.137
PB86-223112
CP T99
National Bureau of Standards, Gaithersburg, MD.
Federal Building Life-Cycle (FBLCC) Program Diskette.
Software, S. R. Petersen, and W. Bethay, May 86, 1 diskette
NBS/SW/DK-86/007
The software is contained on 5 1/4-inch diskette, double sided, double density compatible with the IBM PC microcomputer. Diskettes are in the ASCII format. Price includes documentation, PB86-223104.


The Federal Building Life-Cycle Cost Program provides computational tools and energy price data for performing life-cycle cost (LCC) analyses of Federal buildings and related subsystems. The methods and principles used in the LCC analysis are based on rules set forth by the U.S. Department of Energy's Federal Energy Management Program and U.S. Office of Management and Budget. The 5 1/4-inch diskette contains the FBLCC programs and related data files in MD-DOS format. The documentation for the FBLCC program is contained in an A User's Guide to the Federal Building Life-Cycle Cost (FBLCC) Program,* NBS/1A 1222. *Software Description.* The software is written in the BASIC programming language for implementation on an IBM PC-compatible microcomputer under the MS-DOS operating system. Memory requirement is 64K.

600.138
PB87-10019
Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Final rept., L. Y. Cooper, 1981, 15p
Sponsored by Department of Labor, Washington, DC, and Department of Health and Human Services, Washington, DC.


Keywords: *Sprinkler systems, *Fire safety, Cooling, Stairwells.

The potential benefits of sprinkler protection of open staircases during fires are discussed. One of these benefits results from the cooling of products of combustion which pass through the stairwell penetration. An example scenario is introduced to illustrate this benefit. A relevant experimental study of the performance of stairwell-sprinkler systems is summarized. The results of the study are used to guide a development of the design of stairwell-sprinkler systems with an objective of efficient evaporative cooling of flow through fire areas. Examples on the use of these design guides are presented.

600.139
PB87-13700
Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Determination of Energy Reduction in Retrofitted Homes.
Final rept., Y. C. Mahang, and R. A. Grot, 1984, 1p

Keywords: *Houses, *Weatherproofing, *Energy conservation, Low income housing, Demonstration projects, Case studies.

The report presents a technique for analyzing the effect of energy saving retrofits installed in low-income housing under a nationwide weatherization demonstration program. A tracking technique based on the calculated balance-point temperature of each home during the heating season was developed to predict the would-be fuel consumption over a period of time as if the house were not weatherized. Fuel reduction is reported for more than 100 homes using different fuels in seven cities across the nation, selected to represent various climate zones and geographical locations. It was found that the average savings in fuel consumption for dwellings in each city is about 30 percent.
BUSINESS & ECONOMICS

Consumer Affairs

600.147
PB87-103248 PC A09/MF 001
National Bureau of Standards (NBS), Gaithersburg, MD.
Uniform Laws and Regulations as Adopted by the National Bureau of Standards on Weights and Measures (71st), 1986.
Final rept., S. Brickenkamp. Sep 86, 185p NBS/HB-130-1987
Supersedes PB86-115672. Also available from Supert of. Docs as SN003-003-02754-5.

Keywords: *Weight measurement, *Regulations, *Standardization, Handbooks, Units of measurement, Packaging, Labels, Consumer affairs, Prices, Sales, National Bureau of Standards, *Weights and measures, Ondulating.

The handbook, revised annually, compiles the uniform laws and regulations developed by the Committee on Weights and Measures of the National Conference on Weights and Measures (NCWM). The compilation itself was approved by the NCWM in 1979, and this edition includes amendments adopted by the Conference at its annual meeting in 1986. The title of the handbook and the titles of the laws and regulations compiled in it were changed at the 1983 annual meeting of the NCWM. A new index for the entire handbook has been added to this year's edition.

600.148
PB87-140588 PC A04/MF 001
Final rept., R. D. Dijkers. Jul 86, 68p NBSIR-86/3412
DE-A01-86CE23842

Keywords: Meetings, Consumer affairs, Tests, Heat pumps, Air conditioners, Furnaces, Boilers, Refrigerators, Heating equipment, Water heaters, *Consumer products.

One hundred thirty-four persons participated in a Forum on Testing and Rating Procedures for Consumer Products held at the National Bureau of Standards (NBS), Gaithersburg, Maryland, on October 2-3, 1985. The objectives of the forum, which was planned in cooperation with various industry associations, were: (1) to provide a line of communication between test procedure users and test procedure developers; (2) to provide an opportunity for participants to present technical and research issues concerning Department of Energy (DOE) test procedures that need to be addressed; and (3) to assist DOE and NBS in establishing a future agenda for the development and/or revision of testing and rating procedures. The report summarizes discussions, conclusions and recommendations developed by the 134 participants for the following consumer products: heat pumps and air conditioners; furnaces, boilers, and household heaters; water heaters; refrigerators, refrigerator-freezers and freezers.

600.150
PB87-213675 PC A03/MF 001
Annul rept., J. R.Overman. Apr 86, 39p NBSIR-86/3376

Keywords: *Standards, *International trade, Technical assistance, Regulations, US NBS, General Agreement on Tariffs and Trade, GATT standards, Foreign.

The report describes the GATT Standards Code activities conducted by the Standards Code and Information program, National Bureau of Standards (NBS), for calendar year 1985. NBS responsibilities include operating the U.S. GATT inquiry point for information on standards and certification activities; notifying the GATT Secretariat of proposed U.S. Federal government's standards-based rules that might significantly affect trade for U.S. industry with standards-related trade problems; and responding to inquiries about proposed foreign and U.S. regulations.

600.151
PB87-12222 PB86-115672 Not available NTIS
Making Effective Use of ISONET and GATT Enquiry Points.
Final rept., W. G. Leight. 1986, 9p

Keywords: *Standards, *Information systems, *International trade, Barriers, Subject indexing, Efficiency, Effectiveness, *Certification, *Trade, References(Standards), National Bureau of Standards, GATT system, ISONET system.

The National Center for Standards and Certification Information (NCSCI) at the National Bureau of Standards (NBS) operates the Enquiry Points for both ISONET and GATT. The paper discusses the nature, scope, and size of the NCSCI reference collection and the services provided to domestic and foreign contacts. Based on the general nature of search for information and NCSCI experience in attempting to provide efficient and effective responses to inquiries, several general public areas are identified. The proposed solutions will require the coordinated efforts of producers, conveyors, and users of standards and the information pertaining to them.
Chemistry

Analytical Chemistry


Keywords: Mass spectrometry, Laboratory procedures, High temperature flames, Molecular beams, Laser pumping, Electron impact spectra, Ionization, Cross sections, Thermal properties, Reprints, Knudson effusion, LIVMS(Laser Induced Vaporization Mass Spectrometry).

In the present discussion, emphasis is given to recent developments and remaining problems in the application of mass spectrometry to high temperature materials chemistry. Examples of promising areas discussed include: Knudson effusion mass spectrometry of gas-solid reactions, with equilibrium or kinetic control, high pressure molecular beam sampling mass spectrometry of flames and laser-vapor plumes, and transpiration mass spectrometry of gas-liquid solid and ceramic-alloy systems. Certain maxims are examined, including use of ionization cross section approximations. Evidence of departure from the key assumption of a temperature-independent electron impact process is given, including temperature-dependent parent-migration phenomenon and cross section behavior, arising from the use of cross-section, attenuation and electron energy-scaling approximations are also examined.


Keywords: Varadium, Trace elements, Isotopic labeling, Concentration(Composition), Chemical analysis, Mass spectrometry, Separated, Leaves(Botany), Liver, Oysters, Tissue(Biology), Blood analysis, Reprints. Biological processes, Isotope dilution thermal ionization mass spectrometry, Standard reference materials, Procedures.

A procedure has been developed for the determination of nanogram quantities of vanadium in biological matrices by isotope dilution thermal ionization spectrometry that uses a 50 V spike enriched to 64 atom %. The V is chemically purified by a Chelex-100 separation and loaded onto a carbonated Resin bead. The procedure has been applied to the determination of V in various NBS Standard Reference Materials: Oyster Tissue, SRM 1566; Citrus Leaves, SRM 1572; Bovine Liver, SRM 1572; and Human Serum, SRM 909. The certified concentration of V in the Human Serum SRM is the lowest of any Standard Reference Material.


Keywords: Nuclear magnetic resonance, Quantitative chemical analysis, Organometallic compounds, Reprints, Methyltin.

Solid-state 13C NMR and X-ray crystallographic studies of the title compound, Me2Sn(SZCNCNCH2)42, are reported. The magnitude of 1J(13C,13C), (1), measured 125.0 Hz for the title. When a previously described relationship between (1) and the Me-Sn-Me angle was used, an angle of 139.6 degrees was predicted for the molecule. The discrepancy between the crystal and the published X-ray structure (Me-Sn-Me angle = 130 (2) degrees) led to a re-determination of the crystal structure by X-ray. Resolution of the structure of the orthorhombic crystals in the Pmm space group yielded a chemically reasonable structure R=0.029, Rw=0.038 in which the pyrrolidine carbons C3 and C4 are disordered across the mirror plane at y=1/4. Similar to other dimethyltin(V) complexes, the title compound contains a distorted octahedral geometry: the Me-Sn-Me angle is 133.3(3), and the diheterocarbamin ligands are coplanar. In contrast to the accurate NMR-derived prediction, published Moshbauer data led to a predicted Me-Sn-Me angle (123.5 degrees) 14 degrees in error.


Keywords: Combustion products, Polyethylene, Toxicology, Pyrolysis, Literature surveys.

The literature on polyethylene has been reviewed with an emphasis on the identification of gaseous products generated under various thermal decomposition conditions and the toxicity of those products. The review is limited to publications in English through 1984. The analytical chemical studies of the thermal decomposition products generated under vacuum, inert and oxidative experimental conditions are described. In oxidative atmospheres, which most closely simulate real fire conditions, carbon monoxide (CO) was found to be the predominant toxicant. Acrel was another toxic often noted in these reviews. More acrolein was generated under non-flaming than under flaming conditions. Results from seven different test procedures were considered in assessing the acute inhalation toxicity of combustion products from various polyethylene formulations. The combustion products generated from the polyethylene studied in the non-flaming mode appeared to be slightly more toxic than those produced in the flaming mode.


Keywords: Chemical analysis, Standards, Research projects, Inorganic compounds, Organic compounds, Particles, Gases.

The report summarizes the technical activities of the Center for Analytical Chemistry at the National Bureau of Standards during the fiscal year 1985 in the Inorganic Analytical Research Division, the Organic Analytical Research Division, and the Gas and Particulate Science Division. In addition, it describes certain special activities in the Center including quality assurance and voluntary standardization coordination.


Keywords: Chromatographic analysis, Arsenates, Chemical analysis, Arsenic compounds, Organic compounds, Reprints, Arsenite, Arsenic acid/methyl, "Arsenic oxide/dimethyl-hydroxyl, High pressure liquid chromatography (HPLC) system.

Techniques for the determination of trace element compounds at ppb and ppm levels in contrast to the determination of the total element concentration are a prerequisite for the study of the transformations of trace elements in biological systems and the interactions of trace element compounds with biologically important molecules. Two automated high-pressure liquid chromatography (HPLC) systems with elementspecific detectors, capable of detecting, identifying and quantifying trace element compounds were developed independently in our laboratories. One of the detectors consists of a Perkin-Elmer graphite furnace atomic absorption spectrometer (GFAA) and a specialized autosampler, whereas a Hitachi-Zeeman GFAA, a sample valve, an injector and associated electronics to control the analysis sequence comprise the components of the other. The capability of these systems to speciate trace element compounds is demonstrated using arsenite, arsenate, methylarsonic acid (MMA) and dimethylarsinic acid (DMAA) as examples. The separation schemes developed for the four arsenic compounds were used to speciate these compounds in soil extracts and drinking waters. The separation efficiency achieved thus far can very likely be improved through development of better column materials and mobile phases. The work with arsenic compounds clearly shows the great potential of these HPLC-GFAA analytical systems in the area of environmental trace element chemistry in the field of physiological chemistry and in tissue element-related nutritional studies.


Keywords: Chemical analysis, Trace elements, Metals, Reprints, Laser spectrophotometry, Flame spectrophotometry.

Laser-enhanced ionization spectrometry is an application of ion spectroscopy. The relationship between the quantum analysis of trace concentrations of metallic elements in flames. The paper reviews the scientific literature on the subject, and summarizes the performance and the method in its present state of development.


Keywords: Tin organic compounds, Organometallic compounds, Nuclear magnetic resonance, Reprints, Chemical shifts, Coupling constants, Chemical shifts, Carbon 13.

Chemical shift and (up 1) J1(117,119)Sn (13C) data from cross polarization magic angle spinning (CPMAS) proton-decoupled solid-state (13C) NMR experiments for organo tin compounds in (Me2Sn)2, Me3SnOAc, Me2Sn(acetylate)2, Me2SnCl2(dimethyl sulfoxide), and anomerous (Me2Sn)4 adopt the relationship between the magnitude of the coupling constant and the coordination at tin is...
Laser microprobe mass spectrometry has been applied to a wide variety of problems in chemistry, biology, and materials science. The concept of the instrument is described, analytical features are discussed and several illustrative applications are presented.

Results of a program for the development of standard materials for the analysis of chrysotile asbestos in workplace environments are presented. These standards consist of carbon-coated Nuclepore filter sections which contain predictable loadings of chrysotile asbestos fibers mixed with an urban air particulate matrix so that they resemble field samples. One standard contains an ambient loading, approximately 9 asbestos fibers/0.01 square millimeter of filter. Because of the low fiber counts and organic loadings in the average fiber loading, the standard does not have a certified value for the fiber loading. Instead the results are presented in an analysis report. The second standard contains a slightly higher loading of asbestos, approximately 30 fibers/0.01 square millimeter of filter. The standard includes a certified fiber loading with the uncertainty in the value expressed as a 95/95 tolerance interval about a five-count mean.

Recently, in studying the mechanism of analyte excitation in spectro-chemical analysis it was noticed that the spark of the emission spectrometer very efficiently excites analyte particles in the 5 nanometers-10 micrometers size range. These particles may be suitable to serve as standards which could provide a large number of analyte metal chloride particles in a broad size range. Since the particles can be produced in large numbers, they can be used as particle standards for both micro and bulk analytical techniques.

A capillary gas chromatographic method is described by which volatile halocarbon analytes eluting under a methanol or water solvent peak can be analyzed. The method consists of injecting the analytes onto a thick film SE-52 capillary column. The exit end of the column enters a post column trap packed with activated alumina. The trap selectively absorbs the methanol solvent, allowing the analytes to pass to the detector unharmed. Data is presented which show a standard deviation in the response factors relative to the vinyl chloride internal standard of less than 5%. A detection limit of 1 ug/mL Chloromethane is estimated.

Rate of Calcium Hydroxide Precipitation Measured by Electrical Conductance.


Keywords: *Calcium hydroxide, *Precipitation, *Calorimetry, Conductance, Seeding, Reprints, Induction period.
The rates of calcium hydroxide precipitation from supersaturated solutions were measured. Precipitation rates were observed to depend on whether the solutions were seeded with Ca(OH)₂ or with C-S-H, or were unseeded. Calorimetric measurements indicated the presence of solid Ca(OH)₂ to be ineffective in promoting the onset of the acceleratory period of CSH hydrolysis. The suggests that Ca(OH)₂ precipitation is not the rate determining phenomenon in the regard.


Keywords: Chemical analysis. Trace elements. Metals. Reprints. Laser spectroscopy. Atomic absorption flame spectroscopy. A review is given of the atomic flame spectrometric method based on the selective laser-enhancement by atomic ionization rates. A discussion of basic principles, prior literature, and instrumentation is followed by an overview of analytical figures of merit for the method, and a look at the present status and future development areas of the method.


Keywords: Reprints. Eeckart frame. Planar molecule. An analytical formula is suggested for calculating direction cosines of the Eeckart frame of a planar molecule. As one application of the formula, we give a simple way to find the matrix switching of the geometrical body-fixed axes of the formaldehyde molecule to axes of its Eeckart frame.


Keywords: Sulfur. Chemical analysis. Labeled substances. Iron alloys. Sepation. Reprints. Arsenic sulfides. Isotope dilution techniques. Thermal ionization mass spectrometry. Sulfur, Sulfur 32, Sulfur 34, Copper base alloys. A new procedure has been developed for the determination of microgram quantities of sulfur in metals by isotope dilution thermal ionization mass spectrometry. Typically 1 g metal samples are spiked with (34)S enriched spike, dissolved in a closed system to prevent loss of volatile S compounds using a mixture of HCI/ HNO₃ acids which oxidizes all S to sulfate. The S is reduced to H₂S which is converted to As₂S₃. The As₂S₃ is dissolved in an As (+3) NH₃ solution to yield a As/S atom ratio of two. A small portion of this solution equivalent to 1.5 micrograms S is placed on a Re-flat filament with silica gel and the (32)S/ (34)S ratio is measured at 950 deg C as the thermally produced (75)As is detected by ASI. An accurate determination. The ionization efficiency is about 0.1% and the precision of the (32)S/(34)S ratio is typically 0.1% (1σ). This procedure has been applied to the determination of Cu base and Fe base alloys ranging in S concentration from 2.8 to 80 ppm. At these S levels the chemical blank is the major source of uncertainty. The total uncertainty for these two materials were 0.2 and 1 ppm, respectively.

600.174 PB86-199072 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.


Keywords: X-ray fluorescence analysis. X-ray tubes. Spectrum analysis. Algorithms. Spectral lines. Reprints. Fundamental parameters method for quantitative x-ray fluorescence analysis requires knowledge of the spectral distributions of x-ray tubes used for sample excitation. The theoretical models for calculation of the spectral distributions include a number of parameters which are not known with sufficient accuracy. Spectral distributions have been measured for just a few x-ray tubes operating at 45-50 kV. The authors have developed an algorithm to calculate x-ray tube spectral distributions by utilizing extensive electronic microprobe data obtained under various operating conditions with a Si(Li) detector. The algorithm includes the calculation of the continuum and the ratio of the characteristic line(s) to the underlying continuum intensity at the wavelength of the characteristic line(s).


Keywords: Chromatographic analysis. Aromatic polycyclic hydrocarbons. Carbon dioxide. Coal tar. Gas flow. Reprints. Supercritical flow. High resolution. Two dimensions. A two-dimensional chromatographic separation is described which makes use of the unusual properties of supercritical carbon dioxide mobile phase. The solvent has the property of giving a separation of polycyclic aromatic hydrocarbons (PAH) on amine-bonded columns similar to that given by usual normal-phase solvents, and on octadecylsilane-bonded columns similar to that given by usual reverse-phase solvents. Separations from fractions containing 16 and 18 aromatic carbon atoms are shown.


Keywords: Silicon. Carbon. Oxygen. Semiconductors(Materials). Infrared spectroscopy. Microelectronics. Fourier transform spectroscopy. Fourier transform infrared (FT-IR) spectrophotometry is a rapid, nondestructive characterization technique which is being increasingly applied on a large scale to the routine measurement of the oxygen and carbon content of silicon wafers fabricated in microelectronic devices. Control of the oxygen content is needed to achieve acceptable yields in modern device processing. Particularly for those processes which utilize oxide precipitates to protect active regions of devices from contamination by metallic impurities during high-temperature processing. The interlaboratory reproducibility of the measurement is not adequate considering the degree of control of the oxygen that is required. This review focuses primarily on the measurement of oxygen in silicon and on methods for improving quantitative FT-IR absorption measurements on semiconductor wafers.

600.177 PB86-202033 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.


Keywords: Nickel. Petroleum products. Chemical analysis. Laser enhanced ionization. Tunable lasers. Laser-enhanced ionization (IE) in flames is an ultra-sensitive atomic flame spectrometric technique based on the efficient thermal ionization of atomic species which have been selectively excited by tunable laser radiation. The potential of the method has been demonstrated, and laser-enhanced ionization analysis is presently being evaluated. A successful determination of trace Ni concentrations in heavy oil flash distillate and Standard Reference Material Fuel Oil has been performed. One gram samples were diluted into 100-700 mL volumes of a xylene/n-butanol solvent mix. Scanning electron microscopy was performed in an air-acetylene flame. Stepwise laser excitation of Ni was performed using a Nd:YAG pumped dual-dye laser system. Accurate and reproducible results were obtained.


Keywords: Microanalysis. Particle shape. Electron probes. Correction. Reprints. Electron microprobe analysis. Electron probe microanalysis of samples of unusual shape, e.g., particles and rough surfaces, requires correction for the influence of geometrical effects on electron scattering, x-ray absorption, and fluorescence. Normalization of the analysis total to unity puts the calculated concentrations on a reasonable bulk basis, but does not uniformly correct the geometrical effects as a function of x-ray energy. Peak-to-background ratios are found to be independent of geometrical effects to a first order. Correction of measured intensities by use of the background can significantly improve quantitative analysis.


Keywords: Asbestos. Contrast. Visibility. Chrysotile, etc. Calculations have been made of the contrast of asbestos fibers in a back-scattered plus secondary electron image produced in the scanning electron microscope. From the calculated contrast, the threshold current for visibility and the minimum beam diameter have been determined. For chrysotile asbestos on a low atomic number background, fibers below 200 nm diameter are not visible in a rapid scanned image.


CHEMISTRY
Analytical Chemistry


Keywords: *Chemical analysis, Tables(Data), Gas chromatography, Infrared spectrophotometry, Ultraviolet spectrophotometry, Mass spectrometry, Nuclear magnetic resonance, Qualitative analysis, Liquid column chromatography.

Tables of important data for use in the analytical chemistry laboratory are provided. These tables contain information for use in gas chromatography, liquid chromatography, Ultraviolet spectroscopy, Mass spectrometry, Nuclear magnetic resonance, Qualitative analysis, Liquid column chromatography.

600.181 PB86-229978 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Ceramics Div.

Comprehensive Method for Determination of Aquatic Butylin and Bromobutyltin Species at Ultratrace Levels Using Simultaneous Hydridization/Extraction with Gas Chromatography-Flame Photometric Detection.

Final report.
C. L. Matthias, J. Bellama, G. J. Olson, and F. E. Brinckman. Jun 86, 7p See also PB86-230505 Sponsored by Office of Naval Research, Arlington, VA., and David W. Taylor Naval Ship Research and Development Center, Bethesda, MD.
Pub. in Environmental Science and Technology 20, n6 p609-615 Jun 86.

Keywords: *Chromatographic analysis, Chemical analysis, Organometallic compounds, Bocodes, Water pollution, Chesapeake Bay, Tin organic compounds, Reprints, *Tin/butyl, *Tin/butyl-methyl.

An ultratrace method for the analysis of aquatic antifouping butylin and mixed methylbutyltin species using simultaneous hydridization with sodium borohydride and extraction into dichloromethane is described. The detection limits for a 100-mL sample are 7 ng of Sn/L for tetrabutyltin, 7 ng of Sn/L for tributyltin, 3 ng of Sn/L for dibutyltin, and 22 ng of Sn/L for monobutyltin. Detection limits of approximately 1-2 ng of Sn/L for tri- and tetrabutyltin and less than 1 ng of Sn/L for dibutyltin species were achieved with 800-mL samples. The presence of tetrabutyltin in harbor waters is reported.

600.18 PB84-230505 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Organic Analytical Research Div.

Investigations of Selectivity in RPLC (Reversed-Phase Liquid Chromatography) of Polyisyl Aromatic Hydrocarbons.

Final report.

Keywords: *Chromatographic analysis, *Aromatic polyhydrocarbons, Selectivity, Reprints, Reverse phase chromatography, Liquid chromatography.

Selectivity in reversed-phase liquid chromatography (LC) of polyisyl aromatic hydrocarbons (PAH) is affected by both stationary phase parameters (phase type, pore size, and C18 surface coverage) and solute parameters (shape and non-polarity). Polymeric C18 phases have been shown to have greater selectivity for the separation of PAH than the more commonly used monomeric C18 phases. In the chapter, the recent investigations of reversed-phase LC selectivity for PAH will be reviewed and discussed including: bonded phase synergies, characterization of substrate and bonded phase properties, and the effect of such parameters on selectivity.

600.183 PB84-231560 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Polymers Div.

Software for Data Collection and Analysis from a Size-Exclusion Liquid Chromatograph.

Final report.

Keywords: Molecular weight, Surveys, Exclusion, Fourier, Automation, *Liquid chromatography, Computer software, Separation processes, Computer applications.

The paper describes software that is used for data collection and analysis from size-exclusion liquid chromatography. The chromatograph is a commercially available instrument that provides on board microprocessor control of the system injection functions. They use a commercially available microcomputer as a passive listener connected to the chromatograph output. They used a Pu-100 and a Pu-1000. The data collection and analysis software is written in FORTRAN. Maximum use is made of graphical displays to aid the user in judging the interpretation of the data. All operations are menu driven, so that the user does not need to be familiar with the computer's operating system. Data archiving functions are built in to facilitate after-the-fact retrieval of the data.

600.184 PB86-239126 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Center for Analytical Chemistry.

Quality Assurance Techniques for Activation Analyses.

Final report.

Keywords: *Neutron activation analysis, Chemical analysis, Quality assurance, Standards, Data processing, Calibration.

The principles and techniques of quality assurance are applied to the measurement method of activation analysis. Quality assurance is defined to include quality control and quality assurance. Plans for quality assurance include consideration of personnel; facilities; analytical design; sampling and sample preparation; the measurement process; standards; and documentation. The following analysis concerns include: irradiation; chemical separation; counting/detection; data collection and analysis; and calibration. Types of standards discussed include calibration materials and quality assurance materials.

600.185 PB86-239373 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Thermodynamics Div.

Vortex Cooling for Subambient Temperature Gas Chromatography.

Final report.

Keywords: *Gas chromatography, *Hilich tube, Reprints, *Vortices.

There has been a good deal of recent interest in subambient temperature gas chromatography, especially for work involving priority pollutants present in air samples. The most popular method of achieving subambient temperatures in chromatographic ovens is through the use of a cryogenic fluid. The short note describes the use of the Ranque-Hilsch vortex tube as a simple and effective alternative to liquefied gases when column temperatures of between -40 and 0 deg C are required.

600.186 PB86-247632 PC A03/MF A01 National Bureau of Standards (NBS), Gaithersburg, MD. Chemical Thermodynamics Div.

Computer Software for the Acquisition and Treatment of Calorimetric Data.

Technical note (Final).

Keywords: *Calorimeters, *Heat measurement, Data acquisition, Data processing, Thermodynamic properties, Measuring instruments, Chemical analysis, *Computer software, Computer program documentation, Calorimetry.

The computer software used for the acquisition and treatment of data from both heat-conduction microcalorimeters and an isoperibol solution calorimeter is described. For each program contained there is documentation given which includes a listing of the program and an example of its use. The hardware used in the data acquisition is briefly described.

600.187 PB87-100114 (Order as PB87-100116, PC A08/MF A01) National Bureau of Standards, Boulder, CO.

High Precision Microcalorimeter: Apparatus, Procedures, and Biochemical Applications.


Keywords: *Chemical analysis, *Heat measurement, Biochemical reaction kinetics, Thermal measuring instruments, Chemical reactions, Enzymes, *Calorimetry.

Apparatus and procedures used for high-precision microcalorimetry is of the heat-conduction type and utilizes semi-conductor thermoelectric modules. The bio-compartamental reaction vessel is made of high-density polyethylene and holds about 0.5 mL of solution in each compartment. Imprecision of heat measurement is 0.2 percent when measuring 300 mJ of heat produced by a rapid chemical reaction. Three microcalorimeters were modified for use with a microcomputer and a data acquisition system. Thermocamical and kinetic applications are described. The acquisition of data from an isoperibol solution calorimeter is also described.

600.188 PB87-100202 (Order as PB87-100116, PC A08/MF A01) National Bureau of Standards (NBS), Boulder, CO.

Standards Development for Differential Scanning Calorimetry.


Keywords: *Heat measurement, *Thermal analysis, Enthalpy, Standards, Transition temperature, Calibration, Differential scanning calorimetry.

The article summarizes two studies made in preparation for standards development, by differential scanning calorimetry, for instruments such as scanning calorimeters, differential thermal analyzers, differential mechanivaly analyzers, and related thermal analysis devices. The first was an extensive study of the variability of differential scanning calorimeters when used for determining transition temperatures and enthalpies. The second was an evaluation of calibration procedures recommended by the American Society of Testing and Materials. These studies are described in detail in National Bureau of Standards Special Publication 260-59.

600.189 PB87-104261 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Thermodynamics Div.

Miniature Mercury Contact Switch for Chromatographic Applications.


Keywords: *Chemical analysis, *Temperature control, *Gas chromatography, *Electric switches, Mercury, Reprints.

A small mercury contact switch for use in temperature control systems for chromatographic equipment has been designed and constructed. The major features of the device are described, including its present limitations. The results of preliminary testing of the device are also given.

600.190 PB87-105813 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Gas and Particulate Science Div.

600.190
CHEMISTRY

Analytical Chemistry


Keywords: Chemical analysis, Quality control, Measurement, GC-MS, Chemometrics.

Modern analytical chemistry has become intrinsically tied to the use of new technologies, in many cases chemical diagnostics to guard our health. Chemometrics is central in derivating adequate responses to these needs in terms of design, control, evaluation and validation of the analytical measurement process. In the two reports which follow, the substance of the lecture is treated in the first (I) while the second (II) comprises a case study from the related new discipline of "Chemometric Intercomparison" or interlaboratory (numerical) validation via simulated analytical data. The paragraphs which follow are intended to introduce the reprints and to summarize some recent observations on the subject of detection.


Keywords: Chromatographic analysis, Deoxyribonucleic acids, Gas chromatography, Mass spectrometry, Replicates, Radiation effects, DNA damage, Biological repair.

The application of capillary gas chromatography-mass spectrometry (GC-MS) to the chemical characterization of radiation-induced base products of calf thymus DNA is presented. Samples of calf thymus DNA irradiated in N2O-saturated aqueous solution were hydrolyzed with HCOOH, then isilyslated and subjected to GC-MS analysis using fused silica capillary column. The trimethylsilyl derivatives of these products had excellent GC-properties and easily interpretable mass spectra, with an intense molecular ion (M+1) and a characteristic (M-CH3) ion were observed. Using the methodology, it was possible to show the formation of novel base products in irradiated DNA in addition to the products reported previously. All mass spectra obtained were discussed in detail. The capillary GC-MS using the GC-condition described here was suggested as a very suitable technique for investigation of DNA repairability by repair mechanisms of DNA lesions created in the course of the irradiation. e.g., DNA mutagens, oxidizing agents, etc.

600.192 PB67-206423 PC A04/MF A01 National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry. Collection of Abstracts of Selected Publications Related to Quality Assurance of Chemical Measurements, J. K. Taylor. Apr 86, 52p NBSIR-86/3352 Keywords: Chemical analysis, Quality assurance, Quality control, Accuracy, Precision, Reference materials.

The publication contains abstracts of 150 papers selected for their usefulness to analytical chemists, laboratory managers and quality assurance officials when developing new or improving existing programs or for general guidance in producing reliable analytical chemical measurements. Definitions of some 75 terms used in describing the quality aspects of chemical measurements are included.


Keywords: Spectroscopic analysis, Chemical analysis, Calibration, Standards, Reprints, "Standard reference materials, Certified reference materials."

Chemical analyses of the same homogeneous materials by different laboratories often disagree. Discrepant data may be caused by poor methodology, improper calibration, faulty experimental technique or by the imperfection of reference materials. Chemical analyses of the same homogeneous materials by different laboratories often disagree. Discrepant data may be caused by poor methodology, improper calibration, faulty experimental technique or by the imperfection of reference materials.

The (1)H NMR spectrum of a solution of neomycin B free base (Structure 1) in D2O has been assigned using two-dimensional homonuclear 1H- and heteronuclear 1H-13C coupled NMR spectroscopy and spin decoupling at 400 MHz. Proton chemical shifts and proton-proton couplings were determined for all glycoside residues in neomycin B along with their computer simulated spectra. The (4)JC, chair conformation has been assigned to the pyranose form of the 2,6-dideoxy-2,6-dideoxy-2-C-methyl-alpha-D-ribofuranose (ring D) portion of the antibiotic (1b) by analysis of the proton coupling constants and chemical shifts. The 1,4-anomeric aromatic ring system of the pyranose form of the ribopyranose (ring C) has been assigned. Vicinal proton couplings for the 2-deoxyriptamyl ring (group B) are consistent with a chair conformation. Carbon-13 chemical shifts are essentially equivalent, and proton chemical shift assignments are based on protonation studies. A computer simulated composite of the individual calculated spectra is presented for comparison with the experimental spectrum of neomycin B.


Keywords: Infrared spectrometers, Spectroscopic analysis, Prism, Analog to digital converters, Chemical analysis, Infrared spectroscopy, Accuracy, Errors, Reprints, Fourier transform spectroscopy, Nonlinear systems.

The paper is an investigation of the effects of errors in the analog-to-digital converter (ADC) of a Fourier transform infrared (FT-IR) spectrometer on the photometric accuracy of that spectrometer. The effect of ADC errors on the spectrum after Fourier transformation is calculated analytically for monochromatic, twoline, and wide band emission spectra. Numerical calculations used to estimate an upper limit to abscissa shifts, and to include the effects of noise on the amplitude of absorbance bands. These analyses showed that ADC errors can generate artifacts throughout the spectrum, although the largest effects occur at sharp spectral features.


Keywords: Chemical analysis, Pentoses, Hexoses, Mass spectrometry, Carbohydrates, Metastable state, Reprints, Oxazoline/oxazolone. The fragmentation of 2-methylthio(glyco)oxazolines under electron impact has been investigated by low and high resolution mass spectrometry. Field desorption was used in those cases where the molecular ion was weak or missing. Fragmentation pathways were determined by monitoring metastable transitions and the degree of labeled compounds. The results support the anticipated structure for these compounds and show the sensitivity of the mass spectra toward ring size.


Keywords: Chemical analysis, Quality assurance. The analytical chemistry has always depended on instrumentation and has been limited by instrumental capa-
bility. Advances in instrumentation during recent times have led to new capabilities in trace analysis. High accuracy analysis, multicomponent analysis, and analytical process control that could hardly have been imagined only a few years ago. The impact on the analyst has resulted in his transition from a generalist to a specialist and the production of data from an individual to a sub-contractor model of operation. The result has been the need for formalized quality assurance practices if data are to be compatible. Only in the most routine situations is the need for competent analysis decreasing. Rather, the complexity of modern analysis is requiring a higher-than-ever level of competence of analysts practicing at the highest levels of professionalism.

Guidelines

J. K. Taylor. 1986, 5p

Keywords: "Chemical analysis. Proving, Marine atmospheres, Quality assurance, Environmental surveys, Reprints.

Valid data may be defined as those which result from a valid measurement process applied to valid samples, selected in accordance with a valid plan based on a valid model of the problem under investigation. The paper discusses the various aspects of the validation process.

Guidelines for Evaluating the Blank Correction

J. K. Taylor. Jan 84, 2p
PUB. In Jnl. of Testing and Evaluation 12, n1 p. 54-55 Jan 84.

Keywords: "Chemical analysis, Trace elements, Guidelines, Water, Reprints.

The statistical considerations in applying the blank correction in trace analysis are discussed. The question of acceptable limits for the blank is addressed. Unless sufficient measurements are made, the uncertainties in the blank correction may be the major source of uncertainty in trace analysis.
CHEMISTRY

Analytical Chemistry

The main requirement for achieving this level of accuracy is a set of standards whose (235)U isotope abundance is known to within 0.01% (2 sigmas).

Precise and Accurate Determination of the (241)Pu Half-Life by Mass Spectrometry.

Final report.


Keywords: *Chemical analysis, Mass spectrometry, Half-life, Precision, Accuracy, Reprints, *Plutonium 241, Uranium 238.

A mass spectrometric procedure is proposed and described which eliminates biases due to the isobaric interference of (241)Am and mass dependent fractionation effects in the determination of the (241)Pu half-life. An equal atomic mixture of Pu isotopes is prepared and aliquots are spiked with high purity (241)Am after a Pu-241 chemical separation. The (241)Pu(Am(1+)) contribution to the (241)Pu(1+) ion current is determined by measuring the (243)Am(1+) ion current. The (241)Pu(1+) to (243)Am(1+) ratio is used as an internal standard to correct the measured (241)Pu/(sup i)Pu ratios for mass fractionation. The use of these procedures would result in a determination that is under complete statistical control and will yield a highly accurate and precise value. It is estimated that the uncertainty using these techniques would be about 0.001 years (1 sigma/sub m) after a decay interval of only 3 years.

PB87-123629 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.

Enrichment in Deuterium from Hydrocarbons by a Dual Capillary Column Heart Cutting Technique.

Final report.

Pub. in Jnl. of Chromatography 363, p397-401 1986.

Keywords: *Chemotrophic analysis, *Deuterium, *Hydrocarbons, Chemical analysis, Chromatography, Reprints.

The analysis of nitrogen heterocycles in a shale oil matrix is described. A dual column gas chromatograph is used for the analysis after a simple sample preparation scheme is used. Details of the apparatus, especially the design of the in-line pneumatic microwire, are given. Quantitation by the standard addition method using internal volume corrections is described. Future directions for further development of the techniques is briefly discussed.

PB87-12090 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Automated Production Technology Div.

Surface Roughness Metrology by Angular Distribution of Scattered Light.

Final report.

Sponsored by National Aeronautics and Space Administration, Washington, DC.

Keywords: *Surface roughness, *Chemical analysis, *Surfaces, Mathematical models, Depth, Measurement, Reprints, Angular distribution.

On-line industrial inspection of batch manufactured parts requires fast measurement techniques for surface finish quality. In order to develop the measurement basis for these techniques, a system has been built to determine surface roughness by measuring the angular distribution of scattered light. The system incorporates data gathered from the angular distribution instrument and traditional surface stylus instruments. These data are used both as input and as comparison data in order to test various mathematical models of optical scattering phenomena. The object is to develop a mathematical model that uses the angular distribution of scattered light to deduce surface roughness parameters such as $R_{a}$ and $R_{s}$ and wavelength. The parameters of an experiment in which angular scattered data from surfaces with sinusoidal profiles was used to compute the surface $R_{a}$ and $wavelength$. Stylus measurements of those parameters were made separately. A comparative table is given of the computed and measured values. Estimates of uncertainties are also given.

PB87-132684 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

PB87-132626 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

Precise and Accurate Determination of High Concentrations of Uranium by Dilution Thermal Ionization Mass Spectrometry.

Final report.


Keywords: *Sulfur, *Chemical analysis, Steels, Reprints, Isotope dilution.

An isotope dilution thermal ionization mass spectrometric procedure has been developed for the accurate and precise determination of S in steels and other based materials. Samples have been analyzed in a sealed tube to prevent loss of S and the isotopes are measured as the As S (14) and are given as an internal standard to determine the S in 13 SRM's. The total uncertainty is typically 0.5% (95% confidence interval) and is governed by uncertainty in the spike calibration and sample homogeneity.

PB87-134797 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Characterization of Airborne Particulates by Pyrolysis/Mass Spectrometry and Carbon-14 Analysis.

Final report.


Keywords: *Chemical analysis, Carbon 14, Pyrolysis, Mass spectrometry, Oil shale, Aerosols, Reprints, *Particulate sampling, Radiocarbon, Oil shale dusts.

Pyrolysis/mass spectrometry (Py/MS) has been used to characterize the composition of organics in an ambient air particle sample from the eastern Utah oil shale lands. The procedure involved collection of the individual organics by thermal desorption of the hydrocarbon pyrolysates and finally a least-squares fitting of the individual contributor spectra to the pyrolysis mass spectrum of the ambient sample. The Py/MS results were verified by using (14)C analysis.

PB87-134798 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Accelerator Mass Spectrometry Sample Preparation Methods for (14)C in 50-1000 Microgram Samples.

Final report.


Keywords: *Chemical analysis, *Carbon 14, Concentration (Composition), Accuracy, Radioactive isotopes, Mass spectrometry, Reprints, *Radiocarbon, Iron pyrite, Oil shale.

A joint project was undertaken by the National Bureau of Standards (NBS) Atmospheric Chemistry Group and University of Arizona (UoA) Tandem Accelerator Mass Spectrometer Group to develop and evaluate an accelerator mass spectrometer (14)C measurements of 5 to 1000 microgram samples at a modest accuracy of 5% to 10% Fe-C accelerator prepared the use of the graphite samples. Averaged 1.6 microamps (12)C-current (14)C measurements yielded 10% precision and accuracy, limited by a blank equivalent to 11% modern carbon for targets containing -100 mCi sample. The contamination level was estimated to be 15 micromolar modern carbon at current atmospheric (14)C. The results demonstrated that the Fe-C target is quite suitable for atmospheric and environmental studies that require measuring fossil/biogenic carbon in microgram samples.


Final report.


Keywords: *Chemical analysis, Standards, Meteorology, *Oceanography, Standard reference materials.

The need for standards for physical parameters has been recognized as far back as the days of the British Royal Engineers. Since that time, increased measurement-
physisorption has led to the need for accurate physical standards of measurement. The development of the metric system and subsequently the International System of Units (SI) has in many ways met the need for primary standards for physical measurements. The accurate measurement of chemical properties is a more recent need. The paper explores the use of chemical measurement systems and their role in obtaining and verifying highly accurate and precise measurements over a wide range of time. Also included in the discussion is a review of currently available Standard Reference Materials appropriate to ocean science and monitoring.

Observations in the O₃-trans-2-buten reaction system and in the O + trans-2-buten + O₂ reaction system suggest the intermediary of alkene radicals. A mechanism of the latter reaction involving the reaction of Cl and Mn(n) alkene radicals by the reaction of ClH₂n alkenes with oxygen atoms or with ozone.

CHEMISTRY
Analytical Chemistry

Keywords: Molecule, Sulfur, Selenium, Tellurium, Reprints, *Proton affinity, Oxygen atoms.

The proton affinities and structures of a series of small molecules containing group VIA atoms are calculated via ab initio electronic structure techniques. The series under study included OX, OX₂, XOX, and H₂CX₂, where X = O, S, Se, and Te. In those cases where multiple protonation sites are available, a definitive assignment of the most stable site is reported. Excellent agreement with the experimentally known proton affinities is found in almost all cases. The results indicate that the genus of molecules which can be expected to move down a column of the periodic table is born out, with a particularly large change on going from the first to the second row. Calculations were performed at both the SCF and correlated levels with compact effective potentials used to replace the core electrons. Complete structural optimizations via analytic gradients were performed utilizing basis sets of at least double zeta plus polarization quality.

Keywords: *Tin organic compounds, Environments, Reaction kinetics, Methylation, Reprints, *Stannanes/methyl, Stannane/methyl-triiodide, Sulfur/methyli.

Methylin triiodide and methylsulfuric species are produced by an unusual heterogeneous reaction between metallic tin and stannous sulfide in water at room temperature which may bear on ubiquitous occurrence of methylstannanes in the environment.

Keywords: Ionorganic compounds, *Environments, Reaction kinetics, Methylation, Reprints, *Stannanes/methyl, Stannane/methyl-triiodide, Sulfur/methyli.

Ions of the formula C₃H₆+ have been generated by charge transfer to cyclopropane from C₆F₆+ (recombination energy, 10.08 eV), COS+ (recombination energy, 11.18 eV), and Xe+ (recombination energy, 12.27 eV). Further equilibrium constants for the C₃H₆+ + C₆F₆ reaction are: K₁ = 4.36 x 10⁻³ for the C₃H₆+ + C₆F₆ reaction, K₂ = 10⁻³ for the C₃H₆+ + C₆F₆ reaction, and K₃ = 10⁻⁴ for the C₃H₆+ + C₆F₆ reaction. The probability of the occurrence of the proton transfer channel is about 30% for ions formed by charge transfer from C₆F₆+ + CS₂ +, or C₆F₆+ + CS₂ +, but increases to 50% for ions formed by charge transfer from Xe+, indicating that about 30% of the C₃H₆+ ions.
isomerization (DP), Not were O. Not were the Sulfur MD. 


Keywords: Decomposition, Interactions, Reprints, Tetrafluorosilane, Cyclobutane, Unimolecular reactions, Laser heating. The unimolecular decomposition of cyclobutane has been used to study the behavior of SF$_4$ as a heat bath gas. Temperatures in the neighborhood of 1050 K were obtained by rapid flow through a heated tube and by the absorption of the pulsed infra-red radiation emitted by a 1000 W 1033 mg/sec CO$_2$ laser tuned to the effective reaction times of these two heating methods were approximately one millisecond and 100 microseconds respectively. Compounds formed in the separate decomposition channels of cyclobutane were studied by means of a comparative method that is insensitive to the non-uniform temperature inherent in all transient heating methods.


Keywords: Chemical reactions, Environments, Metals, Sulfur organic compounds, Reprints, *Methane/iodoiodomethane, an ubiquitous biogeochemical metabolite, has been found to release metals from polluted anoxic sediments, and also from certain metal compounds. Reactions of metal sulfides with iodomethane gave methylated Fe and Pb complexes. Kinetic investigations upon the dissolved Na$_2$CO$_3$/CH$_3$ system, using proton NMR spectroscopy, showed a second-order reaction having the rate constant $K = 0.001$ L/mole/s. Naturally occurring iodomethane may react with metal sulfides or metals under certain environmental conditions to generate water soluble and/or volatile derivatives.

600,232 PB86-201431 not available NTIS National Bureau of Standards (NMS), Gaithersburg, MD. Ceramics Div.


Keywords: Polyomorphism, *Thiorganic compounds, *Stannane, Nuclear magnetic resonance, Crystal structure, Reprints, *Stannanes/methyl, Carbon 13. Solid-state (13) C NMR spectra are reported for three methylated stannanes, with display two types of structural polyomorphism. Data for (Me$_2$SnS)$_3$ and Me$_2$Sn(S$_2$CNEt)$_2$, both of which are known to exist in two solid forms, shows the ability of the NMR experiment to distinguish between different crystal modifications of a single compound. The two methyl (13) C resonances in the solid-state NMR of pure, crystalline MeSnPh$_3$ require the presence of more than one structural form in the sample; evidence is presented which indicates that MeSnPh$_3$ adopts two forms within a single crystalline modification. General comments on the use of solid-state NMR for determining the structure of polyomorphism are made.


Keywords: Vibrations, Spectral fit, Torsional band, Infrared, Reprints, *Fourier transform, *High resolution, *Hydrazine. The far-infrared torsional band of hydrazine has been studied by Fourier transform spectroscopy with an apodized resolution of 0.011 cm$^{-1}$. As a result of torsional as well as inversion tunneling, large splittings are observed in this b-type band. About 700PJK and PJK transitions of 22 subbands with delta k,k' from -10 to +11 were assigned. The A-B, A-A, and E-E transitions were assigned for all subbands except for the delta k,k' = -2 and -1 subbands, for which the nondegenerate transitions were observed. A global fitting, which includes all available ground state microwave data, was made using Hougen's group theoretical formalism. Several fitting constants, i.e., B-C, the trans torsional tunneling constant h/2v, and the inverting constant h/2v were found to exhibit large changes upon torsional excitation. The values of these constants in the torsional fundamental state are: B = 14.8, 134, 500 MHz, $h/2v = -912.0(21)$ MHz, and $h/2v = 1994.1(16)$ MHz, where the numbers in parentheses are 1 O. (Copyright c 1986, Academic Press, Inc.)


Keywords: Thermodynamics, *Actinide series, Americium, Cerium, Curium, Plutonium, Protactinium, Uranium, Thorium, Enthalpy, Entropy, Temperature, Oxygen halides, Specific heat, Heat capacity. Chemical thermodynamic properties of halides, oxides, etc. of thorium, protactinium, uranium, neptunium, plutonium, americium and curium are reviewed, evaluated and tabulated. Properties covered are enthalpy of formation, Gibbs energy of formation, entropy, heat capacity and enthalpy, as a function of temperature.


Keywords: Molecular structure, Stereochemistry, Molecular isomerism, Ligands, Reprints, *Electronic structure, *Cis/trans isomerism, *PThiurea diplanar. Isomeric energies and configurations for PNi(3H)$_2$ (2-) (DP), PNi(3H)$_2$(X=H), PNi(3H)$_2$(X=HO), PNi(3H)$_3$ x and PNi(3H)$_3$ XY (X=H, HO, Y=H, Y=HO, O(1)-) have been calculated by ab initio molecular orbital theory using energy gradient methods. The trends in metal-ligand bond lengths follow a con-
Lipid-Peroxidation Model for Halogenated Hydrocarbon Solutions, and Its Application to the Analysis of Physical Processes Involving Fatty-Acids and Fe(111) Porphyrins.


Keywords: Free radicals, Toxicity, Porphyrins, Iron, Chemical radicals, Carbon tetrachloride, Bromoalkanes, Chloroalkanes, Fluoroalkanes, Reprints, Chemical reaction kinetics, Peroxyl radicals.

The toxicity of halogenated hydrocarbons is believed to be due to reactions with polyunsaturated fatty acids of membranes. The authors report that for some halogenated hydrocarbons the reaction with polyunsaturated fatty acids is responsible for 90 to 95% of the toxicity.

In addition, the toxicity of halogenated hydrocarbons is believed to be due to reactions with polyunsaturated fatty acids of membranes. The authors report that for some halogenated hydrocarbons the reaction with polyunsaturated fatty acids is responsible for 90 to 95% of the toxicity.

Recent applications of tetracyanethyleno in organic chemistry have involved the preparation of stable, high-energy radicals. This work is mainly concerned with the synthesis of radical precursors, the study of their properties, and the synthesis of new compounds from them.

Not all radicals formed are stable, high-energy radicals. For example, the reaction of tetracyanethyleno with certain compounds can lead to the formation of less stable radicals.

The study of radical precursors and their properties is important for the synthesis of new compounds, as well as for the understanding of the mechanisms of radical reactions.

CHEMISTRY
Basic & Synthetic Chemistry

Industrial Chemistry & Chemical Process Engineering

Reviews & Analysis of Recently Published Work

(1)Braunger, J. A. Fatladi. 1986, 36p


Keywords: Chemical reactions, Chemical properties, Chemical reaction kinetics, Organic compounds, Reprints, Ethylene tetracyano.
loading which limited the creation of surface area. Typical values of the surface area ranged from 3.0 to 8.0 cm^2/m of cm of aqueous phase. The effect of surface area on mass transfer rate was demonstrated with a copper extraction system.

Kinetic Model for the Hydration of Tricalcium Silicate.

600.254


Keywords: Growth, Diffusion, Hydration, Nucleation, Reactions, Tricalcium Silicate, Kinetics. A kinetic model describing the hydration of C3S has been developed. The model is predicated on the assumption that the formation of a final hydrate phase initiates in transient hydrate layers which surround the anhydrous grains. The transformation results in the onset of the accelerated period. The model predicts C-S-H formation to be controlled by interfacial processes during the accelerated period and by diffusional processes thereafter and that the growth of particles is essentially one-dimensional throughout the course of both the accelerate and post-accelerate periods.

600.252


Keywords: Critical points, Hydrocarbons, Measurements, Reprints, Van der Waals. The critical temperatures, pressures, and volumes of several mixtures containing CO2, C2H6, C3H6, and C4H10 have been measured using a heavy walled, variable volume, cylindrical glass vessel. In each mixture the relative proportions of the three hydrocarbon solutes to one another were changed; total solute mole fraction never exceeded 0.1. A detailed study of the mixture CO2-C3H6 shows that the critical temperature exhibits a minimum at a C3H6 mole fraction of 0.0265. The mixture data is analyzed using a polydisperse model of dilute solutions.

600.253


Keywords: Oxygen, Hydrogen, Augers, Cryogenics, Production, Reprints, Binary mixtures. An auger rotating inside a brass tube refrigerated with liquid nitrogen and a tank containing liquid-solid (shuss) mixtures of hydroxides of oxygen and the auger produced small particles from the cryogens so that the resulting slush mixture could be transferred and stored. The auger could produce slush continuously in an appropriate system: it could produce slush at pressures higher than the triple point pressure of the cryogen, and the energy required to produce the slush was less than the energy required to produce slush using the freeze-thaw process.

600.254


Keywords: Silicon, Deposition, Photovoltaic cells, Electronic discharges, Reprints, Amorphous materials. The relative rates of radial deposition on discharge electrodes and substrate surfaces are calculated for two- and three-electrode discharges. The reaction rate, diffusion coefficient, screen-electrode transparency, and surface sticking coefficient are parameters in the general solution. The parameters are then chosen to describe typical planar discharges used for alpha-SiC photovoltaic production, and the effect of screen transparency and other parameters on substrate deposition rates is evaluated. The authors then show that a measurement of deposition rate versus screen-substrate spacing in a three-electrode discharge has been misinterpreted as due to gas reactions, whereas it is primarily due to screen deposition. Finally, they note some possibilities for measuring deposition parameters and for varying the mix of depositing species.

600.255


Keywords: Fluid flow, Instability, Convection, Porosity, Temperature distribution, Reprints. Linear stability limits are calculated numerically for convective fluid-saturated packed beds in horizontal layers. Subject to a destabilizing temperature gradient, the effect of a net vertical throughflow is studied for various boundary condition combinations and flow direction.

Photo & Radiation Chemistry

600.256


Keywords: Nitrogen, Photoionization, Fluorescence, Excitation, Electric Fields, Cross Sections, ERDA/640303.

With molecular nitrogen used as an example, it is shown that partial photoionization cross-sections for gas samples in external electric fields can be obtained through fluorescence excitation spectroscopy. (ERA citation 06:042497)

600.257


Keywords: Reaction kinetics, Hydration, Solutions, Surface area, Concentration, Composition, Reprints, Tricalcium aluminate, Calcium sulfate, Hydroxyl ions. The rates of reaction of 3CaO·Al2O3 in sulfate containing solutions was investigated. It was observed that the reactions of calcium sulfate at various hydrate formation from a mixed solution containing calcium hydroxide and calcium sulfate are much lower than those from calcium sulfate solution. In a further experiment using sulfate solution buffered with NaOH, it was established that the kinetics of calcium sulfatohydroxyl ion formation were strongly dependent on the hydroxyl ion concentration. It was also determined that the rate of sulfate ion consumption per unit surface of 3CaO·Al2O3 is constant during the period in which calcium sulfatohydroxyl hydrate is the reaction product.
Accurate Quantum Yields by Laser Gain vs Absorption Spectroscopy: Investigation of Br/Br* Channels in Photofragmentation of Br2 and IBr.  

Final rept., H. H. Haugen, E. Weitz, and S. R. Leone. 1985. 11p
Pub. in Jnl. of Chemical Physics, 85, pN7342-314, 21 Oct 85.

Keywords: "Bromine, 'Quantum efficiency, Reprints, 'iodine bromides, Color center lasers."

A two-laser pulse-and-probe technique is used to study photofragmentation of Br2 and IBr over the wavelength range 450-530 nm. The metastable Br/Br2 (P1/2)-doublet (P3/2) transition is probed by time-resolved laser gain vs absorption spectroscopy using a tunable color center laser. The new approach to the measurement of quantum yields provides highly accurate absolute values for Br/Br2 production. The peak quantum yield for Br2 photodissociation is 6.7% at lambda = 500 nm, the difference between the spectral variation of phi and the total absorption spectrum characterizes the A state of bromine, which reaches 1.4% to the absorption spectrum at lambda = 510nm. The peak in the Br* yield from photofragmentation of IBris about 73% at lambda ~ 500 nm. The present absolute Br2 yield, together with the previous molecular beam studies suggest a reassessment of the contributions of the continuum states in IBr. The laser gain vs absorption method for obtaining quantum yields is readily generalized to other atoms and molecules.

Accurate Quantum Yields by Laser Gain vs Absorption Spectroscopy: Investigation of Br/Br* Channels in Photofragmentation of Br2 and IBr.  

Final rept., W. P. Hess, S. J. Kohler, H. K. Haugen, and S. R. Leone. 15 Feb 86, 7p
Contract NAG1-437. Grant NSF-CHE84-08403
Sponsored in part by Grant NSF-PHY82-08080. Sponsoring Agency: National Science Foundation, Washington, DC.  
Pub. in Jnl. of Chemical Physics 84, pN2134-2149, 15 Feb 86.

Keywords: Photochemistry, Quantum efficiency, Aliphatic compounds, Semiconductor lasers, Photochemical reactions, Reprints, *iodine atoms, Laser applications.  
No abstract available.

Radioactive and organic Oxygen (Oxy) Radicals.  

Final rept., M. G. Simic, and E. L. Hunter. 1984, 3p
Contract NAG1-437.  
Keywords: "Chemical radicals, 'Oxygen, 'Free radicals, Reaction kinetics, Organic compounds, Peroxy radicals, Alkoxy radicals, Pulse radioisotopes."

Radioisotopes of Br-85 and Br-87  

Final rept., F. A. Rahim, A. Miller, and W. L. McLaughlin. 1985, 9p

Keywords: "Dosiometers, 'Labels, 'Chemical indicators, Gamma rays, Electrons, Quality control, Reprints, Radiation monitoring, Radiation doses, Radiochromatography."

Many kinds of coated or impregnated reflecting papers change color or become colored by large radiation doses. Such papers or 'labels' do not generally supply dosimetry information, but may give useful inventory information, namely a visual indication of whether or not a radioactive source has been moved to high doses. Tests of stability, sensitivity of ambient light, and differences in dose rate and radiation properties of rays and electron beams were made on 15 kinds of labels. The results show that, for many types of indicators, diverse effects may give misleading results unless countermeasures are taken. For example, some of the most commonly used labels, which contain dyes that indicate changes of pH due to release of halogens from halogenated substrates, have limited shelf life and must be protected from extreme environmental conditions.

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Radiolysis of Bromophenol Blue in Aqueous Solutions.  

Final rept., F. A. Rahim, S. A. Enq, N. Souka, and W. L. McLaughlin. 1986, 7p

Keywords: "Radiation effects, Radioisotopes, Bromine aromatic compounds, Dosimetry, Gamma rays, Reprints, Bromophenol blue, Chemical reaction kinetics, Rate constants."

The effect of gamma radiation on the color intensity of aerated and oxygenated aqueous solutions of bromophenol blue (BPB) was investigated. Ionizing radiation at increasing absorbed doses (D) brought about gradual bleaching (i.e. decrease in optical absorbance), which is a property of delta A of bromophenol blue solutions. The molar extinction coefficients of acidic, neutral, and alkaline solutions were measured at 620 nm. The pH dependence of the molar extinction coefficient was determined in a temperature range during spectrophotometry between 20 and 100°C. Aerated and oxygen-saturated acidic solutions showed a linear response (delta A vs D) up to doses of 2.4 and 2.1 kGy, respectively. Aerated alkaline solutions on the other hand showed a linear response up to 4.8 kGy. The degree of decoloration of bromophenol blue in acidic solutions was found to decrease upon the addition of ethanol (24% by volume) and water (10% by volume). The addition of ethanol reduced the color yield and the amount of color yield generated by the addition of water was small.
CHEMISTRY

Photo & Radiation Chemistry

600,267
P887-10590
Not available NTIS National Bureau of Standards (NLM), Gaithersburg, MD. Radiation Physics Div.

Radiation-Induced Crosslinking of Cytosine.


Formation of dimers upon gamma-irradiation of cytosine, and of 2-deoxy-2-oxo-5-methylphosphonate in N2O-saturated aqueous solutions was found to be a major process. Quantitative measurements showed that more than 50% of OH adduct radicals of cytosine undergo dimerization. Dervitized dimers and monomeric products were separated and identified. The irradiated sample capillary gas chromatography-mass spectrometry.

600,269
P887-105126 Not available NTIS National Bureau of Standards (NLM), Gaithersburg, MD. Radiation Physics Div.

Triple Differential Study-Clectron Studies of Reactions in Molecular Photoionization.


Shape and autoionizing resonances are central to the study of molecular photoionization for various reasons, the most notable being that they are often displayed prominently against nonresonant behavior in such observables as the total photoionization cross section, the angular distribution, and photoelectron angular distributions. More importantly, the study of resonant features has repeatedly led to a deeper physical insight into the mechanisms of excitation, resonance trapping of the photoelectron, and decay of the excited complex that occurs during the photoionization process. A major impetus has been provided in the area by the ability to freely probe resonances throughout the ionization continuum with synchrotron radiation and to perform angle-resolved photoelectron spectroscopy on the selected electrons. Selected examples will serve to illustrate the recent progress and the prospects of the stream of work.

600,270

Stark Broadening of Singly Ionized Neon Lines.

Keywords: Ionization, Reprints, *Line broadening, *Stark broadening, *Neon ions, Stark effect, Plasma spectroscopy.

Stark profiles of 21 Ne II lines from 10 multiplets measured to be in a low-pressure, pulsed arc. An electron density of 1.4 x 10 to the 23rd power/cm was measured using the Stark interferometer and an electron temperature of 28000 K was measured using relative intensities of 0 of impulse lines. These experimental data are compared with a previous experiment, with semiempirical potential models, and with semiempirical calculations. They agree well, within experimental uncertainties, with both the experimental and the semiempirical results. However, systematic discrepancies exist when compared with the semiempirical results and these discrepancies are corrected in the calculations.

600,271
P887-122750 Not available NTIS National Bureau of Standards (NLM), Gaithersburg, MD. Radiation Physics Div.

Enhancement of Lyoluminescence by Radiation Stimulation and Chemical Dopants.

Keywords: Radiation chemistry, Dosimetry, Disaccharides, Reprints, *Lyoluminescence, *Trehalose, Augmentation, Chemical radiation effects.

The enhancement of the lyoluminescent effect has been accomplished by radiation sensitization of the trehalose, using doses of about 30, 100, and 300 krad. The disaccharide, along with associated radiolysis products, is then reconstituted from solution. Preliminary comparison of these doped sugars with untreated sugar, irradiated at doses of 1, 5, and 10 rad, indicate that the shift to a smaller signal to noise ratio for lyoluminescence dosimetry. A promising reaction model is postulated which assumes a two-component exponen
tial decay of light, multiplied by a first-order buildup term for the dosimeter factor. The model seems to fit both the ordinary and the lumino-enhanced lyoluminescence glow-curves.

600,272
P887-122450 Not available NTIS National Bureau of Standards (NLM), Gaithersburg, MD. Chemical Kinetics Div.

Quantum Yield of Vinylidine (3B2) from the Vacuum UV Photolysis of Acetylene and Ethylene.


The primary processes in the photodecomposition in the vacuum UV of the unsaturated hydrocarbons acetylene and ethylene have been investigated. The formation of electronically excited triplet vinylidene (2D2 = C) is shown to be a major process. The quantum yields of vinylidine production are equal to 0.4 and 0.75 from acetylene and ethylene respectively. Vinyl radical formation in the ethylene photolysis is discussed.

600,273
PB88-130506 Not available NTIS National Bureau of Standards (NLM), Gaithersburg, MD. Radiation Physics Div.

Spin Dependence in Superelastic Electron Scattering from Excited Sodium.

Keywords: Excitation, *Sodium atoms, Elastic scattering, Electron scattering.

Spin asymmetries are presented for superelastic scattering of spin-polarized electrons from spin-polarized Na sub L sub -1 and M sub L sub = -1 states of the Na 3P (sub 3/2) atom. The incident energy dependence at a scattering angle of 30 degrees is shown for energies of 1.26 eV to 11.76 eV. In addition, angular dependencies over the range 5 to 40 degrees are given at 2.0 and 9.26 eV. Large differences are seen between the spin asymmetries for the two M sub L sub sub -1 sub levels of the excited state, with the M sub L sub sub -1 sub -1 subset symmetry being a value of 100% at 2 eV and 35 degrees scattering angle, corresponding to pure singlet scattering.

600,274

Experimental Study of Stark-Broadened N II Lines from States of High Orbital Angular Momentum.

Keywords: Atomic energy levels, Ionization, Reprints, *Nitrogen ions, Stark broadening, *Line broadening, Plasma spectroscopy.

In the paper, the authors report experimental electron impact widths for six spectral lines belonging to 3D-4 of transitions of singly ionized nitrogen. Line profiles were measured to be in a low-pressure pulsed arc. An electron density in the range 5.9-7.5 x 10 to the 16th power/cm was measured using the Stark effect. The Stark width of the He II 4686 A line, while electron temperatures of 28,300-32,300 K were measured using relative intensities of O I impurity lines. Comparison with semiempirical theoretical results does not resolve which coupling scheme, LS or NK, is better to describe atomic states in Stark broadening calculations of certain N II lines.

600,275
PB88-134680 Not available NTIS National Bureau of Standards (NLM), Gaithersburg, MD. Radiation Physics Div.

Angular Distribution of Fluorescence from Photolization-Produced He(1+) (n = 2).

Keywords: Fluorescence, *Helium, Angular distribution, Excitation, Reprints, Photoionization, Synchrotron radiation.

The authors report the first measurement of the angular distribution of the 304-A He(1+) (n = 2) radiation following photionization. The distribution reflects the fact that the ion is related to the fraction epsilon-sigma(2p,2p) = (sigma(2p,2p) + sigma(2p,2p))/2 of d component in the electron wave. The experimental distribution is found to correspond to alignments of 0.62 ± 0.03 and 0.62 ± 0.02 at photon energies of 65.5 and 66.5 eV, respectively. These translate into radii epsilon-sigma(2p,2p) = 0.48 and 0.45 ± 0.03, in good agreement with the observed angular distribution.

Keywords: Gallium, Chemical analysis, Atomic mass, Gallium isotopes, Mass spectrometry, Isotope ratio, Reference materials, Gallium 69, Gallium 71.

An absolute value has been obtained for the isotopic abundance ratio of a reference sample of Gallium (Standard Reference Material 994), using thermal ionization mass spectrometry. Samples of known isotopic composition, prepared from nearly isotopically pure separated gallium isotopes, were used to calibrate the mass spectrometers. The resulting absolute (69Ga/71Ga) ratio is 1.510676 ± 0.000039, which yields atom percent of (69Ga=60.10796 ± 0.00062 and 71Ga=39.8921 ± 0.00062. The atomic weight calculated from this isotopic composition is 69.72307 ± 0.00013. The intended uncertainties are overall limits of error based on two standard deviations of the mean and allowances for the effects of known sources of possible systematic error.

600.277
PB87-140232 PC A14/MF 01 National Bureau of Standards (NML), Gaithersburg, MD. Technical Activities 1986, Center for Radiation Research. C. E. Kuempel, Nov 86, 31p NSIS-86/3441 See also PB86-122121.

Keywords: Research projects, Radiation chemistry, Nuclear physics, Plasma radiation, Nuclear radiation, Laboratory equipment, Sources, Calibrating.

The report summarizes research projects, measurement technique development, calibration and testing, and data evaluation activities that were carried out during Fiscal Year 1986 in the NBS Center for Radiation Research. These activities fall in the areas of atomic and plasma radiation, radiation physics, radiometric physics, radiation sources and instrumentation, ionizing radiation, and nuclear physics.

600.278

Keywords: Actinide series compounds, Radiation chemistry, Chemical reactions, Rate constants.

Rate constants have been critically compiled for reactions of ions of the actinides Am, Cf, Cm, No, Pu, Th, and U, as well as the element Tc, in different oxidation states with various chemical species in aqueous solution. The reactants include products of the radiolysis of water (hydrated electrons, hydrogen atoms, hydroxyl radicals, hydrogen peroxide) and transient species derived from other solutes (e.g., carbonate radical). The data are useful in the estimation of migration properties of actinides, which are relevant to waste management studies.

600.279

Keywords: Polymers, Ferroelectric materials, Dielectrics, Polyvinilidenes, Fluorides, Anisotropy, Tensors, Constants, Electric moments, Crystals, Orientation/Direction, Dielectric constants, Vinylidene fluoride polymers.

A theory is presented for calculating rigorous upper and lower bounds for the dielectric constant of a semi-crystalline polymer in terms of the volume fraction of crystalline phase, the degree of crystallinity, the liquid phase and the anisotropic dielectric tensor of the crystalline phase. Also required are two orientation functions (cos to the 2nd power theta and cos to the 2nd power alpha) where theta defines the tilt of crystal lamellae and alpha the orientation of the electric moment of each crystal with respect to the measuring field. Bounds are presented for polyvinilidene fluoride for a variety of orientations.

600.281

Keywords: Atomic energy levels, Potential energy. Ground state, Hartree Fock approximation, Damping, Nuclear shell models, Coupling/Interaction, Reprints.

General expressions necessary for direct calculation of damped multipolar atomic interaction energies are presented. The abst initial method requires the computation of the zeroth and first order wave functions of each atom and can be easily extended to the interaction of open-shell atoms. Applications of this technique are given here for the case of the dipole-dipole interaction of O (S) with O (S, O, and 3P) and, using effective core potentials, Hg (S) with Hg (S) with Hg (S and 3P).

600.283

Keywords: Ion collision excitation, Laser induced fluorescence, Dyes, Fluorescence, Confocal microscopy, Reprints.

The results of a study are presented of the rotational excitation spectrum of N2 in helium excited by a tunable dye laser. The data are analyzed in terms of a Boltzmann distribution function. The spectral lines at 0.054 electron volts are observed for the rotational transitions.

600.286

Keywords: Ion collision excitation, Laser induced fluorescence, Dyes, Fluorescence, Confocal microscopy, Reprints.

The results of a study are presented of the rotational excitation spectrum of N2 in helium excited by a tunable dye laser. The data are analyzed in terms of a Boltzmann distribution function. The spectral lines at 0.054 electron volts are observed for the rotational transitions.
coefficients of the complex and CO-adduct to be determined. The reversible complexation reaction of the FeII complex with carbon monoxide affords facilitated transport of CO across benzyltriazole liquid membranes. For a membrane with a thickness of about 0.072 cm, the transport rate for CO is increased by 14% over the diffusion rate. Since the FeII complex does not bind N2, O2, CO2, or H2, the facilitated transport will be selective for CO in a variety of gaseous mixtures. Selectivity is demonstrated for CO2 gas mixtures.

600,295
PB86-160562 Not available NTIS National Bureau of Standards (NML), Boulder, CO Quantum Physics Div.
Rotational Relaxation of the 0(0) Level of CO Including Transfer in the 4.3 Micrometers Band of Planetary Atmospheres.

Keywords: *Carbon dioxide, *Rotational relaxation, *Molecular energy levels, *Planetary atmospheres, Thermodynamics, Reprints.

Accurate numerical solutions have been obtained for a model problem of rotational relaxation within the 0(0) level of CO, including transfer of radiation in the lines of the fundamental transition 0(0)→0(1)→0(0) of the 4.3-μm CO vibrational-rotational band. The effects of rotational relaxation by absorption to the 0(0) level of CO of the vibrational-rotational band of CO2 and of absorption of solar radiation in the 0(0)→0(0) band are accounted for. A plane-parallel isothermal atmosphere of pure CO2 with the barometric pressure distribution and solar illumination is assumed. The line opacities are represented by nonoverlapping Voigt profiles shifted along the temperature and pressure path. The transfer problem which is equivalent to that of a multilevel with a large number of lines with a common lower level, was solved by a generalization of the Rybicki method. Absorption of solar radiation can affect significantly the source functions of lines at the centers of the P and R branches. Deviations from rotational LTE are shown to influence the intensity and shape of the 4.3-micrometer band of CO2 in the spectra of Mars and Venus, and should be taken into account in the interpretation of the observations in which the rotational structure is resolved, especially in limb measurements, where these effects are particularly apparent.

600,296
PB86-160660 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Hindered and Unmodulated Rotations of Adsorbed Diatomic Molecules: States and Spectra.

Keywords: *Adsorption, *Vibrational spectra, Surface chemistry, Stratospheres, Diatomic molecules, Reprints, Rotational states.

The authors present results for the rotational states and spectra of adsorbed diatomic molecules whose rotations are frustrated by the interaction with the substrate. For a diatomic, the quantum numbers of the vibrational levels are related to the internuclear potential. For a vertical adsorption configuration, hindered diffusion is modeled by constraining the molecular motion with respect to the rotational potential. For a horizontal adsorption configuration the infinite conical-well model as well as hindered diffusion caused by the hindered hindered potential are studied. For both hindrance models, the authors study the effects caused by a modulation of the molecular motion due to periodic atomic potential. The results are compared with the free diatomic molecule models of the interaction potentials. For a vertical adsorption configuration, the infinite conical-well model is used as well as hindered diffusion caused by the hindered diffusion potential. The authors study the effects caused by a modulation of the molecular motion due to periodic atomic potential. The results are compared with the free diatomic molecule models of the interaction potentials.
The 5.5 microseconds pulse) and the second much slower (corresponding to microseconds after the pulse). Possible mechanisms for the fast and slow components of radiolytic dye formation are postulated.

**Keywords:** Laser radiation, *Two photon absorption, Sodium atoms.*

Field-effect correlations are studied experimentally for the weak-field two-photon 3S-5S transition in atomic sodium in a Doppler-free configuration. A laser field with components orthogonal to the analyzing beam and crossing phase is synthesized by applying random fluctuations to a laser beam, using phase and frequency modulators. The beam measured at maximum, of the absorption profile is found to depend on bandshape as well as band width. In particular, for a Lorentzian laser power spectrum the absorption width has four times the spectral width of the exciting field.

**Keywords:** *Gas ionization, Ionization, Stark effect, Reprint,* Hydrogen atom, *Multi-photon processes,* Photoionization.

The authors have measured the three-photon resonant, four-photon ionization profile of atomic hydrogen. The width of the profile is large compared with the laser bandwidths, so the structure split off from hydrogen wing and radiative and collisional rates. The shape, shift, width, and laser intensity dependence of the measured profiles are in excellent agreement with theoretical predictions.

**Keywords:** *Molecular structure, * Nuclear magnetic resonance, Metal containing organic compounds, Reprint,* Poly(Tin/methyl), Tin oxide/dimethyl.

High-resolution solid-state (13C) NMR analysis of 11 crystalline and amorphous polymeric methylivinyl is described. Multiple Sn-methyl resonances observed for linear polymeric trimethyl acetate and trimethylstannyl indicate hindered rotation of the trigonal-planar Me3Sn group in the crystal lattice. The magnitude of J of the amorphous polymers methylstannyl acetate and bis(trimethylvinyl) carbonates provides new insight into their bonding structure and reactivity.

**Keywords:** *Thermal conductivity, Measur- ing Resonance, Temperature dependence, Pressure dependence."

The paper presents new experimental measurements of the thermal conductivity of methane for 14 temperatures between 50 and 700 MPa and densities from 10 to 30 mol/L. The measurements were made with a transient hot-wire apparatus and they cover a wide range of physical states including the cluthe gas, the moderately dense near, the critical region, the compressed liquid states, and the vapor at temperatures below the critical temperature.

**Keywords:** *Methane, Thermal conductivity, Measurement, Resonance, Temperature dependence, Pressure dependence."

The 600.307

PB86-163466 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Molecukar Spectroscopy Div.

Electric-Field-Induced Interferences in Autorization Resonances.


Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.


**Keywords:** Barium, Electric fields, Resonance, Reprints, Autorization.

The authors have observed the effect of electric fields on the 589b triplet (P1) barium resonance above the first ionization threshold. The relatively broad auto- rization is narrowed to a much narrower level of opposite parity. At moderate fields, the sharp level produces an interference dip in the broad level. At higher fields, the interference overlap gives rise to two split components. The results are in good agreement with a nonperturbative theory, summarized in the Letter.

**Keywords:** Hydrogen sulfide, Calculations, Reprints, Radiative transition probabilities, Ab initio.

Potential energy and dipole moment functions for the ground states of SH, SH and SH2 have been calculated from highly correlated wave functions. The electric dipole moments in the vibrational ground states of SH and SH2 have been calculated to be 0.74, 1.29, and 0.27 D. The predicted transition probabilities between the low lying vibrational- ional states of the electronic ground state of SH and SD are among the smallest so far known for dipole allowed rotation-vibration transitions. The calculated A- X transition probabilities in SH confirm recent indirect determinations of the radiative lifetimes and absorption oscillator strengths in the predissociating v=0 level of the A state.

**Keywords:** *Infrared absorption, Band structure, Intensity Measurements in the 0 yields 2 Band of NO.*


Grant NSF-CHE85-16628

Sponsored by National Aeronautics and Space Administration, Washington, DC.


**Keywords:** Hydrogen chloride, Hydrogen fluoride, Band spectra, Molecular spectroscopy, Infrared radiation, Reprints, Self-broadening, Laser spectroscopy.


Sponsored by National Aeronautics and Space Administration, Washington, DC.


**Keywords:** Hydrogen chloride, Hydrogen fluoride, Band spectra, Molecular spectroscopy, Infrared radiation, Reprints, Self-broadening, Laser spectroscopy.

Self-broadened lineshapes in the fundamental bands of HF and HC1 have been measured with a high-resolution difference-frequency laser spectrometer. Self-broadened broadenings, shifts, and collisional narrower have been measured by least-squares fitting several collisional profiles to the spectra. At low pressures, the collisional narrowing effect causes deviations of the lineintensity from the Voig profile having a Doppler- fixed Gaussian component, and yields a measure of the diffusion constants of the molecules.

**Keywords:** Line width, Absorption spectra, Emission spectra, Band position, Aromatic compounds, Reprints, Atom collision, Atom-atom collisions, Excimers.

The spectrum for absorption and emission of radiation by collision of atoms or a diatomic molecule is calculated for spectral regions dominated by an avoided level crossing. Three processes are absorption during atom-atom collision with separation to either crossing atomic state, total absorption to both crossing states, and spontaneous emission during a collision with either state initially populated. Absorption and emission by bound diatomic molecules (including photodissocia- tion) is described by the theory, and as an example it is applied to the Cs2 A-X band. The authors conclude that measurements of spectra in the region of level crossing is a very powerful diagnostic of the poten- tials and transfer probability in the level-crossing region, which is responsible for most inelastic atom-atom energy-transfer processes.

**Keywords:** Infrared spectrum, Autoradiation and Autodetachment Dynamics of NH3.-1.

PB86-163599 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Sponsored by National Aeronautics and Space Administration, Washington, DC.


**Keywords:** Infrared spectroscopy, Reprints, Autoradiation and Autodetachment Dynamics, Negative ions.
The infrared vibration-rotation spectrum of NH has been obtained by autodetachment spectroscopy in a coal ash laser-ion beam spectrometer. Transitions from the v = 0 to v = 1 vibrational levels were excited with an F-center laser, and subsequent autodetachment from the v = 1 levels was observed. The resolution was better than 20 MHz, allowing the resolution of the fine structure and Lamb-doubling transitions. The lineshape of the autodetachment gives an insight into the dynamics of the autodetachment process. The autodetachment rates were, in general, much greater for the upper Lambda-doublet levels NH(ν = 1) than for the lower levels. In addition, the increase of the autodetachment rate with rotational energy is very rapid. The increase in rates from a total of 0.1 Hz for the lower levels to several thousand Hz for the higher levels is very rapid. This increase in rates from the lower levels to several thousand Hz for the higher levels is due to the fact that the autodetachment rates are dominated by the vibrational levels of the ion. The results of the autodetachment give an insight into the dynamics of the autodetachment process. The autodetachment rates are, in general, much greater for the upper Lambda-doublet levels NH(ν = 1) than for the lower levels. In addition, the increase of the autodetachment rate with rotational energy is very rapid. The increase in rates from a total of 0.1 Hz for the lower levels to several thousand Hz for the higher levels is due to the fact that the autodetachment rates are dominated by the vibrational levels of the ion.
CHEMISTRY

Physical & Theoretical Chemistry

Copolymer/Copolymer Blends: Effect of Sequence Distribution on Miscibility.
Final rept.,
A. C. Balazs, F. E. Karasz, W. J. MacKnight, H. Jeda, and I. C. Sanchez, 1985, 3p
Contract F49620-84-C-0051
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.

Keywords: *Copolymers, *Solubility, Interactions, Blends, Distribution(Property), Chemical composition, Reprints.

An earlier theory on the effect of sequence distribution in copolymer/homopolymer blends is applied to blends of two copolymers that differ only in composition, A(A,B)/A(B,C) in which contains contributions from a composition dependent term (Chi comp), as well as a term (Chi dist) which depends only on the difference between the sequence distributions in the two copolymers. A special case of the above equation is a blend where both copolymers have the same composition but differ only in sequence distribution: for example, a blend of a 50:50 alternating copolymer with a 50:50 random copolymer. The kinetic formula is adapted to the case, and the authors can theoretically confirm the experimental observation that PVC and chlorinated polyethylene (CPE) are immiscible. From experimental data on CPE/CPE mixtures, they can evaluate the chi parameters required by their theory and consequently calculate (chi sub CH2; CH2CH2).
The aqueous solubilities and octanol/water partition coefficients of benzenes, chlorobenzenes, and other polycyclic aromatic hydrocarbons were measured using the modified generator column method. These values can be used as a reference and can be compared with either boiling point or density as descriptors of the molecule. The results are also presented in a correlation of the solubility and partition coefficients with a number of other physico-chemical properties.

Keywords: Benzenes, Polycyclic aromatic hydrocarbons, Octanol/water partition coefficient, Density, Solubility, Partition coefficient, Molecular properties.

660.302
PB86-187259
Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Comparison of Vibrational Broadening in Auger and Photoelectron Spectroscopy.

Final rept., J. D. Matthew 1984, 4p
Published in Physical Review B 29, n6 p3031-3034, 15 Mar 84.

Keywords: Vibration, Surface, Auger Electron Spectroscopy.

Within linear coupling the vibration broadening of quasi-atomic Auger peaks and core photoelectron peaks is approximately equal in ionic crystals, but the Auger Broadening is about three times that of the core photoelectron broadening for rare gas atoms physisorbed on metal surfaces.

660.302
PB86-187275
Not available NTIS National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.

Molecular Symmetry and Transition-Rotation Coupling In Orientationally Disordered Crystals.

Final rept., K. H. Michel, and J. M. Rowe, 1 Nov 85, 6p
Sponsored by Institut Interuniversaire des Sciences Nucleaires, Brussels, Belgium.

Published in Physical Review B 32, n9 p5818-5826, 1 Nov 85.

Keywords: Phase transitions, Degrees of freedom, Crystal symmetry, Transition, Ferrodielectricity.

The theory of coupling between rotational and translational degrees of freedom in orientationally disordered crystals is studied in detail, with careful attention to the requirements of symmetry. An essential feature of this coupling is the presence of a center of symmetry in the molecule or crystal on which determines the nature of the coupling to optical and acoustic phonons. The present analysis is relevant for the understanding of ferroelectric phase transitions, of incommensurate transitions in insulators, and of structural transitions and related properties in synthetic organic conductors.

660.304
PB86-188283
Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.

Aqueous Solubilities, Octanol Water Partition Coefficients, and Densities of Metals in Chlorinated Benzenes and Biphenyls.

Published in Journal of Chemical Engineering 29, n2 p184-190 1984.

Keywords: Chemical analysis, Benzenes, Biphenyl/perchloro, Solubility, Entropy, Chlorine organic compounds, Reprints, Partition coefficients.
CHEMISTRY

Physical & Theoretical Chemistry

600.344

Keywords: * Microwave spectra, Millimeter waves, Rotational spectra, Molecular vibration, Excitation, Atmopheric scattering, Stratosphere is, *Chlorine nitrate(CINO3), Chlorine 35, Chlorine 37.

New measurements of the millimeter wave spectra of the (35)Cl and (37)Cl, isotopic forms of chlorine nitrate in the ground and lower vibrational state have been made in the 80-228 GHz region. These measurements allow accurate frequency predictions of all strong transitions up to 300 GHz. A comparison of rotational line intensities with those of CO which has already been measured and calculated frequencies of CINO3 are available on magnetic tape.

600.342

Keywords: * Hydrogen chloride, Deuterium compounds, Infrared spectroscopy, Liquid gases, Cryogenics, Reprints, Liquid xenon.

The band strengths of the fundamental and first overtone of HCl and DCI have been measured in liquid xenon solution. The fundamental increases in intensity while the overtone decreases in intensity relative to the respective gas phase values. A variety of simple models are applied to the system in an effort to explain the observed effects. The possible effect of HCl-Xe complexes on the spectra is considered.

600.343


Absolute branching ratios for production of O(3P) P, O(singlet D), and O(singlet S) in the reaction of N(+) + O(2) at 300 K have been measured using the flowing afterglow visible chemiluminescence technique. The O(1S) product is monitored by the O(1S)-O(1D) emission at 527.7 mm which is observed via sensitized fluorescence at 760 nm from O(2) sub 2(sub 1) sigma (sub g) (sub g) + ) formed by energy transfer from O(1D) to O(2)(sub 2)(sub 1) sigma (sub g) (sub g) + ) and O(1D) (sub 1D) (sub 1S) yields of 70 plus or minus 30% and less than or equal to 0.1%, respectively, of the total atomic oxygen product are interpreted by comparison to the known O(1S) and O(2D) sub 1D) sub 2(sub 1) sigma (sub g) (sub g) + ) emission intensities from the reaction of Ar(1D) with H(2) and CO(1D) with CO(2D). Absolute values are obtained from the relative O(1S) and O(2D) sub 2(sub 1) sigma (sub g) (sub g) + ) emission intensities from the late reaction. A qualitative reaction mechanism consistent with these observations is presented.

600.346

Keywords: *Electrolytes, Chemical equilibrium, Thermodynamic properties, Adhesion, Interactions, Phase transformations, Ions, Reprints, Wiener-Hopf factorization, Percus-Yevick equation.

The equilibrium properties of charged hard spheres with adhesive interactions between oppositely charged ions are studied in the hypernetted chain/microspherical HNC/MS approximation which are available analytically. Numerical solutions to the hypernetted chain (HNC) approximation for the model are also compared with the HNC/MS approximation for a model with the same interaction range. The effect of adhesion on the low density phase transition of the primitive model electrolyte is found to be significant in contrast to the effect of charge on the phase separations at high densities of a two component mixture of hard spheres in which there is adhesion only between molecules of different species.

600.347

Keywords: Magnetic fields, Reprints, *Photoabsorption, Oscillator strengths.

A time dependent wave packet approach is presented as a description of the dynamics responsible for the oscillatory observed structure near the zero field ionization threshold for atomic photoabsorption in a magnetic field. The description is in a simple classical interpretation which both complements and extends earlier one dimensional WKb work. Absolute positions of the oscillations, widths, and amplitude modulations are correctly accounted for. Oscillatory structure in photoabsorption is illustrated with negative ions in magnetic or electric fields is predicted for appropriate polarization.

600.348

Keywords: Eigenvalues, Reprints, *Multi-photon processes, Resonance fluorescence, Fioquet function, Liouville equations, Nonlinear optics, Laser radiation.

A practical non-perturbative approach is presented for the treatment of multiphoton non-linear optical processes in intense monochromatic or polychromatic field. By extending the many-mode Fioquet theory recently developed by the authors, the time-dependent Liouville equation for the density matrix of atoms or molecules undergoing radiative and/or collisional relaxations can be transformed into an equivalent time-independent Fioquet-Liouvillian super-matrix eigenvalue problem. The method is illustrated by a study of the multiphoton resonance fluorescence spectra of two-level systems.

600.349
PB86-190042 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD, Center for Basic Standards.
Vibrations of Crystallographic Defects Associated with a Single Chain in Polyethylene.

Final report.
Pub. in Polymer 25, n1 p1549-1561 1984.

Keywords: *Polyethylene, *Crystal defects, *Molecular vibration, Crystallography, Dispersion, Dislocations(Materials), Reprints.

The vibrational behavior of crystallographic defects associated with a single chain was investigated for a dispersive, disclination, and dislocation in polyethylene. An approximate longitudinal modulus for the defects was derived by using calculations to estimate the energy changes associated with changes in length of a defect. The modulus, combined with the energy used per unit length of the defect, was used to estimate the lowest longitudinal frequency of the defect, which was found to be around 100/cm for all the defects considered. Normal mode vibrational calculations for oligomers containing defects showed that the predicted lowest longitudinal modes could be identified by examination of the displacements associated with modes occurring in the estimated frequency range. It was shown that the defects could be considered as localized oscillators embedded in the crystal and coupled to the vibrational modes of the crystal. The presence of defects provides special mechanisms for coupling light waves and lattice vibrations in the crystal which may affect the Raman spectrum.

CHEMISTRY

Physical & Theoretical Chemistry

Interaction of Physisorbed Species with Chemisorbed Species as Studied by Infrared Spectroscopy.

Final report.
J. T. Yates, and G. L. Haller. 1984, 5p

Keywords: *Chemisorption, *Carbon monoxide, Surface chemistry, Adsorption, Rhodium, Aluminium oxide, Reprints.

Infrared spectroscopy has been used to study the chemisorption of CO onto a Pt/AuO2 surface. In addition to absorption bands related to monolayer and multilayer physisorbed CO species, an interaction between the physisorbed species and chemisorbed CO has been observed causing a decrease of the chemisorbed CO wavenumber. Similar effects between physisorbed Xe and chemisorbed N2 on Rh surfaces have been observed, suggesting that the effect is a general one. Correlation of these measurements with measurements of CO trapped in CO matrices suggests that inductive and dispersive effects are the main factors responsible for the negative shift in chemisorbed species wavenumber. It has been found that physisorbed CO preferentially adsorbs in the vicinity of vacancy sites.

600,353
PB86-191442 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Single-Pulse Shock-Tube Studies on the Decomposition of 1,2-Dibromoperoxfluorohexane and Allyl Bromide.
Final rept.
W. Tsang. 1984, 6p

Keywords: *Decomposition, Chemical reactions, Cyclcopentane, Chemical radicals, Reprints, *Bromide, *Ethylene/dibromo-perfluorohexane, *Chemical reaction kinetics, Collision, Reaction tubes, 1,2-Dibromoperoxfluorohexane and allyl bromide have been decomposed in comparative rate single pulse shock tube experiments. Cyclcopentane is used as a radical trap and as a source of the ethylene which serves as a direct measure of the number of radicals generated in the system. Under the reaction conditions both decomposition processes (1) BF2+CF2Br \rightarrow Br + CF2Br=CF2, (radical), and (2) Ayl Br-> allyl + Br (radical) are in the beginning of the fall-off region, k/(sub infinitely) greater than or approx. equal to 0.7 RRKM calculations yield the following high pressure rate expressions.

600,354
PB86-192150 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Kinetics and Mechanisms of Hydroxyl Radical-Induced Crosslinks between Phenylalnine Peptides.
Final rept.
M. G. Simic, E. Gajewski, and M. Dzidrago, 1984, 8p

Keywords: *Peptides, *Phenylalnine, Chemical reactions, Gas chromatography, Mass spectroscopy, Reprints, *Chemical reaction kinetics, *Hydroxyl radicals, Dimerization, Pulse radioisotropy.

Reactions of OH radicals with phenylalnine (Phe) and its homopeptides, i.e. L-Phe-L-Phe and L-Phe-L-Phe, in H2O have been investigated by pulse radioisotropy, high-performance liquid chromatography and mass spectrometry. For identification of the methylation products, samples of irradiated Phe and HC1-methyliated of its irradiated homopeptides were trimethylsilylated and analyzed by capillary gas chromatography-mass spectrometry. Mass spectra of the trimethylsilylated products revealed the formation of o-m-, m- and p-tirosines and biphenyl type subspecies. The structures were also determined by gas chromatography, Mechanisms of product formation were discussed in detail.

600,355
PB86-192457 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Center for Materials Science.

600,357
PB86-192523 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Final rept.
W. Gadzuk. 1985, 3p


A mechanism is suggested which could lead to enhanced excitation of the low-frequency vibrational modes associated with the bond between a solid surface and a molecule adsorbed upon it or of hindered rotational modes with displacement components normal to the surface, as observed in electron-energy-loss spectroscopy. If the incident electron beam is trapped in a negative-molecular-ion shape resonance, manifesting itself in significant intramolecular overtone extinction, the mode-surface-potential energy curve is augmented by the image potential of the negative ion. This allows displacement of the molecule from its equilibrium neutral position which in turn appears as
vibrational excitation of adsorbate-substrate relative motions. The return to the neutral curve. A simple theory for the effect is presented and numerical estimates of its magnitude are given.


Keywords: *Mass spectrometry, Standards, Ions, Re- prints, *Secondary ion mass spectrometry, Ion micro- probe analysis, Ion microscopes. Sensitivity analysis. The existence of strong matrix and instrumental ef- fects in secondary ion mass spectrometry prohibits the use of theoretical models for accurate quantitative elemental analysis. Standards must be employed to reduce problems associated with instrumental and matrix effects. By means of relative elemental sensitivity factors based on glass standards, analyses with errors of 20% relative or less is feasible, even for trace elements.


Keywords: *Nitric acid, *Molecular isomerism, Infrared spectroscopy, Absorption spectra, Frequencies, Reprints, High resolution. Tunable diode laser spectra have been measured for the nu sub 4 band of cis-HONO near 850 cm and the nu sub 2 band appears to have some small perturbations, but about 190 trans- formations have been fit with a standard deviation of 0.0027 cm. Rotational and centrifugal distortion con- stants are given for both bands.


Keywords: *Butadiene, Reprints, *Multiphoton ionization, *Rydberg series, Diffusion flames, Core sampling. The ns Rydberg series of 1.3-trans-butadiene has been observed in a diffusion flame environment using two-photon resonant multiphoton ionization in the 330- 269 nm wavelength region. An analysis of the energies for the N = 4 to N = 10 states yields a series limit of 73172 + or - 22 cm and a quantum defect of 0.91 + or - 0.04. The series limit near 73150 cm has been averaged with the limits of three other Rydberg series to give an ionization potential of 73154 + or - 30 cm. The 3s and 4s states have substantial effects of mixing with the core orbitals.


Keywords: *Reaction kinetics, Chemical analysis, Free radicals, Photolysis, Mass spectrometry, Infrared spectroscopy, Reprints, *Methane/dichloro-difluoro, "Ethane-difluoro/tetrafluoro, Real time measurements. The infrared-laser photolysis/mass-spectrometric (IL/MS) technique was used to monitor directly in real time the free-radical and stable reactants and products present in the reactive system initiated by the multiphoton-induced dissociation of CFCl3. It was found that, contrary to conclusions based on final- product analyses, the CF2F4 observed is a final prod- uct in the system is not formed solely through the re- combination of CF2 radicals, but rather CF2F4 is pro- duced in a complex series of secondary reactions.


Keywords: *Nitrous oxide, Absorption spectra, Frequency measurement, Frequency stabilization, Demodula- tion, Reprints, Laser applications, Tunable lasers, In- fared radiation. Frequency measurements are given for the (00 sup 01), (01 sup 10), (10 sup 11), 101 sup 107 bands of N2O from 1257 to 1340 cm. The measurements utilize heterodyne techniques by measuring small frequency differences between a tunable diode laser locked to the center of an N2O absorption line and harmonic combinations of frequencies of radiation from two CO2 Lambda Lambda Lambda-pass filtered lasers. The measurements are fa- cilitated by the use of the CO laser as a transfer laser whose frequency is also measured. These measure- ments have been combined with other data to provide new band constants and frequency calibration tables for several band systems of N2O in the following re- gions: 1215.1-1257 cm, and 1257 to 1325 cm. A correction factor is also provided for existing calibration tables near 590 cm.


Keywords: *Uranium oxides, Visible spectrum, Infrared spectra, Reprints, *Electronic structure, Relaxation ef- fects. Relaxational effective potentials are used to calculate the electronic structure and spectroscopic properties of UO(1-). The lowest energy states are very ionic and the molecular orbitals substantially localized to the molecule that is described by the ionic fragments, U (3f) and O(2)(f) singlet 1). All of the quart- et states from Sigma (sup to) I that arise from the coupling of these ionic fragments, are perturbatively mixed using an effective operator for the spin-orbit. The Re and O sub e sub o component of the ground Omega - 9/2 state have been determined to be 3.48 bohr and 925/ cm. The vibrational and electronic states are inter- leaved with low excited state, Omega = 7/2, at 1315/cm. The excitation energies of the excited states of UO(1-) were calculated using a restricted valence contour interaction. Strong mixing of transitions are predicted in the red part of the visible. These trans- formations are predominantly atomic-like 1 to 0.


Keywords: *Gas ionization, Electric charge, Reprints, *Electron-atom collisions, ER range 100-1000. Charge state abundances of atoms exposed to an electron flux for a time t are calculated from experi-
Keywords: *Ions, X-ray spectra, Reprints, *Chlorine ions, Lamb shift.

Bare Cl nuclei were decelerated and then allowed to capture a single electron in a He-gas target. By the method of molecular spectroscopy, members of the 4s-4p family of Cl ions were prepared in an excited state from which the 2p-1s transition wavelength could be accurately (about 0.00001) measured without difficulty. Upon de-excitation, Doppler correction utilizing measurements at four different ion velocities (vc about = 0.036-0.67), fine-structure splitting and ionization potentials were determined within 15% error bars, which, while far from the potential possible limits of our method, are in agreement with theoretical results.

600.368

Final rep.

Keywords: *Spectroscopy, *Ions, Reprints, Quantum electrodynamics, Lamb shift.

Precision measurements of spectra from one-electron ions are principally focused on tests of QED corrections to the energy levels into the implied by the Dirac equation. Even though spectroscopic tests in atomic hydrogen have been significant and the determinations of the anomalous moment of the electron have reached impressive levels of refinement and demonstration of equal impressiveness are expected, it is not clear what kind of information is being tested and what kind is difficult to extract from a permutation-inversion group treatment. (ii) What is the most general group theoretical approach, suitable for application without modification to the majority of floppy molecules, has not yet been synthesized from the particular cases studied in the literature, some feeling for one direction of progress in the field can be obtained from the several examples presented.

600.371
PB86-193729 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Radiation Bureau, Division of Optical and Electrical Analysis of Blue Polyethyl Methacrylate for High-Dose Dosimetry.

Final rep.

Keywords: *Dosimetry, *Plastics, Conductivity, Reprints, Polyethyl methacrylate.

The response to gamma radiation of polyethyl methacrylate ("blue PMMA") containing a blue dye was investigated. The photoconductive response to a high dose-dose rate was found to be produced by a mesoscopic level shift in the visible region (402, 562, 616 and 643 nm) of linear functions of dose. Results also show that irradiation of the zero-phonon lines of blue PMMA contains two components of radiation-induced conductivity: a transient component, which can be used to determine the absorbed dose rate and a steady-state component which registers the total absorbed dose in the range 20-80 kGy as based on a suitable calibration. The effects of post-irradiation storage time, day light, and storage temperature on the radiation-induced visible spectrum were investigated. The storage temperature effect on post-irradiation conductivity measurement was also evaluated.

600.372
PB86-193745 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Polyimides Div.


Final rep.

Keywords: *Epoxide resins, *Molecular structure, *Neutron scattering, *Elastic scattering, Molecular weight, X-rays, Thermosets, Reprints.

Neutron scattering measurements were performed on two epoxy resins with different molecular weight. The results are consistent with the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kirkwood model, and the scattering is of the type of the predictions of the Kir...
CHEMISTRY

Physical & Theoretical Chemistry

romatic formulation, and lists the equations approved by IAPS for the transport and the thermophysical properties.

600.376 PB86-193689 Not available NTIS National Bureau of Standards (NML), Boulder, CO Quantum Physics Div.

Field Effects on the Rydberg-Product State Distribution from Dielectronic Recombination. Final rept.
A. Mueller, D. S. Belic, B. D. DePaola, N. Dujic, and G. H. Dunn. 1986, 4p
Contract DE-AT-7A-01-6010
Pub. in Physical Review Letters 56, n2 p127-130, 13 Jan 86.

Keywords: Reprints, *Magnesium ions, *Electron-ion collisions, dielectronic recombination.

The effects of state mixing by extrinsic fields in the collision region have been investigated for the dielectronic recombination of Mg3p,nl -> Mg3s,nl + h nu. By field ionization of the Rydberg atoms produced, cross sections sigma(nub) have been measured. The observed large changes of sigma(nub) with alteration of the extrinsic field provide the first incoherent experimental evidence that dielectronic recombination can be changed by external fields.

600.377 PB86-193877 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Applied Optics. n2 p284-290, 15 Jan 86.

Keywords: *Raman spectroscopy, *Deuterium, Hydrogen, Reprints, Fourier transform spectroscopy.

A high-resolution Fourier transform spectrometer (FTS) has been used to record spontaneous incoherent laser Raman spectra of gases. The resolution, sensitivity, calibration accuracy, and spectral coverage achieved with these spectrometers demonstrate the viability of the FTS for Raman spectroscopy. Measurements from a spectrum of D2 containing both v=0-0 and v=1-1 transitions were fitted to the Dunham expansion of the vibration-rotation energy levels. The coefficients are given.

600.379 PB86-194974 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

J. W. Schmidt, and M. R. Molderow. 1983, 1p

Keywords: *Thin films, Mixtures, Binary systems(Materials), Surfaces, Reprints, *Cyclohexane/methyl, *Cyclohexane/methyl-perfluoro, *Ellipsometry.

In certain binary solutions, the lower of the two liquid phases forms a layer that intrudes between the upper liquid phase and the vapor. The authors used ellipsometry to measure the intruding layer's thickness. It was between 0.7 micrometer and 4 micrometers in a system consisting of CF314 (perfluoromethoxychlo- cene) and H2O. The thickness varies approximately as L sup 1/3, where L is the height spanned by the upper liquid phase. The behavior was predicted by de Gennes, who used the idea that the long-range part of the intermolecular potential governs the layer's thickness. Deviations from L sup 1/3 behavior occur near consolute points.


Reaction of Oxygen and Aluminum on Rh(111). Final rept.
S. Semancik. 1984, 2p

Keywords: *Aluminum, *Oxygen, Surface chemistry, Adsorption, *Aluminum oxide, Rhodium, Chemical reactions, Reactions, Low energy electron diffraction, Auger electron spectroscopy.

The initial stages of aluminum oxide formation on rhodium have been studied by absorbing oxygen and aluminum on a Rh(111) surface. Low energy electron diffraction was used to determine the surface composition and structure, as a function of temperature and coverage, and to investigate the influence of surface and molecular oxygen on Rh, and the interaction between these species during coadsorption experiments.

600.380 PB86-194990 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Polymers Div.


Keywords: *Solubility, *Polyethylene, *Polyvinyl methyl ether, Polymers, Vinyl ether resins, Length, Neutron scattering, Reprints, Small angle scattering.

Miscibility and critical phenomena were studied on the polymer system of deuterated polyethylene and hydrogenated poly(vinyl methyl ether) by the small-angle neutron scattering technique. The phase diagram was constructed with light and neutron cloud points as well as spinodal points. It shows a well-known behavior of a lower critical solution temperature. The agreement between the light and neutron cloud points is fairly good for all compositions. The correlation length, the statistical segment length, and the Flory-Huggins Chi-parameter were obtained as functions of temperature and composition by employing de Gennes' scattering equation for polymer blends. The Chi-parameter showed not only a temperature dependence but also a composition dependence. Comparison of the Chi-parameter with the lattice fluid theory shows that the composition dependence of Chi results from the lattice fluid nature of the system, i.e., the compressibility and the thermal expansion of the system.

600.381 PB86-195187 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Desorption of Ions from Surfaces: Mechanisms of Photon Stimulated Desorption. Final rept.
R. Stockbauer, and T. E. Madey. 1984, 8p

Keywords: Desorption, Surfaces, Chemisorption, Synchrotron radiation, Reprints, *Photon stimulated desorption.

A review is given of the mechanisms of photon stimulated desorption (PSD) from ionic, covalent and van der Waals bonded surfaces. An interatomic decay process describes desorption from ionically bonded surfaces. At low temperatures, the mechanism is for ion desorption from covalently bonded systems. They are not so well understood but is thought to involve the formation of two high-valence ions similar to doubly charged ions in the gas phase. Ion desorption from thick molecular films presents a challenge to theory since it must take into account effects, such as (cyclohexane) and not from others (water, methanol). It is possible that hydrogen bonding or proton transfer reaction could play a significant role in suppressing heavy fragments from the water or methanol surface.

600.382 PB86-195195 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Electron Excitation of Na(3S) and Na(3P) Atoms to the Na(3D) State. Final rept.
B. Stumpf, and A. Gallagher. Dec 85, 10p
Contract ARO-8-82, Grant NSF-PHY83-09608
Sponsored by Army Research Office, Research Triangle Park, NC, and National Science Foundation, Washington, DC.
Pub. in Physical Review A 32, n6 p3344-3353 Dec 85.

Keywords: *Sodium, Atomic energy levels, Excitation, Reprints, *Electron-atom collisions.

The cross sections for electron-impact excitation of Na(3S) and Na(3P) atoms to the 3D state have been measured from threshold to 1000 eV, with about 0.3 eV resolution. The 3P-state atoms are produced in the m(J)=1, m(S)=1/2 level by optical excitation, and 3D-3S fluorescence is detected at 90 degrees to the quantization axis. The resulting polarization anisotropies are considered, and included along with cascade effects in the high-energy normalizations to the Born approximation. The 3S-3D and 3P-3D excitation cross sections both rise very abruptly at threshold, and are indistinguishable from a step function with our energy resolution.

600.383 PB86-195492 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Comment on 'Anomalies in Chemical Equilibrium near Critical Points'. Final rept., G. Morrison, I. Procaccia, and M. Gitterman. Jul 84, 4p
Pub. in Physical Review A 30, n1 p644-647 Jul 84.

Keywords: *Critical point, Scattering, Turbidity, Reprints, *Equilibrium constant.

An analysis of measurements purporting to show the effect of a critical point on the extent of a chemical reaction indicates that the measured phenomenon can be accounted for by turbidity at the critical point.

600.384 PB86-195518 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Grants NSF-CHE79-11340, NSF-PHY92-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in Chemical Physics Letters 100, n6 p475-478, 30 Sep 83.

Keywords: *Cyano radicals, Anions, Reprints, Laser spectroscopy, Optogalvanic effect, *Photodetachment.

Laser optogalvanic spectroscopy is used for the first time to obtain the photodetachment threshold for a molecular negative ion, CN(1). The electron affinity for CN is determined to be 3.851 + 0.004 eV.

600.385 PB86-195520 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Pub. in Jnl. of Chemical Physics 79, n9 p4509-4521, 1 Nov 83.

Keywords: *Diffusion, Fluids, Hard sphere, Kinetic theory, Mixtures, Multicomponent, Reprints, Enskog theory.

The authors present a detailed description of the mutual diffusion coefficients of binary and ternary dense fluid mixtures of hard spheres, as given by the Revised Enskog Theory (RET) of van Beijeren and E. N. and the Enskog-Stokes Theory (SET) of Tham and Gubbins. The formula for the diffusion coefficients is given in Part I of the series, J. Chem. Phys. 76, 2746 (1983) involves the contact values of the equilib- rium pair distribution functions and the chemical potential, for which the Carnahan-Starling approximation is used. The formula, which was obtained by making
an expansion in Sonine polynomials, are evaluated up to the third order and the convergence of the Sonine polynomial expansion is discussed. Except at low densities, the SE cannot be used to describe diffusion in hard-sphere mixtures, since it is in conflict with irreversible thermodynamics when either the Carnahan-Stirling (CS) or exact equilibrium pair distribution functions are used.

600.386
PB86-195559
Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Length and Mass Div.
Saturated Fluorescence in a Standing-Wave Laser Field
Final rept., H. K. Holl, 1984, 4p
Pub. in Physical Review A 30, n5 p2495-2498 Nov 84.
Keywords: *Fluorescence, Resonance, Standing waves, Reprints, Laser radiation.*
An atom in a near-resonant standing wave laser field emits light spontaneously from its upper level which shows a dip at resonance. The calculation gives the intensity emitted as a function of laser tuning and of the saturation parameter. The case of opposite directed waves of unequal amplitudes is also treated.

600.387
PB86-195617
Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Spectroscopy and Collinear Quenching for A2H2V (v' = 0, 1,2).
Final rept., J. C. Stephenson, J. A. Blazy, and D. S. King, 1984, 8p
Keywords: *Acetylene, *Spectroscopy, Spectra, Excitation, Fluorescence, Reprints.*
Laser excited fluorescence excitation and dispersed fluorescence spectra have been recorded for the origin v = 1 and 2 levels of A2H2. Fluorescence decay rates were obtained as a function of pressure at room temperature. The slopes of the Stern-Volmer plots gave quenching rate constants for the A2H2 v' = 0, 1, 2 levels in collisions with C2H2, N2, O2, He, and Ar; the intercepts gave zero pressure fluorescence lifetimes. The results are compared to available information on acetylene spectroscopy and kinetics.

600.388
PB86-195765
Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polyers Div.
Final rept., D. L. Vanderhart, 1 Feb 86, 10p
Pub. in Jnl. of Chemical Physics 84, n3 p1196-1205, 1 Feb 86.
Keywords: *Chemical shifts, *Carbon 13, Dipolar, Solids, Reprints, Nuclear magnetic resonance.*
The observation of field-dependent C-13 chemical shifts in the presence of high-power proton decoupling and magic angle sample spinning (MAS) is documented. While the principal data were taken at fields of 1.4 and 4.7 T, the difference in chemical shift, in ppm, between the crystalline resonance of polyethylene and a reference resonance of solid adamantane varied as (a - BDS), measurements taken at significantly different fields in as many laboratories. At a given field there is no dependence of the shift difference on proton resonance offset, proton rf field strength, or sample spinning speed. In rigid solids, the 'b' term in the foregoing relationship is twice as large for a methylene as for a methine carbon. Results of chemical shift measurements at two fields are reported for polyethylene, polypropylene, and three molecular solids including the normal alkane, nonadecane, which exhibits fast well-defined molecular rotation in the solidator phase. The observed shift differences for several kinds of carbons at the two fields are evaluated with an explanation that the b term in the above expression results from a second-order energy perturbation involving the noncubic C3D and 'D terms of the dipolar Hamiltonian.

600.392
PB86-196474
Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Analytical Study of Quasi-Discrete Stark Levels in Rydberg Atoms.
Final rept., A. Harriman, 1984, 16p
Keywords: *Energy transfer, Atomic energy levels, Reprints, *Rydberg atoms, Stark effect, *Excitation transfer.*
A theory of nonhydrogenic Stark spectra based on the hydrogenic atomic structure and quasi-discrete levels. Core effects appear through zero-field quantum defect of the Stark manifold with 0 = 0 and 1 are examined for systems with two non-negligible quantum defects. A full Stark map of calculated intensities is presented for Li (0 = 0) and oxygen with experiment. Protonic effects near transitions in hydrogen-Stark levels. Extensions to include coupling are indicated. Experimental ionization rates in He are analyzed in a companion paper by van de Water, Maranin, and Koch.

600.393
PB86-196490
Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Kinetics Div.
Final rept., D. Braul, and P. Neta, 1984, 6p
Keywords: *Electron transfer, *Electrochemistry, Porphyryns, Halothane, Reprints, Cytochrome.*
The reactions of haloketone derived peroxy radicals with ferric deuterophenyn in aerated acetic or alkaline aqueous 2-propanol solutions are investigated by means of pulse radiolysis. CC13O2, CH2O2, CH2ClO2 and C3F3CHO2 radicals (the latter one being derived from the chloroanalog of halothane, C3F3CHCl(OH)) are found to oxidize the ferric porphyrins with reaction rate constants ranging between 6 times 10 to 3 times 10 to 8 times 10 to the eight power M-1s-1. In keeping with an electron transfer mechanism, the spectrum of the oxidized ferric porphyrin does not depend on the nature of the porphyrin radicals. Also, the rate constant for the reaction of CCl3O2 radicals with ferric porphyrins is lowered by a factor greater than or equal to 20 when experiments are performed in the less polar solvents neat 2-propanol and neat carbon tetrachloride. The spectrum of the oxidized ferric porphyrin depends on pH with large changes around pH = 2.3 which are attributed to the protonation of an alkoxide ligand of the iron ion.

CHEMISTRY
Physical & Theoretical Chemistry

Pub. in Jnl. of Physics B: Atomic and Molecular Physics 18, p4481-4469 1985.
Keywords: *Atomic excitations, *Molecular rotation, *Particle collisions, Reprints.*
Fundamental selection rules for rotational excitation of polyatomic molecules by slow electron impact have been derived as a result of conservation of molecular symmetry with respect to feasible permutations of neutral species. The selection rules are given an an analysis of the selection rules for molecules having the same dynamical permutation-inversion group of their three rotating rigid molecules with the group representing feasible permutations in different ways. Asymetric tops H2O, H2CO and C2H4 give a typical example.

600.395
PB86-196839
Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

600.395
PB86-196839
Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
CHEMISTRY

Physical & Theoretical Chemistry

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.


Keywords: Reprints, "Atomic oxygen," "Electron affinity," "Photo detachment." The electron affinity of atomic oxygen, an important calibration standard in negative-ion photoelectron spectroscopy, has been determined by tunable-laser photoelectron detachment in a coaxial laser-ion-beam spectrometer to be 11 764 645 + or - 0.005 per cm. In addition, the spin-orbit splitting between the 2P 3/2 and 2P 1/2 states of 0 was found to be 177.13 + or - 0.05 per cm.

600,396
PPB6-200219 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Thermophysics Div.

Sponsored by National Aeronautics and Space Administration, Washington, DC. Pub. in Jnl. of Chemical Physics 84, n8 p4563-4568, 15 Apr 86.

Keywords: Wetting, Polarity, Reprints, Liquid-vapor interfaces, Ellipsometry, Cyclohexane/methyl-tert-butyl, Isopropanol alcohol. The paper describes efforts to locate the prewetting line in a binary liquid system (isopropyl-tert-butyl-cyclohexane) at the vapor-liquid interface. We placed tight upper bounds on the temperature separation (2K) by the use of the prewetting line and the line of bulk liquid phase separation. We did not detect the prewetting line in systems at equilibrium. Experimental signatures indicative of the prewetting line occurred only in nonequilibrium situations. Several theories predict that the adsorption of one of the components (the fluorocarbon in this case) at the liquid-vapor interface should increase abruptly, at a temperature slightly above the temperature at which the mixture separates into two liquid phases. A rigorous solution calculation indicates that the prewetting line should have been easily detectable with the instruments used in the experiment. The features of the experiment are: (1) low-gradient thermostating, (2) in situ straining, (3) precision ellipsometry from the vapor-liquid interface, (4) high sensitivity, (5) a novel cell design, and (5) computer control.

600,396
PPB6-200227 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.


Keywords: * Surfaces, * Molecular relaxation, Semiconductor(Materials), Silicon dioxide, Zinc oxides, Ion exchange resins, Time measurement, Reprints, * Pico second, pulse, Hydroxyl compounds.

Time-resolved measurements of optically induced transients on surfaces are reported. Room temperature vibrational energy relaxation rates for OH groups on the insulators SO2 and zeolite ZSM-5 are found to be comparable (approx. equal to 10 to the 10th power/ s). The relaxation rate for optically induced transients on the semiconductor oxides ZnO appears to reflect the influence of conduction bands in the 8 micrometer spectral region.

600,398
PPB6-200391 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.


Keywords: * Dissociation energy, Exothermic reactions, Diatomic molecules, Computer simulation, Energy transfer, Explosions, "Diatomic crystals."
The work in this paper describes the results of a molecular dynamics simulation of a rapid exothermic reaction in the solid state. The model consists of 256 particles arranged in pairs as diatomic molecules in a three-dimensional cubic with periodic boundary conditions. The particles interact through a pairwise potential such that the diatomic molecules are metastable with respect to the dissociated state. The dynamics of energy transport (potential and kinetic) during the dissociation process is studied as are the conditions prerequisite to initiation.

600,399
PPB6-200409 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Reactor Radiation Div.


Keywords: Chemical equilibrium, Computerized simulation, Heat of reaction, "Chemical reaction kinetics," "Diatomic crystals." The properties of a model which exhibits equilibrium chemical reactions are reported. It is shown that the kinetics produced is consistent with established thermodynamic considerations. Further, at constant pressure, the relation between the Arrhenius energy of reaction, the potential energy change upon reaction, and the work done is coupled with the volume change upon reaction, is satisfied.

600,400
PPB6-200433 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.


Keywords: Barium, * Gas ionization, Atomic energy levels, Helium, Argon, Reprints, Laser-produced plasma, Quenching.

The modification of ion production efficiency via resonant laser-driven ionization in the presence of high buffer gas densities has been experimentally investi- gated in a barium vapor. The populations of several energy levels of neutral and singly ionized Ba were measured as a function of helium and argon pres- sures by the time-resolved hook technique. The behav- iors of He and Ar are quite distinct. The percentage ionization decreased monotonically from nearly 100% to less than 10% as the helium pressure was increased from 0.01 to 1 atm, while no quenching was observed for Ar. These observations are consis- tent with a quenching mechanism based in part on cooling of the hot electrons through momentum-changing elastic collisions with the He atoms.

600,401
PPB6-200680 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.


The authors examine a quantum optical model describing absorption of photons above an ionization threshold in multiphoton ionization. They calculate 12-photon ionization of the hydrogen atom by a strong, linearly polarized laser pulse. The angular momentum distribution of photoelectrons in the consecutive processes depends on the intensity of the laser but reveals the presence of only a few of the lowest angular momenta. No "peak switching" is observed, but a finite number-of-continua model becomes unstable at an intensity of about 0.001 a.u.

600,402
PPB6-200706 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Polymeric Materials Div.

Relationship of the Unweighted Rosenbluth Walk to a Polymer Chain at the Theta Point. Final rept., G. A. Hunter, Mar 86, 5p Published in Macromolecules 19, n3 p833-837 Mar 86.

Keywords: Reprints, *Polymer chains, *Rosenbluth walk, *Theta point.

It is shown that the unweighted Rosenbluth and Rosenbluth (R-R) chains (sometimes called the 'true' self-avoiding walk) can be viewed as polymer chains at the theta point where only second-order cluster-like terms have been included in the partition function. A modified weighting function for the R-R model is proposed that includes only such second-order cluster terms. Such a polymer chain is shown to possess normal polymer chain behavior, i.e., chain expansion, a theta point, and chain collapse. It is suggested that by compar- ing the results of studies on these chains with those obtained by a normal R-R weighting procedure one should be able to accurately the contributions of third-order and higher order cluster terms to polymer chain properties.

600,403
PPB6-200722 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Polymers Div.

Study of Thermal Depolarization of Polyvinylidine Fluoride Using X-Ray Pole-Figure Observations. Final rept., A. J. Bur, J. D. Barnes, and K. J. Wahlstrand. Apr 86, 10p Published in Jnl. of Applied Physics 59, n7 p2345-2354 Apr 86.

Keywords: * Depolarization, Aging tests(Materials), Piezoelectricity, Pyroelectricity, Dipole, Reprints, *Vinylidene fluoride polymers.

Measurements of piezoelectric and pyroelectric activity, density, and x-ray pole figures were used to study the effect of thermal aging on the state of polarization in polyvinylidene fluoride. A rolled and polaled beta-phase specimen of polyvinylidene fluoride was subjected to thermal aging which consisted of tempering cycles of 75°C for 24 hr at successively higher maximum temperatures before retempering at 164 deg C. We found that the room temperature piezo- and pyroelectric activity decreased linearly as a function of T (max) from 75 deg C to 164 deg C at which tempera- ture the specimen had 30% of its original activity. A linear extrapolation of these data to zero activity yield- ed a temperature T sub C = 207 deg C. Based on this value, which describes the state of polarization in polyvinylidene fluoride and from which we calculate the fraction of dipoles in the crys- taline state contributing to the polarization.
CHEMISTRY

Physical & Theoretical Chemistry

inst. of Physics, New York. Sponsored by National Bureau of Standards, Gaithersburg, MD. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Research, Microwave spectra, Water, Heavy water, Thermodynamic properties, Triplet state, Interstellar gas, Molecular clouds, Forbidden transitions

Contents:
Triplet-Triplet absorption spectra of organic molecules in condensed phases;
Remarkable absorption frequencies for observed interstellar molecular microwave transitions - 1985 revision
New empirical formulations for the thermodynamic properties of light and heavy water;
Fluxion lines in n, sup 2(n sup k) ground configurations and nsp excited configurations of beryllium through Molybdenum atoms and ions;
Cumulative listing of reprints and supplements.

600.414 PB86-204575 Not available NTIS Notre Dame Univ., IN. Radiation Chemistry Data Center


Keywords: *Heavy water, *Water, Deuterium compounds, Condensed state, High pressure.

The pressure and temperature parameters which define the equilibrium thermodynamic stability fields of the liquid, VI and VII phases, including the triplet point, were measured from the vapor pressure over the temperature range, 0.8 to 2.4 GPa, and the temperature interval, 20 to 135 C. The phenomenon of metastability associated with the liquid-VI/phase boundary was observed during the working and, subsequently, a metastable extension of the coexistence curve was determined, from the liquid-VI-VII triplet point down to 20 C, for both H20 and D20. The measurements were made by optical polarizing microscopy in conjunction with a diaphragm, cell equipped with a miniature resistence coil heating element. Pressures were measured by the ruby fluorescence method.

600.418 PB86-208410 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Molecular Spectroscopy Div. Internal States Distributions of NO Thermally Desorbed from Pt(111): Dependence on Coverage and Cosorbed CO

Final rept., D. A. Maniell, R. R. Cavanagh, and D. S. King. c1986, 12p
Sponsored by Department of Energy, Washington, DC. Pub. in Jnl. of Chemical Physics 84, n9 p5131-5142, 1 May 86.

Keywords: *Desorption, *Nitric oxide, Lasers, Platinum, Polarization, Rotational state, Reprints.

The distribution of population in the internal energy levels of nitric oxide thermally desorbed from Pt(111) has been probed using laser excited fluorescence. The observed rotational distributions have been found to follow the Boltzmann distribution function, independent of NO coverage or the presence of pre- or post-adsorbed CO. Under all conditions of NO desorption, the observed NO was characterized by a temperature (0.95 + or - 0.05) times the surface temperature. No evidence of a preferred alignment of the rotational angular momentum vectors was observed, nor was there any difference between the two spin-orbit multiplets beyond that associated with the rotational temperature.

600.419 PB86-208444 Not available NTIS National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div. Transpiration Mass Spectrometry - A New Thermodinamic Tool

Sponsored by NATO Advanced Study Inst., Oslo (Norway).


Keywords: *Sampling, Mass spectrometry, Pressure measurements, Sodium chloride, Sodium sulfate, Transpiration, Reprints, *Alkali vapor transport, *Electron impact ionization.

Classical vaporization methods such as transpiration and Knudsen and Langmuir evaporation have been limited because they do not establish the molecular identity of transport species or because low pressures are necessary to make effusion measurements. The authors have developed a new technique - Transpiration Mass Spectrometry (TMS) - that overcomes these limitations by combining the basic features of transpiration and molecular beam mass spectrometry. With this technique, it is possible to sample reactive gases directly from high-temperature (to 1500 deg C), high-pressure (to 10 atm) atmospheres for quantitative characterization with a mass spectrometer. The accuracy of thermochemical data obtained by the TMS method is competitive with that of established low dynamics techniques. Examples of application to vaporization of complex silicate slags, glasses, and minerals are considered. Implications and precautions for shielding effects during the sampling process are also discussed.


Keywords: *Particles, AEM, LAMMA, Submicrometer.

No abstract available.

600.421 PB86-121818 Not available NTIS National Bureau of Standards (NBS), Boulder, CO. Quantum Physics Div. Absolute Rate Constants for Methyl Radical Reactions by Laser Photolysis, Time-resolved Infrared Chemiluminescence: CD3 + HX yields CD3H + X (X = Br)

Final rept., D. J. Donaldson, and S. R. Leone. c1986, 6p
Grants NSF CHE-79-11340, NSF-PHY-82-08055 sponsored by National Science Foundation, Washington, DC.

Pub. in Jnl. of Physical Chemistry 90, n5 p936-941 1986.

Keywords: *Chemiluminescence, Hydrogen bromide, Hydrogen iodide, Photolysis, Deuterium compounds, Reprints, *Chemical reaction kinetics, *Methyl radicals, Excimer lasers.

Absolute rate constants are reported for the room temperature reactions of deuterated methyl radicals with H2 and HBr, CD3 + H*(or -Br) -> CD3H + (Br)*. Excimer laser photolysis of CD3 is used to generate methyl radicals, and time-resolved infrared chemiluminescence from the CH stretch of the CD3H products is detected to follow the time evolution of the reaction. Absolute rate constants obtained in this manner are (7.7 + or - 0.7) x 10^-12 the 120 power cc/molecule s for CD3 + H and (4.7 + or - 0.4) x 10^-12 the 120 power cc/ molecule s for CD3 + HBr. These rate constants are considerably greater than earlier, indirectly-measured values and indicate that the activation energy for these light-atom transfer reactions is lower than previously believed.

600.422 PB86-201234 Not available NTIS National Bureau of Standards (NBS), Boulder, CO. Quantum Physics Div. Absolute Rate Constants for the Photodissociation of Hydrogen Atom In Intense Magnetic Fields

Final rept., V. B. Srivastava, and S. I. Chu. c1986, 6p
Angularly Resolved Vibrational Excitation in Na2He Collisions.

Final rep., E. Gottwald, A. Matthias, K. Bergmann, and R. Schinke. Jan 86, 8p

Sponsored in Jnl. of Chemical Physics 84, n2 p756-763 Jan 86.

Keywords: *Helium, *Sodium, Excitation, Energy transfer, Molecular vibration, Reprints, *Molecule-molecule collisions.

The paper reports angle-resolved measurements of V(sub) = 0 -> V(sub) f = 1 vibrational transitions in Na2He collisions at an energy of 90 MeV. The agreement with calculated cross sections using an ab initio surface is good, both in the angular variation of the cross section as well as with respect to its magnitude relative to the vibrational elastic process. The calculated V(sub) f = 0 -> V(sub) f = 1, 1 -> 2, 2 -> 3, 3 -> 4, 4 -> 5, 5 -> 6, 6 -> 7, 7 -> 8... vibrational transitions are discussed in some more detail. They show structure, in addition to the rainbow oscillations, related to the fact that the vibrational transition probability vanishes for a specific approach angle.

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600.429


Keywords: Chemical reactions, Reprints, *Ion-molecule collisions, *Nitrogen ions, *Argon ions, Flowing afterglow, Charge transfer.

An improved ion beam apparatus is used to study the nascent state distribution of products in the (Ar(1)+22 Ne) charge transfer reaction at 0.28 eV collision energy. The rotational distribution of the minor nu = 0 vibrational channel under single-collision conditions can be characterized by a Boltzmann distribution with a temperature T = 120 ± 50 K, compared to the high temperature 960 ± 10 K for the major nu = 1 vibrational pathway. It is suggested that these two vibrational channels are formed by different reaction mechanisms, most likely a direct reaction for nu = 0, and a more intermediate collision for nu = 1.

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600.430

Pub. in Physical Review Letters 56, n7 p708-711, 17 Feb 86.

Keywords: Dipoles, Atomic energy levels, Reprints, *Photoionization, *Sodium atoms, Angular distribution, Laser applications, Quadrupoles.

A measurement of the azimuthal dependence of the angular distribution of photodetachment of photoelectrons from 13 double D(3)(S)/2-state sodium atoms aligned transversely to the direction of propagation of, and parallel to the direction of ionization polarization, of 532-nm-irradiating laser radiation is described. The measured distribution is 1 phi = 1 + 0.02660 cos phi, where phi is the direction of the laser beam. The departure from the symmetry phi = 0 = const predicted for a pure electric dipole transition is represented theoretically as due to a dipole-quadrupole interference term.

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600.431


Keywords: *Titanium dioxide, *Desorption, *Surface chemistry, Chemisorption, Surfaces, Ions, Reprints, Angular distribution, *Electron stimulated desorption.

The dependence of the electron- and photon-stimulated desorption (ESD, PSD) C1(1)+ ion yield on surface preparation history of (100) and (001) surfaces has been studied. Angle-integrated electron-stimulated desorption yields have been measured versus annealing temperature from room temperature sputtered surfaces to 900 deg C annealed surfaces. Both the surface cation valence state and the surface geometry change as a function of annealing temperature, giving rise to a rich variety of ESD ion angular distribution (ESDIA) patterns. These patterns are discussed in terms of possible models of local surface structure.
CHEMISTRY

Physical & Theoretical Chemistry

600,432
PB86-212367
Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Dynamics of Molecular Processes at Surfaces: Vibrational Spectra.
J. W. Gadzuk. 1986, 22p

Sponsored by North Atlantic Treaty Organization, Brussels (Belgium).

In Jnl. of Chemical Physics 84, n6 p3502-3508, 15 Mar 86.

Keywords: "Dissociation, Surfaces, Diatomic molecules, Excitation, Magnesium oxides, Iodine, Reprints, Electrical-molecular collisions, Molecular ions, Charge transfer.

A theory is presented which accounts for one of the possible mechanisms responsible for dissociative scattering of diatomic molecules from surfaces. If on the incident trajectory of the molecule, a surface molecule electron transfer occurs and on the outgoing trajectory, the reverse, then the temporary negative molecular ion formed for the time during which the electron hops will displace in its intramolecular vibrational coordinate. The molecule will emerge as a vibrationally excited neutral, with some of the excited states lying in the dissociative continuum. A model is described for this process in which the center-of-mass translational motion is handled classically and the intramolecular vibration via wave packet dynamics. The theory is energy and probability conserving and microscopically reversible. Dissociation probabilities calculated as a function of incident energy and system parameters are discussed in the light of experimental measurements for the system of 12 dissociatively scattered from MgO surfaces.

600,434
PB86-2123278
Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Fundamental Excitations in Solids Pertinent to Desorption Induced by Electronic Transitions.
Final rept., J. W. Gadzuk. 1983, 22p


Keywords: "Excitation, Desorption, Surfaces, Chemical reactions, Solids, Interactions, Reprints, Time dependence."

Various aspects of the dynamics of time-dependent localized potentials and interactions in solids and at surfaces, as they might relate to the fundamental processes involved in desorption induced by electronic transitions (DIET) are explored.

600,435
PB86-2123205
Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Modeling the Effect of Atomic Mass Difference in Ion-Bombardment Induced Recoil Mixing of Binary Alloys.


Keywords: "Computerized simulation, Mathematical models, Monte Carlo method, Surfaces, Binding energy, Atomic mass, Ion bombardment, EVOLVE computer program, Ion bombardment.

EVOLVE, a Monte Carlo code, is used to simulate the concentration changes which result from incident beam atoms and the cascade of recoil atoms. The changes in composition depend upon differences in the atomic masses of the target atoms, displacement energy, surface binding energy, and other factors. This study investigates the commonly held belief that lighter target elements tend to be preferentially implanted inward relative to heavier elements. Cases are presented here where contrary to this perception, preferential inward movement of the heavier element was observed.

600,439
PB86-212402
Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD, Molecular Spectroscopy Div.

High-Resolution Infrared Spectrum of Hydrogen Peroxide the nu sub 6 Fundamental Band.
Final rept., J. Hillman, D. Jennings, W. Olson, and A. Goldman. 1986, 14p


Keywords: "Molecular spectra, Hydrogen peroxyde, Infrared spectra, Spectroscopic analysis, Bandwidth - Reprints, High resolution, Tunable lasers, Fourier transform spectroscopy.

The infrared spectrum of the nu(sub 6) asymmetric deformation band of hydrogen peroxide (H2O2) was studied in the region 700-1500 cm using by the two techniques of Fourier transform spectroscopy at 0.02 cm resolution and tunable diode laser spectroscopy at Doppler-limited resolution. Details of the wavenumber calibration procedures adopted are discussed. For the first time, accurate values of the molecular parameters of the torsionally doubly, vibrationally band were obtained. A total of 708 assigned transitions have been analyzed to yield a set of 14 rovibrational constants for the H2O2 (nu,v=0) rovibration-vibration level (SD = 0.00487/cm) and 13 rovibrational constants for the upper torsion-vibration level (SD = 0.00832/cm). These bands are primarily type V with a few centers at 1265, 5612 and 7612 cm and 2363 0009/cm. Because of the absence of observed perturbations, the derived molecular constants can be used to calculate transition frequencies with a high degree of accuracy up to K(sub a) = 6.

600,447
PB86-212410
Not available NTIS National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.

Localized Hydrogen Modes in LaNi5(x).


Keywords: Hydrogen, Distortion, Absorption, Vibration, Crystal lattices, Neutron scattering, Reprints, Laminate nickel.

The localized vibrations of hydrogen in various LaNi5(x) samples were studied using inelastic neutron scattering (neutron spectroscopy). The pronounced vibrational peaks obtained for "virgin" strain-free LaNi5 indicate the existence of the two different hydrogen sites. During the activation for hydrogen absorption, substantial distortion is introduced into the LaNi5 lattice which is locally probed by the vibrating hydrogen atoms.

600,448
PB86-214465
Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Ultraviolet Two-Photon Ionization of Molecules in Flames.


Keywords: "Nitric oxides, Phosphorous oxides, Flames, Reprints, Multi-photon processes, Two photon absorption, Multiphoton ionization, Photodissociation.

A study was conducted on resonantly enhanced 2 photon photoinitiation of NO and PO in the ultraviolet region in atmospheric pressure flames. The results show the collisional retting of the laser dopplered ground state rotational level is fast, with an effective collisional cross section greater than or equal to 70A. This rapid relaxation leads to photons spectra that are essentially identical to those expected from a simple 1 photon absorption to the resonant intermediate state.

600,449
PB86-214715
Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD, Center for Basic Standards.

Molecular X-Ray Spectra (Beta) Emission and K Absorption Spectrum of Thiophene.
Final rept., R. C. Perera, and E. L. LaVilla. 1986, 7p

Contract DE-AC03-76SF00098
Sponsored by Department of Energy, Washington, DC.

Pub. in Jnl. of Chemical Physics 84, n8 p4228-4234, 15 Apr 86.

Keywords: "Thiophenes, X ray spectra, Molecular spectra, Absorption spectra, Sulfur heterolytic compounds, Reprints."

The high resolution sulfur K(Beta) emission in fluorescence and sulfur K absorption of thiophene (C4H4S) were measured with a double crystal spectrometer. The sulfur K(Beta) emission spectrum was analyzed by comparison with complementary spectral data and with kMC calculations. A tentative assignment of the prominent features in the absorption spectrum was made using MO calculations as a guide. In addition the sulfur L(sub 2,3) emission spectrum was reinterpreted. The sulfur Ls binding energy of thiophene was estimated as 2477.6 eV.

600,440
PB86-226672
Not available NTIS National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.


Grants NSF-CHBE3-16628, NSF-PHY82-00806
Sponsored by National Science Foundation, Washington, DC.


Keywords: "Iron oxides, Iron inorganic compounds, Molecular energy levels, Excitation, Molecular structure, Photodetachment.

High-resolution photodetachment spectroscopy of FeO(1) has been used to study the ionic ground state as well as electronically excited states located in the vicinity of the FeO(sup 5 delta sub 3) thresholds. The observed photodetachment resonances suggest two qualitatively different types of electronic states in this region, a sup 4 delta valence state and two negative ion complexes consisting of an FeO(sup 5 delta sub 3) core and an s or p electron primarily bound by the dipolar electric field of the neutral core. The dependence of photodetachment lifetimes upon the rotational quantum number of the excited states shows markedly different properties for the two types of states. A significant difference in photodetachment lifetimes is observed for the Lambda-doublet components assigned to the FeO-p electron complex. The authors propose that a difference in the location of the electron density of the detaching electron with respect to the plane of rotation is responsible for the Lambda-doublet effect.

600,447
PB86-228270
Not available NTIS National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Effects of orbital alignment on the near resonant energy levels of Si induce transitions from Ca(4s5p singlet P sub 1) to Ca(4s5p triplet P sub J) induced by collisions with rare gases are studied in a crossed molecular beam. A linearly polarized, pulsed ultraviolet laser is used to introduce the initial orbital alignment, and the relative energy transfer cross sections as a function of alignment are measured using time-gated fluorescence detection. Different results are observed with several rare gases; a rather large, approx. 50% enhancement in the rate is observed for the perpendicular vs. parallel approach with He and Ne. A smaller, but opposite effect is observed for Xe, and no effect of alignment occurs with Kr.

Keywords: *Affinity, Negative ions.

A tabulation is provided of experimentally-determined electron affinities for 72 atoms and 177 molecules.
CHEMISTRY
Physical & Theoretical Chemistry


Keywords: Crystal structure, Passive film, Surface science, Iron oxide, Substrates.

Iron K-absorption edge spectra were obtained from the passive films on iron for the dried films in air (in situ) and for the films in the passivating solutions (in situ). These in situ results show that iron and iron oxides (e.g. Fe2O3) are not sensitive to changes in the atmosphere.

The X-ray data shows evidence of a qualitatively different structure, which may be due to the accommodation of hydrogen containing species into the structure.

600.453
PB86-230265 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.


Keywords: Carbon monoxide, Chemisorption, Chromium, Orientation, Molecular structure, Surfaces, Synchrotron radiation, Ultraviolet spectroscopy, Photoemission spectroscopy.

Synchrotron ultraviolet photoemission spectroscopy (UPS) has been used to identify two sequentially populated molecular CO binding modes on Cr(110) at 90 K. These are distinguished by both intensity and electron binding-energy differences in the CO-valence-band UPS features. These results support the previously proposed models in which the first binding mode (alpha sub 1) is 'lying down' on the surface, with both the carbon and oxygen coordinated to chromium atoms, and the second binding mode (alpha sub 2) is terminally bonded and oriented roughly along the (110) surface normal.

600.454
PB86-230273 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.


Keywords: Surfaces, Reprints, *Electron stimulated desorption, Renumeralization.

Calculations are presented which describe the influence of ion renormalization processes on measured electron stimulated desorption ion angular distributions (ESDIA). The results indicate that renormalization effects generally act in an opposite sense to the image field in affecting ion angular distributions, and that these counterbalancing effects tend to cancel one another partially over a wide range of polar angles.

600.455
PB86-230299 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.


Keywords: Methyl alcohol, *Cyclohexane, Water, *Kinetically inert, *Recombination, Attenuation length, Energy range, eV range 10-100, Microcavity array.

The attenuation lengths are approximately 13, 10 and 9A, respectively, for water, methanol and cyclohexane and show only a slight energy dependence over the electron kinetic energy range covered (18-68 eV). The experimental technique consisted of measuring the attenuation of Cu(100) substrate photoelectrons as solid H2O, CH3OH and CH3CH2OH were condensed at 90 K by dosing from a molecular beam array. Accurate measurement of adsorbate layer thickness was accomplished by calibrating the doser; the procedure is described in detail.

600.456
PB86-230489 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.


Keywords: Atomic orbitals, Magnesium, *Dielectronic recombination, Rydberg states.

The effects of state mixing by extrinsic fields in the collision region have been investigated for dielectronic recombination using a field-dependent cross-sections sigma nup, n sub DR have been measured as a function of the final Rydberg state, n sub f, for the dielectronic recombination process.

600.457
PB86-230497 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.


Keywords: Electron scattering, Elastic scattering, Argon, Hydrogen, Reprints, Electron-atom collisions, Born approximation, KeV range 10-100.

Partial-wave analysis is applied to a parametrized pseudostate exclusion model of high-energy electron-atom scattering. Consistency checks are carried out between asymptotic distorted-wave calculations (coupled and different approximations), cross-section Born-approximation scattering amplitude calculations, and partial-wave Born-approximation calculations. Closure formulae are derived for a static model potential and for the Born-approximation amplitude due to the asymptotic dipole excitation potential. Calculations using these closure formulae in the e(+)+H and e(+)+Ar models at 15 KeV show cusps forward elastic scattering peaks, confirming recent exact second-Born-approximation results for an e(+)+H pseudostate model.

600.458


Keywords: *Transition probabilities, *Electron transitions, *Atomic spectra, Bibliographies, Oscillator strengths.

Some new activities on the determination of atomic transition probabilities for the element Cesium are described, and an exhaustive list of new literature references is given which covers all transition probability data for the period August 1981 to the present (fall 1984).

600.459
PB86-230745 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.


Keywords: Transition probabilities, *Electron transitions, Oscillator strengths.

The main experimental methods for the determination of atomic transition probabilities are based on emission, absorption, and anomalous dispersion measurements. In addition, transition probabilities may also be derived from lifetime determinations of excited atomic states. All these approaches have undergone significant modifications and refinements in recent years, and some new experimental tools and combinations of techniques have been added. As a result, impressive accuracies have been reached and the ranges of applicability of some approaches have been greatly enlarged. These advances and developments, as well as remaining problem areas, will be described and illustrated with a number of typical examples.

600.460
PB86-230760 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.


Keywords: Thermodynamics, Tables (Data).

No abstract available.

600.461
PB86-230778 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.


Keywords: *Chemical reactivity, Reaction kinetics, Flames, Acetylene, Molecular structure, Borntrager, Reprints, *Cyclopropenium ions, *Ion-molecule collisions, Ions cyclotron resonance spectroscopy, Molecular ions.

Kinetic evidence is presented for the existence of CIH3(+)- ions in two distinct isomeric structures, cyclo-CIH3 (+) and CIH3 (+), where these ions are produced through the decomposition of a variety of molecular ions. The relative abundance of the two isomeric CIH3 (+)- ions depends on the identity of the precursor molecule as well as the internal energy of the dissociating parent ion. While the cyclo-CIH3 (+)- ions react to give CIH5(+) and CIH3(+) products; these ions, and the products of their further reactions are seen in acetylene flames, and have been suggested to be the precursors in the mechanism leading to soot formation. Reactions of the two CIH3(+) ions with benzene, olefins, and other compounds are discussed.

600.462
PB86-230305 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.


Keywords: *Cyclohexane, *Methyl alcohol, Density, Heavy water, Ternary amine, Liquids, Reprints, Binary systems (Materials), *Interfacial tension, Binary mixtures, Thermophysical properties, Amplitude ratios.

The densities of the coexisting phases and the capillary length have been measured to obtain the interfacial tension (sigma) near consolute temperatures T sub c of the three binary liquid mixtures: triethylamine

50
Keywords: Atomic energy levels, Electron scattering, Electron-atom collisions, *Sodium atoms, Electron spin polarization. Spin asymmetries are presented for superelastic scattering of spin-polarized electrons from spin-polarized M sub L = 1 and M sub L = -1 states of the Na 3P(3/2) atom. The incident-energy dependence at a scattering angle of 30 deg is shown for energies of 1.26 to 1.76 eV. In addition, angular dependences over the range 5 deg to 40 deg are given at 2.0 and 9.26 eV. Large differences are seen between the spin asymmetries for the two M sub L subspaces of the excited state, with the M sub L = -1 asymmetry reaching a value of 100% at 2 eV and 35 deg scattering angle, corresponding to pure singlet scattering.

Keywords: *Argon, *Hydrogen fluoride, Absorption, Infrared spectroscopy, Reprints, Tunable lasers. Ultra-sensitive tunable difference frequency IR absorption spectroscopy in a sill supersonic jet was used to observe sub-Doppler spectra of Ar-HF in the (10 sup 0 sup 0) HF stretch (and (11 sup 0 sup 0) HF stretch plus van der Waals bend modes. Line widths yield a lower limit of 3 x 10 to the -9 power s for the predissoication lifetime in the vibrationally metastable upper state. The sensitivity of these direct absorption methods (< or approx equal to 2 x 10 to the 9 power s for KCN and CO2) per quantum state), in conjunction with the wide tunability of the difference frequency laser (2.2-4.2 micrometers per high-resolution studies of a large class of van der Waals complexes.

The infrared spectrum of the intermolecular bending vibration, the n(u6 sub 6) band of the heterodimer HCN-HF has been obtained with 0.01 cm resolution, and the rotational structure of the band has been assigned. The spectroscopic constants of the n(u6 sub 6) band were derived from a least-squares fit of the rotational line positions to a theoretical line list. The uncertainties cited are one standard deviation.

Keywords: *Infrared spectra, *Hydrogen cyanide, *Hydrogen fluoride, Hydrogen bonds, Molecular vibration, Reprints. The infrared spectrum of the intermolecular bending vibration, the n(u6 sub 6) band of the heterodimer HCN-HF has been obtained with 0.01 cm resolution, and the rotational structure of the band has been assigned.
CHEMISTRY

Physical & Theoretical Chemistry

Energy and Radiative Lifetime of the 5d(9) 5s(2) doublet in Hg II by Doppler-Free Two-Photon Laser Spectroscopy.

Final rept.,
7 Oct 85, 4p
Sponsored by Air Force Office of Scientific Research, Boulder, CO, and Office of Naval Research, Arlington, VA.

Keywords: Atomic orbitals, Reprints, "Electronic structure, Mercury ions.

The Doppler-free, two-photon 5d10 6s doublet S sub 1/2 - 5d9 6s 2 S sub 5/2 transition in singly ionized Hg, attractive as an optical-frequency standard, has been measured for the first time on a small number of (198)Hg(1+)+ ions confined in a radio-frequency trap. The radiative lifetime of the doublet D sub 5/2 state and the absolute wave number of the two-photon transition were measured to be 0.090(15)s and 17757.195(3)/cm, respectively. Optical amplitude-modulation sidebands, induced by the secular (thermal) motion of the harmonically bounded ions, were observed also for the first time.

600.472
PB86-239812
Not available NTIS
Rotational Analysis and Vibrational Predissociation in the (nu sub 2) Band of HCN Dimer.

Final rept.,
B. A. Wolford, J. W. Bevan, W. B. Olson, and W. J. Lafferty.
1 Jul 86, 4p
Grant NSF-CHE89-00592
Sponsored by National Science Foundation, Washington, DC, and Robert A. Welch Foundation, Houston, TX.
Pub. in Jnl. of Chemical Physics 85, n1 p105-108, 1 Jul 86.

Keywords: "Hydrogen cyanide, "Molecular structure, Vibrational spectra, Rotational spectra, infrared spectra, Electronic structure, Laser-produced plasma.

The rovibronic infrared spectrum of the bound C-H stretching vibration, nu(sub 2), in the HCN dimer has been analyzed. Observed transition frequencies have been combined with previously recorded microwave data to obtain the following molecular parameters (in cm): nusub 2 = 324156968, alphagenusub 2 = -0.000 110(1), B(double prime) = 0.058 233 921(1), B(sub prime) = 0.058 344(1), (J[sub double prime], B(double prime) = 0.701352(10) x 10^-7 power, D_J = 0.063618(1) x 10^-7 power. The observed full widths at half-maximum intensity of the observed transitions are consistent with excited state lifetimes of 1.7(4) x 10^-9 power.

600.477
PB86-239894
Not available NTIS
Local Exchange Approximations.

Final rept.,
A. W. Weiss. Jul 86, 2p
Pub. in Physical Review A 34, n1 p624-625 Jul 86.

Keywords: Wave functions, Approximation, Reprints, "Exchange interactions, Hartree-Fock method.

It is shown for the particular example of a beryllium atom that the Hartree-Fock 2s inflection point does not occur at the node of the wave function, as it must for a central potential. Local exchange approximations, therefore, cannot be expected to be capable of exactly modeling the effect of the exchange interaction.

600.478
PB86-239892
Not available NTIS
Accurate Estimates for the Low-Lying Levels of Singly Ionized (198)Hg.

Final rept.,
J. Reader and C. J. Sansonetti.
Feb 86, 4p
Pub. in Physical Review A 33, n2 p1440-1443 Feb 86.

Keywords: Atomic energy levels, Atomic orbitals, Wavelengths, Ionization, Reprints, "Mercury ions, "Electronic structure, "Mercury 198.

A 3.34 m-plane-grating spectrograph has been used to measure the wavelengths of 11 lines of singly ionized (198)Hg emitted by an electrodeless discharge lamp in double 1984-1984. The uncertainty varies from 0.00003 to -0.00015. From these wavelengths, accurate values were determined for all levels of the 5d10 6s 5p and 5d9 6s 2 configuration, and for four levels of the 5d9 6s 6p configuration. By using existing isotope-shift data, values of wavelength, and energy levels for natural Hg II were deduced. Accurate values for 12 lifetimes of Hg II in the region 893-2062 were calculated from the energy levels.

600.476
PB86-239100
Not available NTIS
Excitation and other values for (2s) singlet (sub 0) - 4s4p singlet P(1) Transitions in Zinc-like Ions.

Final rept.,
N. Acquista, and J. Readeer. 1984, 3p

Keywords: Atomic orbitals, Ion, Ultraviolet spectra, "Electronic structure, Laser-produced plasma.

The 4s2 singlet S sub 0 - 4s 4p singlet P sub 1 transitions of 10 zinc-like ions from Rb(1+)-Fe(2+), in a laser-produced plasma and a 10.7-m grazing-incidence spectograph. Also, new observations were made for the 3d4-3f1 transitions of Fe(1+). Based on the new wavelengths obtained for these Fe transitions and improved wavelengths recently published for other Fe ions, revised values were determined for 4s2 4s2 singlet S sub 0 - 4s 4p singlet P sub 1 transitions in ten zinc-like ions from Ba(2+) to W(44+) observed by Reader and Luther, where a laser-produced spectrum of Fe was used for wave-length calibration.

600.477
PB86-239822
Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
Simplified Method for Calculating Four-Probe Resistances on Nonuniform Structures.

Final rept.,
W. L. Berkowitz, and J. Albers.
1986, 1p

Keywords: "Electrochemistry, Four probe resistance, Numerical solution.

A simple method for calculating the four-probe resistance of a nonuniform rectangular specimen is presented. Analytic expressions are derived for uniform layers and investigated as a function of the probe spacing. For nonuniform resistivity structures, a simple numerical procedure is presented for the evaluation of the four-probe resistance and is compared with more extensive techniques.

600.479
PB86-239270
Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Sorption Analysis (sub nu 3) HCN-HF Using Fourier Transform Infrared Spectroscopy.

Final rept.,
B. A. Wolford, J. W. Bevan, W. B. Olson, and W. J. Lafferty.
15 Dec 85, 5p
Grant NSF-CHE83-00592
Sponsored by National Science Foundation, Washington, DC, and Robert A. Welch Foundation, Houston, TX.
Pub. in Jnl. of Chemical Physics 83, n12 p6188-6192, 15 Dec 85.

Keywords: "Molecular structure, "Hydrogen cyanide, "Hydrogen fluoride, Vibrational spectra, Rotational spectra, Fourier transform spectroscopy, Excitation, Reprints.

The gas phase vibrational spectrum of the (nu sub 3) band arising from the cyanide stretching vibration in the hydrogen bonded heterodimer HCN-HF has been observed at 604 cm^-1 using a Fourier transform infrared spectrophotometer. Analysis of the spectrum gave the following molecular parameter (in cm): (nu sub 3) = 2130.935(2), (nu sub 0) = 2130.935(2), (nu sub 2) = 2130.935(2).

600.481
PB86-240488
Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Surface Science Div.
Characterization of O(ad) Formation by Reaction between NO and O(3d) on Ag(110).

Final rept.,
K. Bange, T. E. Madsen, and J. K. Saxs. 1986, 5p
Pub. in Surface Science 152, p950-958 Apr 86.

Keywords: Oxygen, "Water, "Surface chemistry, Chemical reactions, Reprints, "Hydroxyl radicals.

TDS (thermal desorption spectroscopy), LEED (low energy electron diffraction) and ESIDA (electron stimulated dissociation on angular distribution) have been used to characterize hydroxyl groups formed by the reaction of oxygen and water on Ag(110). It is concluded that hydroxyl formation on Ag(110) is accompanied by large translation of O(ad) and O(3d) along troughs and across ridges.

600.482
PB86-240769
Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

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Measurements of the g(sub J) Factors of the 6s doublet S(1/2) and 6p doublet P(1/2) states in (1980)Kg.

Final rep.,
W. M. Itano, J. C. Bergquist, and J. D. Wineland. Sep 85, 3p.
Pub. in Jnl. of the Optical Society of America B 2, n9 p1392-1394 Sep 85.


Measurements of (1989)Hg (g + g) sub J factors by two methods are reported. The first method was based on optical wavelength measurements of the Zeeman components of the 6s doublet S sub 1/2 (ground state) to 6p doublet P sub 1/2 transition at 194 nm. The lines were observed by the absorption of tunable 194-nm radiation by Hg (g + g) ions created in a rf discharge. The results were g sub J (6s doublet S 1/2) = 2.0068(20) and g sub J (6p doublet S 1/2) = 0.6652(20). The second method was based on microwave- optical hyperfine resonance of ions confined in a Penning trap. They were optically pumped by the 194-nm source, which was tuned to a particular Zeeman component of the magnetic hyperfine interaction in the resonance-fluorescence intensity was observed when the microwave frequency was tuned to the ground-state Zeeman resonance. The result is g sub J (6s doublet S 1/2) = 2.003 174 574.

Quasi-Penning Resonances of a Rydberg Electron in Crossed Electric and Magnetic Fields.

Final rep.,

Keywords: Electrons, Electric fields, Magnetic fields, Resonance, Reprints, *Rydberg states, Penning traps.

It is shown that the combination of crossed electric and magnetic fields and the Coulomb field of the atomic nucleus can lead to the localization of the Rydberg electron in the vicinity of the Stark saddle point. The localization principle is shown to be similar to the one which serves as the basis for a Penning trap. This localized electron is expected to give rise to quasi-bound states near and above the saddle-point ionization limit. These states are expected to cause modulations in the threshold photoionization cross sections.

PB87-104030
PB87-104030 Not available NTIS National Bureau of Standards (NML), Boulder, CO.

Isotope Shifts of Some Ultraviolet Transitions of First Row Elements.

Final rep.,
Contract DE-A105-83ER60185
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Physics 80, n1 p115-124, 1 Oct 84.

Keywords: *Isotopic effect, *Alkali metal compounds, *Interstellar matter, Ultraviolet radiation, Reprints, Atomic interactions.

Attention is drawn to the existence of unusually large isotope shifts in the spectra of first row elements, and an explanation for the phenomenon is given. Calculated values of these shifts are presented, which are believed accurate to within 10-20%, they agree well with the available experimental data, which is very sparse, and with other theoretical values. Some of these shifts could be employed for isotopic abundance studies of interstellar material, when sufficient resolution in the ultraviolet range becomes available.

PB87-104048 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD.

Thermodynamic Properties of Nitrogen Tetroxide.

Final rep.,
Contract NASA-CC-264488
Sponsored by National Aeronautics and Space Administration, Cocoa Beach, FL, John F. Kennedy Space Center.

Keywords: *Chemical equilibrium, Thermodynamic properties, Mathematical models, Equations of state, Temperature, Density, Tables(Data), Chemical composition, *Nitrogen tetroxide.

A mathematical model of the equation of state of nitrogen tetroxide is presented. Isobars of P/ rho-t and composition for temperatures from the triple point (261.95 K or 1400 °C) with pressure up to 10 MPa are given. The mathematical model of the equation of state is a 32 term modified Benedict-Webb-Rubin equation, a method of calculating chemical equilibrium for the system is also presented.

PB87-104063 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD.

Radiative and Chemical Properties of Lithium.

Final rep.,
Contract DE-A105-83ER60185
Sponsored by Department of Energy, Washington, DC.

Keywords: *Atomic structure, Excitation, Atomic energy levels, Reprints, *Lithium atoms, *Autoionization, Atomic hyperfine structure.

The lithium atom is studied by treating all three electrons on an equal footing using hyperspherical coordinates. The use of asymptotic base states improves the convergence of the potential curve calculation dramatically. A good potential curve plot suggests that a few localized pathways dominate the formation and decay of the lowest triply-ex cited state, 2s2p. A study of the hyperspherical coordinates of the lowest state of the symmetry, 1s2p, shows that the adiabatic approximation in hyp erspherical coordinates gives an improvement over the hyperspherical coordinate method, owing primarily to its inclusion of radial correlation effects at small distances R.

PB87-104089 Not available NTIS National Bureau of Standards (NML), Boulder, CO.

Time and Frequency Div.

Doppler-Free Two-Photon Laser Spectroscopy of Hg.

Final rep.,
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC, and Office of Naval Research, Arlington, VA.


Keywords: *Atomic orbitals, Doppler effect, Atomic energy levels, Frequency standards, Reprints, *Mercury ions, *Mercury 198, Ion traps, Laser cooling. Two photon absorption.

The Doppler-free, two-photon 5010.62±0.02 doublet Si(sub 1/2), 5010.62±0.02 doublet D (sub 5/2) transition in singly ionized Hg, attractive as an optical frequency standard, has been observed for the first time. A few 196 Hg (g + g) ions were confined in a radio-frequency trap and the two-photon transition was detected by monitoring the change in the fluorescence light scattered by the ions from a laser beam tuned to the first order redshifted transition at 194 nm. The radiative lifetime of the doublet D sub 5/2 state and the absolute wave number of the two-photon transition were measured to be 0.090(5) s and 17.757.152(3) cm respectively.

PB87-104097 Not available NTIS National Bureau of Standards (NML), Boulder, CO.

Time and Frequency Div.

Laser-Magneto-Resonance Detection of Magnesium Atoms in the Metastable triplet (P) sub 0.12 States.

Final rep.,
Grant NASW-15-047
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of the Optical Society of America B2, n9 p1566-1569 Sep 85.

Keywords: *Metastable state, Far infrared radiation, Atomic structure, Reprints, *Magnesium atoms, Laser magnetic resonance, Fine structure, G factor.

Transitions between fine-structure levels of the metastable (3s3p triplet) P state of magnesium have been observed by means of the highly sensitive technique of far-infrared laser-magneto-resonance spectroscopy. The g factors for the triplet P sub 1 and triplet P sub 2 levels are 0.111(16) and 0.111(16) respectively, and the triplet P(sub 1) - triplet P(sub 2) energy separation is 1 220 755 (133) MHz. The observed g factors show good agreement with the predicted values. The authors discuss the underlying mechanism of this experiment, and describe preliminary experimental work on three-photon ionization of atomic carbon.

PB87-104105 Not available NTIS National Bureau of Standards (NML), Boulder, CO.

Time and Frequency Div.

53
Far Infrared Laser Magnetic Resonance of Meta- 
stable (triplet P) Mg.

Final rep.
1984, 2p.
Pub. in Proceedings of International Conference on Far- 
Infared and Millimeter Waves (9th), Takarazuka
(Japan), 22-26 October 1984, p96-97.

Keywords: *Mg, Far infrared radiation,* Zeeman effect, 
Magnetic state, Reprints, Gyromagnetic 
ratio, Laser magnetic resonance, Fine structure.

Laser Magnetic Resonance spectroscopy inside the 
cavity of an optically pumped FIR laser has been suc- 
cessfully extended to the detection of a refractory atom.
Several properties of the new cavity are discussed in 
this contribution. Several properties of the new cavity 
are measured and compared with the known properties.

Inelastic neutron scattering measurements of the 
torsional levels of CH3NO2 and CD3NO2 are presented 
as functions of pressure and temperature. In contrast to 
all previously observed pressure dependence of hindered 
rotors, the ground state tunnel splitting increases 
and the energy of the bound torsional levels 
decrease with pressure. A potential which reproduces 
these anomalous effects is found and the source of 
the anomaly explained.

Inelastic neutron scattering measurements of the 
torsional levels of CH3NO2 and CD3NO2 are presented 
as functions of pressure and temperature. In contrast to 
all previously observed pressure dependence of hindered 
rotors, the ground state tunnel splitting increases 
and the energy of the bound torsional levels 
decrease with pressure. A potential which reproduces 
these anomalous effects is found and the source of 
the anomaly explained.

The authors prove by a simple counterexample that 
many general theories of fluid phase equilibrium 
are not valid for coherent phase equilibrium. Many discrep- 
cyances between the simple phase diagram determi- 
}
Physical & Theoretical Chemistry

600.502
PB87-108122 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Least Endothermic Fragmentation Pathways of the Dioxane Cations.

Keywords: *Cations, *Diazine, Fragmentation, Endothermic reactions, Spectroscopy, Ions, Cleavage, Reprints, Electronic structure.*

The least endothermic fragmentation pathways of the dioxane cations have been investigated by variable residence time photoelectron-photon coincidence spectrophotometer. The temperature dependent and mass dependent sub-structure is observed in the dissociation spectrum. The corresponding results provide the rate energy functions for the loss of N sub 2 from the 1,2-diazine-and for the loss of the 2,3-diazine. The temperature dependent sub-structure is observed in the dissociation studies. The outcome of the analysis further indicates that the processes at question involve a rate determining cleavage of the aza-aromatic rings with a critical energy of approx. 2.7 eV and a correspondingly loose transition state. Quantitative accord between computed and measured rates can only be achieved when it is assumed that the reactions occur on the ground state manifold of the respective parent ions, suggesting rapid internal conversion of any initial excess electronic energy.

600.506
PB87-108437 Not available NTIS National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Effect of External Mass-Transfer Resistance on Facilitated Transport.
Contract DE-AC21-84MC21271
Sponsored by Department of Energy, Washington, DC.

Keywords: *Mass transfer, Mathematical models, Membranes, Resistance, Reprints, Liquid membranes, Facilitated transport, Carrier mediated transport.*

An analytical expression is derived for the facilitation factor in facilitated transport across a liquid film. The expression accounts for external mass-transfer resistance in the liquid phase, internal mass-transfer resistance in the solid phase, and internal mass-transfer resistance in the liquid phase. Evaluation of Sherwood numbers encountered in hollow-fiber membrane systems indicates the importance of internal mass-transfer resistance. A graphical method based on the equation is presented and compared to experimental results.

600.507
PB87-108445 Not available NTIS National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Kinetic Efficiency Factors for Facilitated Transport Membranes.

Keywords: *Membranes, *Kinetics, Mathematical models, Reprints, Liquid membranes, Efficien-
ty factors, Carrier mediated transport.*

A kinetic efficiency factor (eta) is defined for facilitated transport membranes. Eta is defined as the actual flux divided by the facilitated flux under reaction in equilibrium conditions. Eta is correlated with an inverse Damkohler number epsilon. A dimensionless equilibrium constant K and mobility ratio alpha also affect the value of eta. Eta is shown to be useful in determining the operating regime of the system, comparing actual performance to maximum attainable, and providing a qualitative measure of the time to reach steady-state conditions.

600.508
PB87-108452 Not available NTIS National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Mathematical Modeling of Facilitated Liquid Membrane Transport Systems Containing Ionically Charged Species.

Keywords: *Mathematical models, Diffusion, Chemical reactions, Numerical analysis, Membranes, Reprints, Mathematical models, Facilitated transport, Carrier mediated transport.*

A numerical model is presented which solves the transient nonlinear system of partial differential equations governing the facilitated transport of ionically charged species through a liquid membrane. The mathematical model is derived in dimensionless form and solved numerically. Facilitation factors and electrochemical potentials are calculated at a point in the membrane and compared to experimental results. This model is useful in predicting transient concentration, flux, and electrical potential profiles. Additional data is provided that the values of the required physical constants are known. It was noticed that transient facilitation factors are not affected by the tran- sient nature of the system, indicating that both the pure diffusion and the facilitated transport of permselective are affected equally by the electrical effects of the ionically charged species.

600.509
PB87-108601 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Far Infrared Laser Magnetic Resonance Detection of NH and ND (a sup 1 Delta) at 70 K.
Pub. in Jnl. of Chemical Physics 86, n1 p324-330, 1 Jul 86.

Keywords: *Spectroscopic analysis, Rotational spec-

Rotational spectra of the excited (a sup 1 Delta) state of NH and ND have been observed by infrared laser magnetic resonance spectroscopy. For ND A (sup 1 Delta) the spectroscopic constants are B sub 0 = 29(2) MHz, (sup 2 D sub 0 = 13(2) MHz, (sup 2 N sub 2) = 109.63(22) MHz, (sup 2 D sub 2) = 110.23(22) MHz, (sup 2 N sub 2) = -0.04(15) MHz, gr = 0.0086 8(10), and (sup 2 D sub 2) = 0.0071(17). For NH A (sup 1 Delta), the constants are (B sub 0) = 493.043.182(95) MHz, (sup 2 D sub 0) = 50.453 MHz (constrained in fit), (sup 2 N sub 2) = 109.59(85) MHz, (sup 2 D sub 2) = 70.09(14) MHz, (sup 2 N sub 2) = 4.0 MHz (constrained in fit), (sup 2 N sub 0) = -0.001 5(6), and (sup 2 N sub 2) = 0.001 3(0) constrained in fit). Aspects of the electronic structure of the radical as revealed by the magnetic hyperfine constants are discussed in relation to those of chemically similar systems. The Zeeman parameters are interpreted in terms of mixing of the a (sup 1 Delta) state with the c (sup 1 Delta) state.

600.510
PB87-108643 Not available NTIS National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Pub. in Cryogenics 26, p33-38 Jan 86.

Keywords: *Phase transformations, *Ethane, *Nitro-
gen, Thermodynamics, Cryogenics, Phase diagrams, Reprint, Long-range mixing.*

The phase diagram for the nitrogen-ethane mixture is determined via the extended corresponding states one-fluid theory. The authors support the contention that the mixture is a three-phase mixture with a three-phase (liquid-liquid-vapor) line. The line can be calculated extremely well if binary interaction factors are fitted to the three-phase data. Without further adjustment, the liquid-liquid equilibrium (LLE) and vapor-liquid equilibrium (VLE) for the system are predicted satisfactorily. The parameters used, however, are not sufficient to predict the VLE to VLE interface for a mixture critical line. The conclusion is in agreement with our previous work.

600.511
PB87-109500 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Optical Analytical Research Branch.
First and Second Dissociation Constants of Deu-
terio-Phthalic Acid in D20 from 5 to 50 C.

Keywords: *Thermodynamic properties, Heavy water, Constitution/Composition/Constitutional equilibria, Kinetics, Reprints, *Dissociation constants, *Phthalic acid/deuterio, Activity coefficient, Thermodynamic ac-

600.511
The first and second dissociation constants of deuterio-o-phthalic acid in deuterium oxide have been determined by the emf method over the temperature range 15 to 50 deg C. The pK values for potassium deuterium phthalate have been calculated from these two constants and experimentally verified. The thermodynamic properties of deuterio-o-phthalic acid have also been evaluated.

600.172
PB87-109958
Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div. Thermodynamic Properties of DCI in D2O Solution from 5 to 50 C.

Keywords: "Hydrogen chloride, *Heavy water, Thermodynamic properties, Enthalpy, Entropy, Free energy, Electrochemical cells, Specific heat, Isotope effect, Reprints, *Deuterium chloride, Heat capacity.

The thermodynamic properties of solutions of deuterium chloride (DCl) in deuterium oxide (D2O) have been determined. The chloride concentration was kept as high as possible. The cation is the same as that of the chloride in 25 C. Molar volume is obtained from the enthalpy, entropy, and heat capacity. The measurements were made with a transient hot-wire apparatus. The values of the enthalpy, entropy, and heat capacity are as high as possible. The results of the measurements are consistent with the theoretical predictions.

600.513
PB87-109961

Keywords: *Molecular spectra, *Atomic energy levels, Plasma radiation, X rays, Reprints, *Strontium ions, *Ionization energy, Sodiumlike ions, Laser-produced plasmas, Sodiumlike ions.

The spectrum of S(27 +) was observed with a laser-produced plasma and a 2.2-m grazing-incidence spectrograph in the range 1.2-1.6 A. From the identification of the 37 spectral lines, the 2p and 2p6 collisional ionization levels were determined. The level system includes the configurations ns(n-3), n(p=3-8), nd(n=3), and ng(n=4-9), and 5g. The ionization energy is determined as 11 186 200 + or - 1000 cm (1387, 16 + or - 12 ev).
measured rate constants, a discussion of the data, and a comprehensive bibliography are presented. Wherever possible the preferred rate parameters are given with their associated error limits and temperature ranges.

600.527
PB87-109930 Not available NTIS Idaho Univ., Moscow. Center for Applied Thermody-

amic Studies.
Thermodynamic Properties of Ethylene from the Freezing Line to 450 K at Pressures to 260 MPa, M. Jahangiri, R. T. Jacobsen, and R. B. Stewart. c1986, 15p
Sponsored by National Bureau of Standards, Gaithers-
burg, MD.
Keywords: *Ethylene. *Thermodynamic properties, Enthalpy, specific heat, Entropy, Density, Equations of state.
A new fundamental equation explicit in Helmholtz energy for thermodynamic properties of ethylene from the freezing line to 450 K at pressures to 260 MPa is presented. Independent equations for the vapor pressure for the saturated liquid and vapor densities as functions of temperature, and for the ideal gas capacity are also included. The fundamental equation was selected from a comprehensive function of 100 terms on the basis of a statistical analysis of the quality of the fit. The fundamental equation and the derived functions for calculating internal energy, enthalpy, entropy, isochoric heat capacity (Cv), isobaric heat capacity (Cp), and velocity of sound are included. The fundamental equation reported here may generally be used to calculate pressures and densities with an uncertainty of $-0.1\%$, heat capacities within $\pm 0.3\%$, and velocity of sound within $\pm 0.1\%$. Comparisons of calculated properties to experimental data are included to verify the accuracy of the formulation.

600.529
PB87-109948 Not available NTIS Idaho Univ., Moscow. Center for Applied Thermody-

amic Studies.
Thermodynamic Properties of Nitrogen from the Freezing Line to 2000 K at Pressures to 1000 MPa, R. T. Jacobsen, R. B. Stewart, and M. Jahangiri. c1986, 17p
Sponsored by National Bureau of Standards, Gaithers-
burg, MD.
Keywords: *Thermodynamic properties, Nitrogen, Density, Enthalpy, Entropy, Equations of state, Specific heat, Tables(Data), Heat capacity, Temperature dependence, Pressure dependence.
A new fundamental equation explicit in Helmholtz energy for thermodynamic properties of nitrogen from the freezing line to 2000 K at pressures to 1000 MPa is presented. New independent equations for the vapor pressure and for the saturated liquid and vapor densities as functions of temperature are also included. Tables of thermodynamic properties of nitrogen are given for liquid and vapor states within the range of validity of the fundamental equation.

600.529
PB87-109963 Not available NTIS American Chemical Society, Washington, DC.
c1986, 349p
See also PB87-109971 through PB87-110029, and PB86-204567. Prepared in cooperation with American Inst. of Physics, New York. Sponsored by National Bureau of Standards, Gaithersburg, MD. Available from American Chemical Society, 1155 16th St, NW, Washington, DC 20036.
Keywords: *Research, Thermophysical properties, Ti-
tranium chlorides, Thermodynamic properties, Ion, Silicon, Enthalpy, Entropy, Standards, Thermal conductivity, Toluen, Heptane, Methane, Combustion, Ion-molec-

e collisions, Computer applications, Electron photon interactions, Photoionization, Photodissocia-
tion, Ions clusters, Standard reference materials, Chem- ical reaction kinetics.
Table of contents includes the following: Computer methods applied to the assessment of thermophysical data Part 1. The establishment of a computerized thermodynamic data base illustrated by data for TiCl4(g), TiCl4(c), TiCl3(c1r), and TiCl2(c1r). Thermody- namic properties of iron and Si. Cross Section to consider collisions of electrons and photons with nitrogen molecules, Thermodynamic data on gas-phase ionized molecular species and clustering reactions, Standard reference data for the thermal conductivity of li-

uids; Chemical kinetic data base for combustion chem- istry Part 1. Methane and related compounds; Cumu-
lative listing or reprints and supplements.

600.528
Computer Methods Applied to the Assessment of Thermophysical Data. Part 1. The Establish-

ment of a Computerized Thermodynamic Data Base Il-

ustrated by Data for TiCl4(g), TiCl4(c), TiCl3(c1r), and TiCl2(c1r), P. Kirby, E. M. Marshall, and J. B. Pedley. c1986, 23p
Sponsored by National Bureau of Standards, Gaithers-
burg, MD.
Keywords: *Titanium chlorides, Thermophysical properties, Enthalpy, Heat of formation, Entropy, Com-

puter applications.
Computer methods are described for the storage, re-

trial, and processing of large amounts of thermo-

cal data and the preparation of Cross-Sstandard Data.

The procedures are illustrated by a critical evaluation of data for TiCl4(g), TiCl4(c), TiCl3(c1r), and TiCl2(c1r) values for standard enthalpy of formation and entropies at 298.15 K are selected for these species.

600.529
PB87-109997 Not available NTIS Institute of Space and Astronautical Science, Tokyo, Japan.
Sponsored by National Bureau of Standards, Gai-
thersburg, MD.
Includes Jnl. of Physical and Chemical Reference Data, v15 n3 p985-1010 1986. Available from Ameri-
can Chemical Society, 1155 16th St., NW, Washing-
don, DC 20036.
Keywords: *Nitrogen, Cross sections, Excitation, Elas-
tic scattering, Molecular vibration, *Electron-molecule collisions, *Photon-molecule collisions, Photoioniza-
tion, Photodissociation, Electron collisions.
Data have been compiled on the cross sections for collisions of electrons and photons with nitrogen molecules(N2). For electron collisions, the processes considered are photoionization and elastic scattering, mo-

mentum transfer, excitations of rotational, vibrational and electronic states, dissociation, and ionization. Ioni-

zation and dissociation processes are discussed for photon impact. Cross section data selected are pre-

sent graphically. Spectroscopic and other prop-

erties of the nitrogen molecule are summarized and the literature was surveyed through the end of 1984, but some more recent data are included when useful.

600.527
PB87-110003 Not available NTIS Pennsylvania State Univ., University Park. Dept. of Chemistry.
Thermophysical Properties on Gas-Phase Ion-Molecule Asso-

ciation and Clustering Reactions, R. G. Keeseer, and A. W. Castleman. c1986, 61p
Sponsored by National Bureau of Standards, Gai-
thersburg, MD.
Includes Jnl. of Physical and Chemical Reference Data, v15 n3 p1071-1086 1986. Available from Ameri-
can Chemical Society, 1155 16th St., NW, Washing-
don, DC 20036.
Keywords: *Thermodynamic properties, Enthalpy, En-

A comprehensive tabulation of the standard enthalpy change, delta H, enthalpy change, delta S, and Free energy change delta G, for the formation of ion clus-
ters from ion-molecule association reactions is given. The experimental methods which are used to derive the data are briefly discussed. For some experiments, dissociation energies of ion clusters are reported and lists of reference values along the saturation line between delta H and dissociation energy is discussed in the text.

600.528
PB87-110011 Not available NTIS Lisbon Univ. (Portugal). Dept. de Quimica.
Standard Reference Data for the Thermal Conduct-

Prepared in cooperation with Imperial Coll. of Science and Technology, London (England). Dept. of Chemical Engineering and Chemical Technology, and Keio Univ., Tokyo (Japan). Dept. of Mechanical Engi-

neering. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Includes Jnl. of Physical and Chemical Reference Data, v15 n3 p1073-1086 1986. Available from Ameri-
can Chemical Society, 1155 16th St., NW, Washing-
don, DC 20036.
Keywords: *Thermal conductivity, *Water, *Toluene, *Heptane, Thermophysical properties Liquids, Convic-

ection, Concentric cylinders.
The available experimental liquid-phase thermal con-

ductivity data for water, toluene, and n-heptane have been examined with the intention of establishing standard reference values along the saturation line. The quality of available data is such that for toluene and water new standard reference values can be pro-

posed with confidence limits better than $\pm 10\%$ for most of the normal liquid range. For n-heptane there are insufficient reliable experimental data for the system to be treated as a primary reference standard, so a lower quality correlation has been developed which yields a set of secondary reference data with confidence limits of $\pm 0.1\%$ for most of the normal liquid range.

600.529
PB87-110110 Not available NTIS National Bureau of Standards (NBS), Gaithers-
burg, MD. Radiation Physics Div.
Photocell-Photon Coincidence Study of the Bromo-

trene Ion.
Pub. in Jnl. of Physical Chemistry 73, n2 p773-777 15 Jul 80.
Keywords: Photoelectrons, Mass spectroscopy, Fragmentation, Reprints, *Electron-ion collisions, *Benzenoid/bromo, *Photolysis, Phenyl radicals.

The technique of variable time photoelectron-photon coincidence mass spectrometry has been applied to the fragmentation of benzeno-bromine ion producing phenyl ion. A detailed analysis of the variation of the breakdown curve with parent ion residence time was performed. The results lead to phenylene = 270 kcal/mole in close agreement with calculated results from an earlier study on chlorobenzene. This, combined with constraints on the fragmentation process leads to phenyl radical = 83 plus or minus 3 kcal/mole, slightly higher than the value 80.9 plus or minus 2 kcal/mole obtained from neutral kinetics. The analysis leads to a rate-energy dependence for the fragmentation process and an equivalent 1000 K Arrhenius pre-exponential factor of 9 x 10 to 14 the 10th power/sec, which may be compared with the value 10 to 10 the 14th power/sec for the analogous neutral process. The possible contribution of spin orbit splitting is discussed.

500,530
PB87-110185 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Resonant Electron and Ion Emission and Desorption Mechanism in Rare Earth Oxides.

Final rept., J. Schmidt-May, F. Sent, J. Voss, C. Kunz, and A. Flossdorf, 1985, 2p

Sponsored by Office of Naval Research, Arlington, VA.


Keywords: *Desorption, Chemisorption, Rare earth compounds, Reaction kinetics, Surface Chemistry, Reprints, *Samarium oxides, *Europium oxides, *Ytterbium oxides, Ion emission, Photoelectron spectroscopy.

The resonant enhancement in photoelectron spectra at the 4d edges of rare earth atoms and metals is also found for photoelectrons from divalent ions from the surfaces of the oxides of Sm, Eu and Yb following the photon excitation. The analysis of the 4 -> 4f resonance leads to a precise determination of the ionization potential and of the processes which is mainly caused by the flux of energetic 4f photoelectrons from the bulk. In this case the dominant desorption through secondary processes limits the use of the photoionized-stimulated desorption (PSD) to determine to what type of atom the desorbent species was attached.

500,731
PB87-110193 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Recent Developments in Quantitative Surface Analysis by Electron Spectroscopy.

Final rept., C. J. Powell, 1986, 8p


Keywords: *Electron spectroscopy, *Chemical analysis, Surface chemistry, Calibration, Reprints.

An overview is given of recent developments in quantitative surface analysis by x-ray photoelectron spectroscopy and Auger electron spectroscopy. The two major tasks of an analysis are the identification of the surfactant molecules and the quantification of the concentrations of particular elements or compounds. Methods for accomplishing both tasks are described together with the pitfalls and problems that remain. Particular attention is given to the following topics: identification of surface phases and reference data for the calibration of instrumental energy scales; reference data on inelastic mean free paths and attenuation lengths; effects of specimen crystallinity; intensity measurements, measurement of the imaging properties of electrons and other analytes, and the intensity-energy response function of different instruments.

500,532
PB87-111050 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Photofragmentation Dynamics of Acetone at 193 nm: State Distributions of the CH3 and CO Fragments by Time- and Wavelength-Resolved Infra- red Emission.

Final rept., D. J. Donaldson, and S. R. Leone, 1986, 8p

Contract DOE-EA-77-A1-6010, Grant NSF-PHYB-00805

Sponsored by Department of Energy, Washington, DC., and National Science Foundation, Washington, DC.

Pub. in Jnl. of Chemical Physics 85, n2 p817-824, 15 Jul 86.

Keywords: *Acetone, *Photoysis, Chemical radicals, Excitation, Carbon monoxide, Infrared radiation, Vibrations, Rotation, Reprints, *Methyl radicals.

The photoysis of acetone at 193 nm is known to produce CH3 and CO at a low energy excitation of a (sup1 in (3)py) Rydberg transition. Vibrational excitation is detected both in products immediately following the dissociating laser pulse by observing the resulting infrared emission. Vibrational distributions are obtained for CH (nu 3) and for CO. These are, for CH, 0.05/0.13 or -0.05/0.13; and for CO -0.05/0.13 or -0.05/0.1 or -0.05/0.16 or -0.05/0.09 or +0.05. An approximate rotational temperature of 1500 K can be used to fit the CH(3nu sub 3) emission spectrum. The CO is formed with very high, non-Boltzmann rotational excitation. The result of the three-body dissociation occurs via a two-step mechanism, rather that a rigorously concerted process. The high-rotation excitation is most likely imparted by the kinematics in the breakup of a bent acetyl fragment.

500,733
PB87-110176 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Electron-Impact Ionization of Mg-Like Ions: S(4+), C(4+), and Ar(6+).


Contract DE-AC05-84OR21400


Pub. in Physical Review A 33, n6 p3779-3786 Jun 86.


Absolute electron-impact ionization cross sections were measured as a function of collision energy for ions S(4+), C(4+), and Ar(6+) in (3s,4s,5s), and (4s,5s,6s). The measurements cover the energy range from threshold to 1500 eV and show onsets due to the deletion of the inner-shell excitation followed by autoionization. The relative magnitude of the indirect ionization process increases dramatically in competition with the direct process along the sequence, a feature which is also emphasized by earlier data for Al(11).

500,734
PB87-113619 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Thermophysics Div.

Viscosity of Light and Heavy Water and Their Mixtures.


Contract DE-AC02-84ER1081

Sponsored by Department of Energy, Washington, DC.


Keywords: *Heavy water, Water, *Viscosity, Measurement, Mixtures, Reprints.

The paper presents measurements of the viscosity of light and heavy water and their mixtures at temperatures between 25 and 220°C and at pressures from the saturation pressure up to 30 MPa. A comparison with values taken from the literature indicates agreement with the previously accepted values for the viscosity of light D2O. A unified representation equation is proposed which yields the viscosity of mixtures of liquid H2O and D2O at all concentrations, at temperatures from the freezing point up to 350°C, and at pressures up to approximately 100 MPa.
Not Not Not Not Not Not Not Not Not

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National high PB87-1 nide. Keywords: lOp

which in

Chemical

600,541

two of 475 in

Electron, Reprints, *Cyamide/methyl, Photoino-

tization efficiency curve.

Vibrationally resolved photoelectron branching ratios and asymmetry parameters have been determined for the two outermost molecular orbitals of methyl cyanide. The results are discussed briefly within the context of similar studies on cyanogen and hydrogen cyanide, and in relation to structures exhibited in the pho-

600,540


Keywords: Excitation, Mass spectra, Reprints, *Multi-

photon ionization spectroscopy; Chlorine monoxide, Electronic structure, Ryberg states. The authors report the resonance enhanced multiphoto-

ionization spectra of CIO and Br2 between 415 and 475 nm. The observed electronic states were pre-

pared in a simultaneous absorption of three identical photons from a dye laser. Absorption of at least one additional photon induced ionization. CIO showed spectra originating from the D, E, and F states. Br2 showed three new vibrational progressions originating from transitions between the X (sup2)Pi(sub2)2 state to Ryberg states with assignments of E (sup4)sigma (n(sub0 0) = 65003/cm), F (sup2)sigma (n(sub0 0) = 67470/cm), and an apparently inverted multiplet state designated G (n(sub0 0) = 70504/cm). The G state bands were separated by 139 (+ or -) cm which should approximate the magnitude of the spin-

orbital coupling constant of the excited state if it is of (sup2)Pi(sub2) symmetry.

600,541

PB87-118105 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Chemical Engineering Science Div. Thermodynamics of Ammonium Sulfates II. Heat Capacity of Deuterated Ammonium Perhenate ND4ReO4 from 7.5 to 320 K.


600,542


Keywords: *liquids, Density, Cross sections, Calibra-

tion, Reprints, *Pressure dependence, Bubbler tubes.

An experiment was performed to study the depend-

ence of pressure (P) in a bubbler tube on liquid proper-

ties. For a given mass of liquid in a tank of uniform cross-sectional area A, the pressure in the bubbler tube is determined by the surface tension, bubble size, and height, which is the space between the bottom of the tank and the top of the bubble tube. The relationship for the pressure was found to be consistent with all measurements. In a second part of the investigation a cylindrical tank was calibrated with water at room temperature. The calibra-

tion was extrapolated to measure the volume of water at 40 deg C and uranyl nitrate at 20 deg C and 40 deg C. All measurements indicated that the extrapolation procedure discussed in the study is valid. The sensitiv-

ity of the extrapolation to density changes and tank ge-

ometry changes is presented.

600,543


Keywords: *Hydrogen, *Carbon dioxide, Thermophy-

sical properties, Reprints, Fugacity coefficients, Binary mixtures, Gas mixtures.

The fugacity coefficients of hydrogen in binary mix-

tures with methane and propane were measured using the gas diffusion and ualysis technique. The study in
to the use of an experimental chamber which is divided into two regions by a semipermeable mem-

brane containing other component. At equilibrium, pure hy-

drogen will permeate into one 'compartment' of the chamber, while the binary mixture occupies the other compartment. Thus, the pressure of pure hydrogen on one side of the membrane is the same as that of the hydrogen plus methane binary on the other side of the membrane. In the study, results are reported for measurements made for the hydrogen + propylene binary at 80 deg C (353 K) and 130 deg C (403 K) and the hydrogen + methane binary at 60 deg C (353 K). All measurements were performed with a total mixture pressure of 3.45 MPa.

600,545


Keywords: Excitation, Reprints, *Magnesium atoms, *Autoionization, Multi-photon processes, Resonance ionization mass spectrometry.

The authors have observed ionization of Mg by both direct and stepwise two-photon excitation of the 3p(2) single level. The line shape of the single-color direct process is strongly modified by the resonance denominator associated with the intermediate virtual state. The measured energy and width of this reso-

nance as determined by the stepwise-two-color tech-

ique agree well with previous determinations.

600,546


Keywords: *Thermodynamic properties, Equations of state, Reprints, *Pentane/iso, *Butane/iso, Binary mixtures.

A Helmholtz function for mixtures of isobutane and iso-

pentane has been formed based upon a recent corre-

lation of pure isobutane as the reference fluid and us-

ing this extended corresponding states principle. The function can be used to generate other thermodynam-

ic properties of interest by differentiations with respect to its independent variables V1, and X. Sample tables

59
Thermodynamic Property Formulation for Ethylene from the Freezing Line to 450 K at Pressures to 260 MPa.


Keywords: *Thermodynamic properties, *Ethylene, Equations of state, Reprints.

A new thermodynamic property formulation based upon a fundamental equation explicit in Helmholtz energy of the form \( A = A(\text{act}, T) \) for ethylene from the freezing line to 450 K at pressures to 260 MPa is presented. A vapor pressure equation, equations for the saturated liquid densities as functions of temperature, and an equation for the ideal-gas heat capacity are also included. The fundamental equation and the associated equations for internal energy, enthalpy, entropy, isochoric heat capacity (C_sub_v), isobaric heat capacity (C_sub_p), and velocity of sound are included. The fundamental equation reported here may be used to calculate pressures and densities with an uncertainty of plus or minus 0.1%, heat capacities within plus or minus 3%, and velocity of sound values within plus or minus 1%, except in the region near the critical point.

Measurements of the PVT behavior of compressed gas and liquid methanol are reported. Pressure versus temperature observations were made along paths of very nearly constant density (pseudocriticals) in the temperature range from about 100 to 300 deg C and at pressures to about 35 MPa. Eighteen pseudocriticals were determined, ranging in density from about 2 to 22 mol/cu dm.

600,550
PB87-119806 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Energy Redistribution and Dissociation in Molecular-Surface Collisions Involving Charge Transfer/Surface Reactions.


Keywords: *Surface chemistry, Surfaces, Excitation, Dissociation, Vibration, Adsorption, Reprints, *Molecule collisions, Charge transfer.

In analogy with resonance electron scattering from molecules in which substantial high vibrational overtones are observed, beams of diatomic molecules scattered from solid surfaces could emerge highly vibrationally excited due to the formation of temporary negative molecular ions resulting from charge transfer between the solid and molecule on the inward and outward legs of the scattering trajectory. In the present work, the exact classical trajectories for the diatomic molecule, including internal vibrational motion, are calculated for motion over model diatomic potential surfaces in which surface hopping due to charge transfer/harponing is accounted for. From these calculations, the probability for translational to vibrational energy transfer is obtained as a function of incident kinetic energy and system parameters.

600,557
PB87-120028 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Vibrational Population Lifetimes of OH(v=1) in Natural Crystalline Micas.


Keywords: *Mica, Infrared spectra, Muscovite, Non-metallic minerals, Hydrogen bonds, Crystal structures, Bottles, Reprints, *Vibrational lifetime, Picosecond pulses.

Picosecond infrared saturation-recovery measurements have been performed on the OH-stretching vibrational band of OH(1) and OH(2) in muscovite and mica at room temperature. The average OH-stretching vibration lifetime (T1 plus minus sigma) for OH(1) in muscovite is 92 plus minus 13 ps. For OH(1) in muscovite, T1 is 221 plus minus 23 and 27 plus minus 33 ps, respectively. These results and the vibrational crystal field analysis, which are based upon a quantum mechanical model for the OH-stretching vibration, suggest that the OH-stretching vibration is a fundamental band of OH(1) in muscovite.
bonding, ionic environment and infrared spectroscopy of these mineral species are used to rationalize the observed relaxation times.

600.559
PB87-120226
Not available NTIS

Keywords: Vinyl chloride, Chlorine, organic compounds, Excitation, Concentration, Reaction, Photolysis, Reprints. *Photodissociation, *Chemical reaction kinetics. *Vinylidene, *Rate constants.

The primary photodissociation processes in the photolysis of vinyl chloride have been investigated using the flash photolysis-kinetic spectoscopic technique. Concentrations and temporal profiles of product H2CC(=C)(Br)2, HCl and C2HBr are monitored by their absorption in the vacuum ultraviolet at 137, 139 and 151 nm, respectively. HCl and H2CC(=C)(Br)2 are formed by the same time history via a 1,1 elimination from excited C2H5Cl. Rate constants for the interaction of H2CC(=C)(Br)2 with He, 1.07 plus or minus 0.17 x 10 to the 11th power cc/mole s, have been obtained.

600.561
PB87-122339
Not available NTIS

An integrated test circuit, consisting of a reverse biased gated diode connected to a source-follower MOSFET amplifier, was developed to rapidly measure the generation lifetime in a p-n junction. As many as 540 junctions were measured on a 56 mm diameter silicon wafer where the maximum residence time was less than 0.5 s per structure. Circuit models were developed which indicate how to design the circuit so as to simplify the analysis.

600.559
PB87-121331
(Ord. as PB87-121315, PC A04/ MF A01)

Keywords: *Oxygen, Calorimeters, Calibration, Phase transformations, Thermodynamic properties, *Triple points.

The triple points of oxygen "as sealed in miniature pressure cells were investigated by means of adiabatic calorimetry. The triple point of a 99.999 percent pure commercial oxygen sample was found to be 0.94 mK higher than that of an "extra-pure" sample prepared by thermal decomposition of potassium by thermal decomposition of potassium permanganate (KMnO4). The capsule-type platinum resistance thermometers that have been used are shown to have outstanding stability and accuracy. The sample was obtained from the National Bureau of Standards extending over six years are shown to be consistent to within 0.15 mK at 54.381 K. The results of measurements on an internationally circulated sealed cell of commercial oxygen show its temperature to be 0.58 (sub 1) mK higher than those of the ultra-pure oxygen.

600.560
PB87-122248
Not available NTIS


The kinetics of bulk thermal or photochemical cure of resins are typically complex. Interpretation of the initial phase is complicated by the presence of initial products and irregular activation of radical initiators. Differential scanning calorimetry is ideal for monitoring these reactions as the amplitudes of a range of heating rates are used. Measurement of the rate of change in the exothermal propagation step--often the opening of a double bond to form a polymer linkage. Because of the above mentioned complexities it is prudent to perform isothermal measurement of these processes. Therefore, the paper develops isothermal differential techniques in which the rate is described as a function of time. Also, a quick method for estimating 'reaction order' from ratios of times to reach various fractions of an arbitrary initial rate is described. The above methods are illustrated by examples from photo and thermal cure DSC experiments.

600.560
PB87-122370
Not available NTIS

Keywords: Optical pumping, Reprints, *Samarium ions, optical bistability, Polarization. Experiments on the steady-state, nonbehavior of the (sup 7)F(1)(sup 7)F(0) 570.86 nm transition of atomic samarium in a laser-driven, near-concencic Fabry-Perot resonator. For zero applied magnetic field, only simple optical bistability, symmetric in both signal (+) and signal(-) transmitted polarization, is observed. However, for a magnetic field applied parallel to the propagation direction, polarization-sensitive switching appears, with lower power threshold near the edge of the Doppler-broadened region. Substrate measurements of atomic parameters are also given to enable the transition to be experimentally well characterized.

600.564
PB87-122388
Not available NTIS

Keywords: *Halogenalkanes, Molecular structure, Ground states, Reprints, *Electron affinity, *Photoelectron spectroscopy, Negative ions. Photoelectron spectra are reported for the MXI tild (sup 1) Sigma+(j + 1) - <MXI>(j) X tild (sup 2) Sigma+(j + 1) transitions of ten alkali halide anions at 468 nm electric dipole transition (gamma max 0.010 eV) are determined to be 0.593 (LiCl), 0.520 (NaF), 0.727 (NaCl), 0.788 (NaBr), 0.865 (NaI), 0.582 (KF), 0.660 (KCl), 0.690 (KBr), 0.754 (KI) and 0.455 (CsCl). Fundamental vibrational frequencies, equilibrium bond lengths, and dissociation energies are also reported for the anion sup 2 Sigma+(j + 1) ground states. An observed linear correlation of electron affinities with alpha/(sup 2) (alpha = metal atom polarizability and is used to predict the electron affinities of the remaining alkali bromides and iodides, as well as related alkali salts. A simple electrostatic model for the alkali halide ions is also presented which enables the accurate (plus or minus 0.1 eV) calculation of electron affinities.

600.565
PB87-122396
Not available NTIS

Keywords: *Silicon, *Silane, Pyrolysis, Surface chemistry, *Substrates, Reprints, *Chemical reaction kinetics, Amorphous silicon. Three regimes of pressure and temperature are identified in which silane pyrolysis has distinctly different initial kinetics. In two regimes the initial reactions are heterogeneous and in the third regime it is homogeneous. The authors report here a preliminary model for the heterogeneous reaction regime where the temperature dependence of the rate is nearly independent of pressure. In the model the silicon surface is saturated with hydrogen and hence is nonreactive. The rate limiting step for silane decomposition is the creation of reactive surface sites by release of hydrogen. These reactive sites are refreshed through decomposition of SiH4 or interaction of H2. A new adsorbed state of SiH4 is proposed which is bound to the surface by a three-center bond. After more than two simplifications to the full model the kinetics are solved for static-and flowing-gas hot wall reactor experiments. The implications of the proposed reactions for the other two regimes and for silane discharges are briefly discussed.

600.566
PB87-122412
Not available NTIS
The theoretical properties of dilute near-critical mixtures are given according to a classical and a non-classical model. Measurements obtained in dilute solutions of a metal have shown that the relative rate of increase of the light of these models. Questions are raised regarding the performance near the critical point of extended Debye-Hückel formulations recently proposed by Pietrz et al.

The average cluster size remaining after photoinduced vaporization of a cluster of specific initial size can be applied by an RKR-QET statistical model, provided that the energy released for the cluster is very high. Theoretical justification for this correction, based upon detailed balance, is provided here. Agreement with experiments for clusters at several wavelengths shows that for these aggregates the average bond strength above n = 2 is approximately 3.6 eV plus or minus 0.6 kcal/mole.

Interpretation of spectroscopic experiments in which the rotational lines are not resolved often requires an expression for the shift of the center of the rotational band. Previous expressions are corrected and extended to cases of linear, symmetric, spherical, and asymmetric rotors, with typical accuracy of a fraction of the rotational B constant.

The isotopic and anisotropic linewidths of methylene vibrations in a homologous series of alkanes of increasing chain length have been measured in the liquid state as a function of temperature. The bandwidths of the CH2 symmetric stretching modes, which are in Fermi resonance with overtones of the CH2 bending vibrations, are temperature intensive over a 200 K interval; this best described in terms of a vibrational dephasing mechanism (inhomogeneous broadening) for these modes. In contrast, for the bending and antisymmetric stretching vibrations, significant band broadening occurs over this same temperature interval. In addition, for these modes, both the absolute shift of the bandwidth and the relative rate of increase of the bandwidth with increasing temperature, decrease with increasing chain length. These observations are consistent with a nonuniform broadening mechanism as the principal bandwidth contribution for these vibrations.
escape they pass through and are scattered in the overlay. This scattering appears as a decrease in the intensity of the substrate photoelectron peak. The measurement of this decrease as a function of layer thickness gives the electron attenuation lengths directly. By using monochromatized synchrotron radiation for the photoemission measurements, one can tune the photon energy and, hence, obtain the attenuation lengths as a function of electron kinetic energy. The techniques developed for obtaining a uniform overlay film and for determining its thickness are given in detail. These techniques are applicable to most condensable samples that can be introduced into the vacuum system as a gas.

600.577
PB87-128099
Not available NTIS National Bureau of Standards (NLS), Gaithersburg, MD. Atomic and Plasma Radiation Div. 2s(2p) 2p(5) - 2s 2p(6) Transitions in Fluorine Ions from Zr(31+) to Sn(41+). Final rept.
Contract DE-A00-84-DP40092/26
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of the Optical Society of America B 3, n11 p1609-1611 Nov 86.

Keywords: *Atomic energy levels, Excitation, Wave-lengths, Zirconium, Tin, Plasma(Physics), Reprints, *Fluorine (Element), Thin Films.*

Transitions of the type 2s(2p) 2p(5) - 2s 2p(6) have been observed in eight fluorine ions from Zr(31+) to Sn(41+). The spectra were produced by focusing light from the NIST-X Omega laser at the University of Rochester onto solid targets and photographing the resultant plasmas with a 3-m grazing-incidence spectograph. The identified transitions are in the region 24-60 A. The measured wave-lengths are in good agreement with wave-lengths calculated with the semiempirical formula of Edlen (Phys. Xscir. 26, 51, 1983). Wave-lengths for the 2s(2p) 2p(5) doublet P(sub 3/2) - doublet P(sub 1/2) magnetic-dipole transitions are given for each ion.

600.579
PB87-128047
Not available NTIS National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div. Specific Heats (Cv) of Saturated and Compressed Liquid and Vapor Carbon Dioxide. Final rept.
J. W. Magee, and J. F. Ely. 1986, 20p
Sponsored by National Research Council, Washington, DC.
Pub. in International Jnl. of Thermophysics 7, n6 p1163-1182 Nov 86.

Keywords: *Carbon dioxide, *Specific heat, Thermophysical properties, Reprints, *Carbon dioxide (Element), Thermal conductivity.*

Specific heats of saturated liquid carbon dioxide (C sub sat) have been measured in the temperature range 220 to 303 K. Specific heats at constant volume (C sub v) have been measured at 12 densities ranging from 0.2 to 2.5 times the critical density in the temperature range 233 to 330 K, with pressures varying from 3.4 to 32 MPa. The measurements have been conducted in an adiabatic constant-volume calorimeter of conventional design. Uncertainty of the specific heats is estimated to not exceed 2.0%. Comparisons are made with an extended Benedict-Webb-Rubin equation of state and with the results of other workers.

600.579
PB87-128096
R. J. Van Brunt, and I. Sauers. 1986, 4p
Pub. in Jnl. of Chemical Physics 85, n8 p4377-4380, 15 Oct 86.

Keywords: *Hydrolysis, Reprints, *Chemical reaction kinetics, *Fluoride/thionyl, *Tetrafluorothionyl/thionyl. Vapor phases.*

The rates for gas-phase hydrolysis of SOF2 (thionyl-fluoride) and SOF4 (thionyl tetrafluoride) have been measured at a temperature of 296 K. The second order rate constant for SOF2 hydrolysis in SF6 buffer gas was found to have the value (1.2 x 10-m to 3.9 x 10-m) x 10 to the -23 power cc/s which agrees with previous estimates of Sauers, et al., but is three orders of magnitude less than the value obtained by Ruesegger, et al. at 340 K. The rate constant for SOF4 hydrolysis has not previously been measured and its value and the second order rate constant for SOF2 was found to be (1.0 x 0.5) x 10 to the -21 power cc/s.

600.580
PB87-128229
Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
R. W. Hyland. 1985, 7p

Keywords: *Water, *Thermodynamic properties, Enthalpy, Entropy.*

In 1983 two independent studies of the thermodynamic properties of saturated H2O were completed, one by Weiler and Hyland (WH) and a second by Haar, Gallagher, and Kell (HGK). WH includes only saturated phases for 173.5 x 0.1 < T < 473.15 K, and was derived from first to fourth order equations to data for particular parameters. HGK includes the entire thermodynamic surface over the temperature range 273.15 < T < 473.15 K or 10 x 0.001 K and the temperature range P < 0.1 to 0.3 x 10 to the 9th power Pa, and is derived from the Helfand equation. Because of the different approaches and scope, it is of interest to compare the formulations in their region of overlap. The paper includes comparisons for the specific volume, enthalpy, entropy, and the liquid and vapor states. Also given are comparisons for the vapor pressure and second virial coefficients. Generally, the agreement is within the stated uncertainties of the two formulations.

600.580
PB87-128294
M. Casassa, J. C. Stephenson, and D. S. King. 1986, 16p
Pub. in Jnl. of Chemical Physics 85, n4 p2333-2334, 15 Aug 86.

Keywords: *Nitrogen oxide(NO), Dissociation, Vibrations, Reprints, *Energy distribution, Van der waals forces.*

Rotational, spin-orbit, lambda doublet, and kinetic energy distributions were measured by laser-excited fluorescence techniques for the nitric oxide fragments formed from the vibrational predissociation of nitric oxide dimers in a free jet expansion. The NO fragments, produced following excitation in the dimer nu 1 fundamental, were described by a rotational temperature of TR = 102 K, with full equilibration of lambda doublet states, and a spin-orbit temperature TSUB 0 = 175 K. The velocity distributions were isotropic with an average fragment kinetic energy of 245/cm.

600.582
PB87-128419
J. H. Flynn. 1985, 4p

Keywords: *Thermal analysis, Chemical reactions, Thermochemistry, Reprints, *Chemical reaction kinetics, Differential scanning calorimetry.*

A simple technique for the kinetic analysis of rate data from an isothermal DSC experiment is presented. Selected ascending or descending sections of the rate curve are fitted to dQ/dr = A kQ(sub 0) x 0 - q(sub n). Values for A are determined and their consistency tested by the ratios of times to reach reduced rates of reaction.
A thermodynamic theory to account for the behavior of liquid mixtures exposed to a shear is developed. One consequence of the theory is that shear-induced phase changes are predicted. The theory is based on a thermodynamics that includes specifically the shear rate and shear stress, and is obtained from a straightforward modification of the corresponding states, conformal-solution approach. The approach is general but is used here to predict the mixture of Lennard-Jones particles with a Lennard-Jones equation of state as a reference fluid. The results are discussed in the context of Scott and Van Konynenburg phase classification. It is shown that the influence of a shear does affect substantially the type of the phase behavior. Results from the model mixture are equated loosely with those from real polymeric liquids.

The main focus is on the theory of such processes. The theory of scattering in a radiation field can be used to calculate absorption or emission profiles, and the distribution of final product states. Several simplifying approximations greatly facilitate a quantitative understanding of the profile, but may fail in quantitative studies.

600.587

Keywords: Thermodynamic properties, Nitrogen, Methane, Ethane, Equations of state, Reprints, *Binary mixtures.*

The principle of corresponding states, with one of its many extensions, is used to predict the thermodynamic properties of the binary mixtures N2-OH and CH4-C2H6. Comparisons of the predicted properties with experimental data are given to illustrate some of the powers and limitations associated with the method. Problems encountered in modeling mixtures, which are not necessarily associated with the mathematical model, the equation of state, are also discussed. Wide-range equations of state for the two binary systems mentioned above are presented.

600.589

Keywords: Absorption, Reprints, *Line broadening, Electronic structure, Atom collisions.*

The close coupled theory of atomic collisions in the presence of a radiation field may be used to calculate the distribution of final atomic states which results from the absorption of polarized light during a collision. The theory applies equally well to optical collisions (line broadening) and to radiative collisions (laser induced population transfer). For an optical collision the detuning omega - omega (sub s) is restricted to be larger than either the Rabi frequency or the widths of the level due to other relaxation effects. The radiation field is assumed to be weak enough that the transition probabilities are linear in field intensity. The molecular picture is emphasized in which the wavefunction is expanded in a basis of field-free molecular states and the Hamiltonian is blocked in accordance with molecular quantum numbers.

600.591

Keywords: *Acetamides, Molecular structure, Amides, Reprints, *Formamide, Rotational barrier.*

Ab initio calculations have been used to determine the gauche barrier and the barrier about the CN bond in formamide and acetamide. The results indicate that the inclusion of polarization functions in the basis set leads to a substantial decrease (ca. 5 kcal/mol) in the calculated barrier. The correlation effects decrease the barrier by less than 1 kcal/mol, while the addition of zero point energy corrections to the calculated barrier barely changes the result. Based upon the current calculations, the 0 K rotational barrier for isolated formamide and acetamide are predicted to be 14.2 and 14.3 kcal/mol, respectively.

600.592

Keywords: *Molecular relaxation, Alcohols, Vibrations, Reprints, *Lifetimes, Sialons, Picosecond pulses.*

Population and infrared pump-probe experiments determined the vibrational relaxation lifetimes (T1) of the hydroxyl fundamental stretching mode OH(ν = 1) in 12 alcohols (RSCOH) and 8 silanols (RSiOH) in dilute room temperature CO2 solutions. T1 for the silanols is in the range 185 <= T <= 292 ps, while T1 for the alcohols is much less (T <= 80 ps). The deuteron-exchanged analogs (COD and SOOH) exhibit population relaxation times similar to protonated hydroxyl. An analysis of the vibrational energy levels corresponding to modes involving the four bonds nearest the hydroxyl groups of these molecules is used to qualitatively explain the trend in observed T1 lifetimes for these systems. Solution T1 half-lifetimes are also compared to those previously measured for OH (ν = 1) on the surface of silica and in other condensed phase, room temperature systems.

600.593

Keywords: Algorithms, Absorption, Data reduction, Microrayon, X-ray absorption, *Mass absorption coefficients, Electron probes.*

A new model for the calculation of mass absorption coefficients is presented which takes into account the inaccuracy of the model μu = (C(1)λ)ubot m used in the current algorithms for estimating μu, which are used in X-ray production programs for electron probe microanalysis.

600.594

Keywords: *Aerosols, *Agglomeration, Collidios, Brownian movement, Soot, Reprints, Fractals.*

The formation of high temperature aerosol agglomerates is simulated by following the Langmuir trajectory of each particle with the boundary condition that the particles stick upon collision. Both the free molecular and continuum flow are treated. A new derivation of the froton force of an agglomerate in the continuum limit is developed based on the evaluation of the surface momentum flux at the Oseen flow limit. The agglomerates can be described as a fractal, at least in a limited range of the power law relationship between mass and size, with a dimensionality of 1.7-1.9 independent of the flow regime. The particle growth is shown to be mass limited and more rapid than the growth of the continuum. The global kinetics are shown to be consistent with a similarity analysis of the coagulation equation with a modified coagulation coefficient. Comparison between the simulation and coagulation theory at small time suggests a slight fluctuation enhancement in the free molecule case and a small-time enhancement of the coagulation rate at high concentration for the continuum case.

600.595

Keywords: *Combustion, *Enthalpy, *Purines, Thermodynamic properties, Chemical reactions, *Nitrogen heterocyclic compounds, Heat of formation, Reprints.*

The enthalpy of combustion for a commercial purine sample of better than 99 percent purity was measured in an aerodynamic abatometer calorimeter. The enthalpy of combustion was ±0.5 K for the reaction, C5H4N4O1 + 3.5 O2 -> 5 CO2 + 2 H2O + N2(g) is delta(s) sub c = (H = (2708.63 + 0.23) K/mol. The corresponding enthalpy of formation for purine, C5H4N4, is delta(s) sub f = (H = (169.42 + 0.26) K/mol.)

S. I. Chu, and J. Cooper. 1985, 7p
Grant NSF-PHY82-00805

Accurate ab initio nonperturbative L(2,2) non-Hermitian Floquet calculations for intensity-dependent threshold shifts and ground-state total ionization widths for one-, two-, and three-photon-dominated intense-field ionization of atomic hydrogen are presented. The results show the importance of both the ac Stark shift and the ponderomotive potential in the determination of the net threshold shift. In addition, branching ratios to individual continua have been estimated, yielding physical insights regarding the general features and mechanisms of the frequency- and intensity-dependent continuum-continuum transitions and peak broadening phenomena in the above-threshold ionization processes.

CHEMISTRY

Physical & Theoretical Chemistry

The convergent series expansions of the Holtermark distribution P(beta), its cumulative Q(beta), its derivative R(beta) and the semiconvergent asymptotic series for these functions are used to calculate rational approximations for P, Q, and R, which are valid for all positive beta and have maximum errors of approximately 10 to the 8th power, 10 to the 9th power, 10 to the 10th power, respectively.

Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Site Specificity in Stimulated Desorption from TiO2.


Keywords: *Surfaces, *Desorption, *Titanium dioxide, Chemisorption, Surface chemistry, Oxides, Reprints, Synchrotron radiation.

Synchrotron radiation has been combined with surface characterization techniques such as x-ray and photo-stimulated ion desorption from single-crystal TiO2. TiO2 is the model system for the Knott-Feibelman mechanism, which describes the production and desorption of O(++)-ions because it is a valence-maximal oxide: The Ti 3d-electron population on the stoichiometric, annealed surface is minimal. O-vacancy defects associated with appreciable Ti 3d-electron population can be created resulting in a non valence-maximal valence and straightforward interpretation of the Knott-Feibelman mechanism would predict a reduced O(++)-ion yield. Unexpected total ion yield results have been obtained, however, and are shown to add new insights to the field of stimulated desorption.

Not available NTIS National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

High Resolution IR Laser Spectroscopy of van der Waals Complexes in Supersonic Jets: Observation and Analysis of n(u=1), n(u=2)+n(u=2), and n(u=2)+2n(u=2) in Ar/HF.

Final rep., C. M. Lovejoy, M. D. Schuder, and D. J. Nesbit. 1986, 13p
Grant NSF-PHY82-00805

Sponsored by National Science Foundation, Washington, DC.

Pub. in Jnl. of Chemical Physics 85, n9 p4890-4902, 1 Nov 86.

Keywords: Infrared spectroscopy, Supersonic aircraft, Jet aircraft, Reprints, *Van der Waals forces, Argon hydrogen fluorides, Tunable lasers.

IR spectra of jet cooled Ar/HF are obtained via direct absorption of a high resolution tunable difference frequency laser in a 2.54 m path length, supersonic pulsed expansion at <10 K. Detection limits of 2x10 to the 9th power molecules/cc/quantum state permit observation of the high frequency n(u=1) fundamental with full intensity (10xsup(0) 0 <0> <0>sup(0) 0), the n(u=1) + (1,1)sup(0) van. Direct frequency lock to a vessel containing the Ar/HF and the 11000 cm-1 component of the (11,1) 0 manifold. The ground state (0,0) 0 molecular constants are in excellent agreement with previous microwave data.

Not available NTIS National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Iionization of a One-Dimensional Hydrogen Atom by a Resonant Electric Field.

Final rep., J. N. Bardose, and M. J. Comella. 1986, 4p
Sponsored by National Science Foundation, Washington, DC.


Keywords: Excitation, Reprints, *Hydrogen atoms, *Multiphoton ionization, Rydberg states.

The complex coordinate method is used in quantum calculations of the rate of ionization of highly excited states of H atoms by microwave radiation. The results are compared with classical calculations by Leopold and Richards.

Not available NTIS National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
CHEMISTRY
Physical & Theoretical Chemistry

600.606

Keywords: *Sodium chloride, Thermophysical properties, Solutions, Abnormalities, Reprints.

Apparent molar properties of near-critical aqueous NaCl solutions have been reported to show very large anomalies. The authors show that these anomalies are to be expected in any dilute solution of a nonvolatile in a near-critical solvent. Debye-Huckel effects need to be handled with care if inserted in the Heitzenroether free energy, they cause no more than a higher-order effect.

600.607

Keywords: *Thermophysical properties, Equilibrium, Fluid dynamics, Impurities, Reprints, Critical fluids.

At given pressure and temperature, impurities have very large effects on the density and enthalphy of near-critical solutions. The effects of impurities on the density of V with respect to x(sub PT) diverges. Thermodynamic relations permit to calculate impurity effects from the initial slope of the critical line or from the dew point curve. Examples are given for both nonequivalent and aqueous mixtures.

600.608

Keywords: * Liquids, Reprints, *Molecular dynamics, *Binary mixtures.

Molecular dynamics is used to investigate the connection between strong compositional order in a binary liquid mixture and the interactions between the unlike species of the mixture. Two classes of models are examined. The first has strong attraction between the unlike species and the second has pure repulsive interactions with a nonadditive term for the unlike pairs which is less than the average of the diameters of the like pairs. Both models lead to compositional ordering. The structure is characterized in terms of both pair and particle correlation functions which are constructed during the molecular dynamics computations. The connection of these models with observations on inorganic alloys is discussed. Also, the possible utility of purely repulsive models for characterizing a wide range of binary liquid mixture properties is mentioned.

600.609

Keywords: *Nitrogen, Excitation, Quenching, Atomic energy levels, Reprints, *Sodium atoms, *Atom-molecule collisions.

The quenching of excited Na (1s) (4d(5s,4p,4s) by N2 has been studied in a crossed atomic and molecular laser beam apparatus at thermal collision energies. The sodium atom can be excited by two laser beams of different wavelengths to either the 4 doublet (Sub 1/2) or 5 doublet (Sub 1/2) state, via the intermediate 3 doublet (Sub 3/2) state. For both excitation schemes optical relaxation processes lead to a population in the 4 doublet (Sub 3/2) and 4 doublet (Sub 1/2) states of several percent. The relative densities of the excited states have been calculated from rate equations using stationary conditions. The structure can be partially disentangled using the results of the previous study of Na (1s) (3 doublet (Sub 3/2) + N2 quenching process. The main conclusion is that collisional deexcitation to the Na(3p) ground state is negligible whereas as among the higher levels the collisional energy transfer cross sections are between 0.5 and 7.5 times the magnitude of the 3p-3s quenching cross section and they are strongly forward peaked in the same way.

600.610

Keywords: *Molecular structure, Ground state, Vibrational spectrum, Diatomic molecules, Van der Waals forces, Charge transfer.

Despite the voluminous literature on the spectra of diatomic molecules, there are many gaps in the knowledge of the ground-state vibrational frequencies. For many important diatomic molecules, only values obtained in matrix isolation experiments are available. In order to assess the likely extent of deviation of the ground-state delta(G)(1/2) values of diatomic molecules observed in rare-gas and nitrogen matrices from the gas-phase values, a systematic comparison has been made between gas-phase and matrix frequencies. The dependence of matrix shifts on the matrix material and type of chemical bond is considered for the approximately 230 pairs of observations, spanning the entire Periodic Table, which have been reported. Except for van der Waals molecules and for the Group IV and V halides, the argon-matrix shift for most diatomic molecules is less than 2%.

600.611

Keywords: *Carbon tetrachloride, *Molecular relaxation, Molecular spectroscopy, Reprints. *Methanol /fluoroo-trichloro, Chlorofluorocarbons, Picosecond pulses.

Picosecond infrared pump, spontaneous anti-Stokes Raman probe experiments determined the vibrational relaxation rates of HClV(+1) dilute in liquid CC4 and CC13F at T = 295 K to be 2.1(2) x 10(-11) x 10 to the 8th power /s and 1.5(7) x 10(-11) x 10 to the 8th power /s, respectively. In the present work are interpreted in terms of the isolated binary collision model, the resultant deviate is measured to form an extrapolation of gas phase results.

600.612

Keywords: *Hydrides, Dipole moments, Reprints, *Hydride/silver, *Hydride/gold, Relativistic effective potentials.

Relativistic effective potential (REP) are now widely used in molecular electronic structure calculations. Tests of these REP are needed to assess their accuracy. This can be done for AgH and AuH since Lee and McLain have published Dirac-Fock calculations for these molecules. Comparative SCF calculations have been performed for two types of effective potential. Satisfactory agreement between the effective potential results for spectroscopic constants and dipole moments with the Dirac-Fock values is found which supports the use of these potentials for heavy atom containing molecules.

600.613

Keywords: *Research projects, Molecular spectroscopy, Chemical physics, Molecular structure, Chemical properties.

The report summarizes research projects, measurement method development, testing and data evaluation activities carried out during Fiscal Year 1986 in the NBS Center for Chemical Physics. These activities fall in the areas of surface science, chemical kinetics, chemical thermodynamics and molecular spectroscopy.

600.614

Keywords: *Thermal expansion, *Platinum, Thermodynamic properties, *Platinumodium alloys.

The paper contains descriptions of the construction and use over the temperature range -270C to 750C of a Metal-Saunders (optical interferometric) linear thermal expansion apparatus. Measurements of thermal expansion are reported for platinum and for two platinum-rhodium alloys (nominally 12 wt% Rh and 20 wt% Rh). Detailed analyses are given of the measurement uncertainties involved in the experiment and of the representation of the data by polynomials in the same temperatures. The data show precision at the 1-ppm level and good agreement with results already published.

600.615

Keywords: *Liquid phases, Mathematical models, Vortex motion, Two-phase separation process, Vapor phases, Computer applications.

A computer program aimed at the phase separation between gas and liquid at zero gravity, induced by vortex motion, is developed. It utilizes an explicit solution method for a set of equations describing rotating gas-liquid flows. The vortex motion is established by a tangential fluid injection. A. Lax-Wendroff two-step MacCormack's numerical scheme is used. The program can be used to study the fluid dynamic behavior of the rotational two-phase fluids in a cylindrical tank. It is done for a sensitivity test on various parameters and thus provides the guidance for the design and use of actual physical systems for handling two-phase fluids.

600.616
PB87-145066 PC A05/AF A01 National Bureau of Standards (NBS), Boulder, CO. Thermodynamics Div.
CHEMISTRY

Physical & Theoretical Chemistry

Data for the viscosity and thermal conductivity of gaseous and liquid argon have been evaluated and represented by empirical functions. Tables for the viscosity from 85 to 500 K for pressures to 200 MPa are presented. For the viscosity, uncertainties are at 1% or better for pressures below 100 MPa, and 3% for higher pressures are assumed. For the thermal conductivity the uncertainties are 4% for temperatures below 300 K and 3% for temperatures above 400 K. The enhancement in the conductivity close to the critical point has been accounted for. The status of the argon data and the philosophy of fitting them are reviewed.

600.622
PB87-148348
Not available NTIS Massachusetts Inst. of Tech., Cambridge, Dept. of Chemistry
Standard Chemical Thermodynamic Properties of Alkylene Isomer Groups,
R. A. Alberty, and E. Burmenko. c1986, 12p
Sponsored by National Bureau of Standards, Gaithersburg, MD.

Keywords: Thermodynamic properties, Alkylene compounds, Entropy, Gibbs free energy, Specific heat.

The chemical thermodynamic properties of alkylene isomer groups from C2H2 to CsH6 in the ideal gas phase have been calculated from the ideal gas state to 298.15 to 1000 K. The results of the isomers of C6H10 to C8H14 have been estimated using Benson group values. Equilibrium mole fractions within isomer groups have been calculated for the ideal gas state to 298.15 to 1000 K. For isomer group properties, increments per carbon atom have been calculated to show the extent to which thermodynamic properties of higher isomer groups may be obtained by linear extrapolation. Values of C(sub s) f,G(sub s) h, deltaf(sub s) H, and deltaf(sub s) G are given for all species from C2H2 to C9H14 in S1 units for a standard state pressure of 1 bar.

600.623
PB87-148350
Not available NTIS Los Alamos National Lab, NM.
Recent Progress in Deuterium Triple-Point Measurements,
L. A. Hanley. c1986, 6p
Sponsored by National Bureau of Standards, Gaithersburg, MD.

Keywords: Deuterium, Hydrogen isotopes, Triple point.

The triple point of deuterium is a proposed reference for defining the temperature scale between 13.81 and 24.562 K. The author reviewed recent measurements of this fixed point; the discussion concentrates on experiments with samples confined in transportable sealed cells. The authors also present theoretical estimates of the dependence of the triple-point temperature. The spin composition of the sample. Satisfactory agreement is obtained with experimental data at deuterium at low concentrations of the para (1unit plus 1) species. Present results support the adoption of the triple point of e-D(sub s) 2 as a standard temperature reference.

600.624
PB87-148375
Not available NTIS Texas A and M Univ., College Station. Thermodynamics of Atomic Compounds.
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v15 n4 p1369-1436 1986. Available from Ameri-
**Chemistry**

**Physical & Theoretical Chemistry**

can Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Thermodynamic properties, Oxygen organic compounds, Specific heat, Enthalpy, Ideal gases.*

The ideal gas thermodynamic properties of forty-four key organic oxygen compounds in the carbon range C1 to C4 have been calculated by a statistical mechanical technique. The heat capacity, entropy, enthalpy, and Gibbs energy function. The calculations have been performed, in most cases, for temperature ranges 0 to 1500 K and at 1 bar. The contributions to the thermodynamic properties of compounds having internal-or-pseudo-rotations have been made using the polyv Vinyl (PVE) over a large range of molecular weights. The influence of polymer chain length is investigated by using a variety of PS's and PVE's having molecular weights ranging from 20,400 to 1660000 and from 45,000 to 1330,000, respectively. Fluorescence measurements are shown to be suitable for the case of the largest molecular weights, for which the phase separation process develops very rapidly. Particular attention is paid to a series of blends in which the molecular weight of one component is kept constant, whereas that of its sub wj(i), of the other one varies.

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### Polymer Chemistry

**600.602**

**PB86-193539**

Not available NTIS National Bureau of Standards, Gaithersburg, MD. Polymers Div.

Polymeric Electrolytes Based on Poly(ethylene imine) and Lithium Salts.


Keywords: *Battery, Conductivity, Ionic conduction, Lithium salts, Electrolys, Polymers, Reprints, Polyethylene imine.*

The dissolution of lithium salts in linear poly(ethylene imine) has been investigated because of its possible role as a solid electrolyte in lithium batteries. Lithium salts included in the study were LiF, LiCl, LiBr, LiI, LiSCN, LiClO4 and LiBF4. When cast from solution in a common solvent, a uniform mixture is obtained through which the ions can be characterized by studying a loss in crystallinity of the polymer and an increase in the glass transition temperature. At concentrations of salt below 10 mole percent, the polymer can slowly recrystallize at room temperature but at higher concentrations, the matrix remains amorphous for an indefinite period of time. DC conductivity at room temperature is about 1 times 10 to the 8th power S/cm but increases to 0.0001 S/cm at 150 C.

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### Chemistry

**600.630**

**PB86-193512**


Laser Ionization Mass Spectrometry of Poly(4-vinylpyridine).


Keywords: Mass spectrosopy, Reprints, *Laser enhanced ionization, Poly(ethylene/vinylpyridyl).*

Commercial poly(4-vinylpyridine) (PVP) solid beads have been investigated by laser ionization mass spectrometry using a Laser Microprobe Mass Analyzer (LAMMA 500). The objective was to structurally characterize the fragment ion patterns of both the positive and negative ion mass spectra. Main emphasis is placed on PVP 2% crosslinked with divinylbenzene, but comparison with non-crosslinked PVP and 25% crosslinked samples, as well as HCl treated 2% crosslinked PVP are reported.

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### Chemistry

**600.631**

**PB86-193737**

Not available NTIS National Bureau of Standards, Gaithersburg, MD. Polymers Div.

Chemical Modification of Pol(ethylene imine) for Polyelectrolyte.


Keywords: Iodine conduction, Electrolys, Reprints, Conductivity, *Cross linking.*

Linear PEI has been chemically modified in an attempt to prevent formation of a crystalline complex without losing the ability to dissolve salts and conduct ions. Three main systems were investigated: (a) poly(N-acetyl-ethylene imine), (b) partially quaternized PEI with ethyl or butyl groups, and (c) PEI crosslinked with dipyoxocane. Dissolution of salt was followed by x-ray diffraction on the mixtures and changes in Tg as determined by DSC. In all cases, the crystallinity was destroyed but conductivity of salt-containing polymer was not improved. However, lightly cross-linked PEI exhibited its much improved mechanical properties and the incorporation of .05 mole Na/mole of monomer yields a conductivity of 5 times 10 to the 5th power S/cm at 100 C.

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### Chemistry

**600.632**

**PB86-195448**

Not available NTIS National Bureau of Standards, Gaithersburg, MD. Polymers Div.

Small-Angle Neutron Scattering of Partially Segregated Amphiphilic Polyethylene Terephthalate.


Keywords: *Polyethylene terephthalate, Deuterium compounds, Neutron scattering, Reprints, Small angle scattering, Polymers.*

Deuterated polyethylene terephthalate (PET) was synthesized from deuterated ethylene glycol and deuterated dimethyl terephthalate which was derived from 1,4-dibromobenzene. Amorphous specimens for the small angle neutron scattering (SANS) were prepared by solution blending the PET with the hydrogenated- PET and subsequently melt pressing. The SANS results suggested the occurrence of both segregation and transesterification between the deuterated and hydrogenated species. An expression for the scattered intensities from partially segregated blends has been derived. Using this expression the average molecular weight, concentration and width of both the segregation domains can be determined quantitatively from the SANS data.

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### Chemistry

**600.627**

**PB86-192788**

Not available NTIS National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

**Molecular Weight Effects on the Phase Diagram of Polystyrene-Poly(vinyl methyl ether) Blends.**


Keywords: *Molecular weight, Polystyrene, Polyvinyl methyl ether, Phase diagrams, Vinyl ether reains, Reprints.*

Fluorescence emission of labeled polystyrene is employed to reexamine the lower critical solution temperature phase diagram of the system polystyrene (PS)-poly(vinyl methyl ether) (PVME) over a large range of molecular weights. The influence of polymer chain length is investigated by using a variety of PS's and PVME's having molecular weights ranging from 20,400 to 1660000 and from 45,000 to 1330,000, respectively. Fluorescence measurements are shown to be suitable for the case of the largest molecular weights, for which the phase separation process develops very rapidly. Particular attention is paid to a series of blends in which the molecular weight of one component is kept constant, whereas that of its sub wj(i), of the other one varies.
Polyester and Polyamide Synthesis: A Comprehensive Review

Abstract

This paper presents a comprehensive review of the synthesis and properties of polyesters and polyamides, emphasizing recent advances and emerging trends in the field. The review covers the fundamental aspects of polyester and polyamide chemistry, including monomer selection, polymerization methods, and the impact of synthesis conditions on polymer structure and properties. The discussion also highlights the role of polyester and polyamide materials in various applications, such as plastics, fibers, and coatings.

Key topics covered include:

1. Monomer Selection
   - Alcohols and acids
   - Bio-based monomers

2. Polymerization Methods
   - Solution polymerization
   - Emulsion polymerization
   - Interfacial polymerization

3. Chain Extension
   - Homopolymerization
   - Copolymerization

4. Properties and Applications
   - Thermal properties
   - Mechanical properties
   - Environmental stability

5. Emerging Trends
   - Sustainable synthesis
   - Nanoparticle technologies

The review concludes with an outlook on future directions in polyester and polyamide research and development.

References


Acknowledgments

This work was supported by the National Science Foundation under Grant number 2012345. The authors would like to thank Dr. Lee for valuable discussions and Dr. Kim for providing figures. Any opinions, findings, and conclusions expressed in this review are those of the authors and do not necessarily reflect the views of the National Science Foundation.

Keywords: polyester, polyamide, synthesis, properties, applications

General

POLYMER CHEMISTRY

Polymer Chemistry

Bis-(1-pyrene)alkanes: A Novel Spin-Labeling Method

In this section, we explore the use of bis-(1-pyrene)alkanes as spin-labeling agents in polymer chemistry. These molecules are known for their unique optical properties, which can be utilized for the characterization of polymer structures and dynamics. The recent advancements in the synthesis and application of bis-(1-pyrene)alkanes have opened new avenues for understanding polymer behavior at the molecular level.

Key topics covered include:

1. Synthesis of Bis-(1-pyrene)alkanes
   - Chemical synthesis
   - Synthetic strategies

2. Optical Properties
   - Fluorescence
   - Absorption

3. Spin-Labelling Applications
   - Polymer characterization
   - Dynamics at interfaces

4. Emerging Applications
   - Drug delivery
   - Materials science

This section highlights the significance of bis-(1-pyrene)alkanes in polymer chemistry and underscores the potential for future research in this area.

References


Acknowledgments

This work was supported by the National Science Foundation under Grant number 2012345. The authors would like to thank Dr. Lee for valuable discussions and Dr. Kim for providing figures. Any opinions, findings, and conclusions expressed in this review are those of the authors and do not necessarily reflect the views of the National Science Foundation.

Keywords: bis-(1-pyrene)alkanes, spin-labeling, polymer characterization


CHEMISTRY
CHEMISTRY

General

and the procedure recommended for their use are described.

600.643
PB86-227592  PC A08/MF A01
National Bureau of Standards, Gaithersburg, MD.

Keywords: "Catalogs/Publications", Standards, "Standard reference materials."

The catalog describes the Standard Reference Materials (SRM's) currently available from the National Bureau of Standards (NBS), lists those in preparation, and provides ordering information. The descriptions provide nominal values for these SRM's. Certified values are provided in the certificates that accompany each SRM. Price Lists for SRM's are issued as separate supplements to the catalog and include new SRM's as they are issued.

600.644
PB87-100186  PC A08/MF A01
National Bureau of Standards, Gaithersburg, MD.
See also PB87-100194 through PB87-100244 and PB86-206364. Also available from Supt. of Docs as SN003-003-0010-5.

Keywords: *Research, Chemical analysis, Heat measurement, Chemical reactions, Thermal analysis, Enthalpy, Electric switches, Temperature control, Carbon, Oils, Metals, Plastic pipe. Also available from Supt. of Docs as SN003-003-0010-5.

Table of contents includes: High precision microlitermeters. Apparatus, procedures, and biochemical applications, Standards development for differential scanning calorimetry, Miniature mercury contact switches for instrument temperature control, Thermophysical property measurement on chemically reacting systems—a case study, Inorganic materials biotechnology: A new industrial measurement challenge; Improvements in the application of the numerical method of characteristics to predict attenuation in unsteady partially filled pipe flow.

600.645
PB87-100210  (Order as PB87-100186, PC A08/MF A01)

Keywords: "Electric switches, "Mercury, Temperature control, Temperature measuring instrument."

In this short note the authors described the design and construction of several modifications of miniature mercury contact switches for use in laboratory temperature control applications. Commercial contact switches, or contact thermometers as they are commonly called, are limited in their application because of their large size. The units which we present here are much more compact and are thus suitable for a wider range of applications. The limitations of the miniature contact switch in their present configurations are also discussed.

600.646
PB87-128179  Not available NTIS


Keywords: "Calorimeters, "Convection, Ionizing radiation, Water, Thermistor, Reprints."

Schulz and Weinhold (Phys. Med. Biol., 1985 30, 1093-1099) detected convection currents in a water calorimeter irradiated with broad horizontal beams of & subtractive rays and 19-MeV electrons. The region of particular interest is near the beam entrance wall. Considering their recorded results, the broad beams and large electrical powers dissipated in the sense thermistor, and calculations which approximately describe the convective velocity stream, it is hypothesized that the observed convective effects could have been caused by convective cooling of the sensors.

600.647
PB87-137154  PC A04/MF A01
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 91, Number 6, November-December 1986. Dec 86. 187p
See also PB87-137162 through PB87-137188, and PB87-121315. Also available from Supt. of Docs as SN003-003-0010-5.

Keywords: *Research, Chemical analysis, Gases, Gallium, Atomic mass, Thermal expansion, Platinum, Temperature dependence, Isotrope ratio, Reference materials, Platinum-hodium alloys, Temperature measurement.

The report includes the following papers: The temperature dependence of spectral broadening in the Hg (6p) singlet S(0) - 6 triplet P(1) Multiplet at high optical densities; Absolute isotopic abundance ratio and atomic weight of a reference sample of gallium; Thermal expansion of platinum and platinum-hodium alloys.

CIVIL ENGINEERING

Civil Engineering

600.648
PB86-192473  Not available NTIS


Keywords: "Thermal conductivity, "Soils, "Civil engineering, "Plasticity, Cost analysis, "Atterberg limits, Moisture contents, Heat transfer, Soil tests, Reprints."

Information on the thermal properties of soils from different disciplines of science and engineering is compiled and consolidated for the purpose of identifying low cost, simple procedures for assessing the variation of the thermal resistivity of soils with changes in moisture content. Three procedures for determination of the critical moisture content are presented. The critical moisture content is the moisture content at the thernal resistivity versus moisture content curve.

600.649
PB86-138393  Not available NTIS

Keywords: "Soil compacting, "Civil engineering, "Thermal conductivity, "Atterberg limits, Bearing capacity, Moisture content, Optimization, Plasticity, Reprints, AASHO standards.

Laboratory thermal probe tests performed on an AASHO standard reference material (a silt clay) showed that thermal resistivity (C/cm/watt) varies with soil moisture content and dry density. The tests were performed to correlate soil thermal behavior with the limit states of fine-grained soils. Over 80 thermal resistivity measurements were made on specimens compacted to various densities and moisture contents. Re solid results are presented which indicate that the optimum moisture content and the plastic limit can be correlated with the thermal behavior of fine-grained soils.

600.650
PB86-230976  Not available NTIS
National Bureau of Standards (NLS), Gaithersburg, MD. Center for Building Technology.


Keywords: "Buildings, "Construction industry, Productivity, Technology assessment.

Provides comments and observations for the OTA Panel on Technology Changes and Impacts on the Building Construction Industries. It addresses needs for improving the application of computers to construction and particularly the need for interface standards. Arguments are made for advances in education of construction professionals and the opportunity for re search to improve productivity. Other research needs discussed are indoor air quality and diagnostics.

Construction Equipment, Materials, & Supplies

600.651
PB86-160090  Not available NTIS

Content in the 1980s: Challenges and Opportunities.


Keywords: "Cements, Utilization, Performance standards, Forecasting, Standards, Reprints."

Despite large gaps in knowledge of cement science, cement and concrete are the preferred materials for long-term engineering construction. As the gaps are filled, cement and concrete should become even more valuable construction materials. The gaps stem in large part from the inability to characterize cements and their hydration products in unambiguous terms. For many reasons, there have been significant barriers to progress in research. The barriers have resulted in a fragmented research efforts among groups with less than adequate mixes of skills. Nevertheless, the authors believe there will be a revolution in cement technology based on an integration of research efforts through cooperation on national and international levels.

600.652
PB86-192135  Not available NTIS

Shear Resistance of Unreinforced Hollow Concrete Block Masonry Walls.


Keywords: "Concrete blocks, Masonry, Shear strength.

An experimental investigation is described which has as its primary focus the determination of shear resistance exhibited by unreinforced, ungrouted, hollow concrete block masonry walls. Thirty-two wall panel tests are reported. The parameters in the investigation include the amount of applied vertical compressive stress, wall aspect-ratio, block strength and mortar type.
An investigation was conducted to determine the extent of corrosion of an aluminum standing-seam roof system exposed to weathering over a period of nearly three years. The aluminum roofing was installed on three large warehouses at an Army facility in Columbus, Ohio. A high performance elastomeric sealant was used in forming the standing seams of the roofing system. The roof slope, about 5 percent, was less than that usually recommended for unsoldered standing-seam roofing. The roofs were located in a region having a high level of acid rain.

Highway Engineering

The report describes a two phase study directed at developing a portable system for measuring the corrosion of steel in concrete bridge decks. A small, portable computer system is used to control the measurement of polarization resistance of steel in concrete, and using current interruption, iR compensation is accomplished. During the development stage, measurements were made on small specimens in a laboratory controlled environment, and the results of the calculated weight loss measurements based on the electrochemical measurement are compared to gravimetrically determined weight loss. In the second phase, the portable system was used to measure the corrosion of three bridge decks in Frederick County, Maryland, over a four month period. The results of these field measurements and the problems encountered are discussed.

Soil & Rock Mechanics

Prepared in cooperation with Korea Inst. of Science and Technology, Seoul.

The report covers a study to determine whether the ratio of the torque required to extract the Helical Test Probe to the torque required to advance the probe (the reverse torque ratio) can be used to determine the average grain size of the soil. On the basis of 274 test points in sandy, silty, and clayey soils, it was concluded that the reverse torque ratio decreases with increasing average grain size. The relation between grain size and reverse torque ratio is apparently not sensitive to the magnitude of the torque required to advance the probe.
600.666
PB86-171098
PC A04/MF A01
Case Western Reserve Univ., Cleveland, OH. Dept. of Mechanical and Aerospace Engineering.

Diffusion Flame Stabilization at the Leading Edge of a Fuel Plate.
Sponsored by National Bureau of Standards (NBS), Gaithersburg, MD. Center for Fire Research.

Keywords: Combustion, Diffusion flames, Computer programs, Stability, Computerized simulation.

A theoretical model of a laminar diffusion flame at the leading edge of a fuel plate in a forced convective flow is presented and solved numerically to study the flame stabilization and blowoff phenomena. The system of governing equations consists of the two-dimensional Navier-Stokes' momentum, energy and species equations with a one-step overall chemical reaction and second-order, finite rate Arrhenius kinetics. The computation is performed over a wide range of Damkohler numbers. For large Damkohler numbers, envelope flames are found to exist where the computed heat and vaporization rates are comparable with those obtained from detailed calculations for similar flames.

Keywords: Combustion, Diffusion flames, Computer programs, Stability, Computerized simulation.
COMBUSTION, ENGINES, & PROPULLENTS

Combustion & Ignition

600.672 PB86-204617 PC A06/MF A01 Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering. National Center for Atmospheric Research. Structure of Adiabatic Wall Plumes. M. C. Lai, and G. M. Faeth. Nov 85, 106p NBS/GCR-85/503. Grant NANB-4D0002 Sponged by National Standards of (NLS), Gaithersburg, MD, Center for Fire Research. Keywords: *Plumes, Turbulence, Buoyancy, Velocity measurement, wall flows, Cross-correlation. A theoretical and experimental study of turbulent buoyant plumes along plane surfaces is described. These flows are of interest since their hydrodynamic properties are similar to those of wall fires and can be studied without complications due to combustion and radiation. Wall plumes were generated by carbon dioxide/air mixtures flowing from a slot at the top of the wall (since the flows were negatively buoyant). The following measurements were made: mean and fluctuating velocities and Reynolds stresses, using laser Doppler anemometry (LDA); mean and fluctuating concentrations, using laser-induced fluorescence (LIF); and velocity/temperature correlations, using combined LDA/LIF. The flows were also analyzed using a mixing-length model and a k-epsilon-v turbulence model (both ignoring buoyancy/turbulence interactions). Buoyancy/turbulence interactions were significant in the present flows; therefore while predictions of mean properties were, overall, good, turbulence quantities were underestimated.

600.673 PB85-215159 PC A03/MF A01 National Bureau of Standards (NLS), Gaithersburg, MD, Center for Fire Research. Buoyancy as the Flowing Force of Smoke Transport Models. Final rept., W. W. Jones, and J. Bodart. May 86, 27p NBSIR-86-3329. Keywords: *Smoke, Flow distribution, Buoyancy, Numerical analysis, *Fire models. Flow at vents is the major driving force in smoke transport models. The precision with which we can calculate these flows determines to a great extent how accurately we can model buoyant flow and the inherent speed of the models. This report describes some of the problems encountered in calculating these flows, and gives a general algorithm for their calculation.


Keywords: *Buoyancy, *Plumes, *Flames, *Layers, Heat transfer, Turbulence,Smoke. A point source of buoyancy is located at a specified elevation within the lower of two, homogeneous, stably stratified layers. A turbulent buoyant plume is formed above the source and interacts with the layers interface. Derives and solves a set of model equations for these plume-interface interactions, and the results are applied to generic heat transfer problem related to fires in enclosed spaces.


600.676 PB87-110029 Not available NTIS National Bureau of Standards (NLS), Boulder, CO, Chemical Engineering Science Div. Ignition and Combustion Temperatures Determined by Laser Heating. Final rept., J. W. Branford. 1985, 20p Contract NASA-H-43201(B). Sponsored by National Aeronautics and Space Administration, Huntsville, AL. George C. Marshall Space Flight Center. The report describes the development of an automated probe device designed to measure extensive measurements of temperatures at a large number of positions within a laboratory-scale fire-flow experimental apparatus. The device is designed to operate within a 1.2 m diameter cylindrical enclosure. The apparatus has horizontal, vertical, and rotational motion capabilities. A single microphone is used to control probe positioning, perform data-taking, and evaluate statistical results. These statistical results are used by the system to determine the number of data points to record at a given position.

600.670 PB87-110029 Not available NTIS National Bureau of Standards (NLS), Gaithersburg, MD, Chemical Kinetics Div. Chemical Kinetic Data Base for Combustion Chemistry, Part 1, Methane and Related Compounds, W. Tsang, and R. F. Hampson. c1986, 195p. Included in Jnl of Physical and Chemical Measurements Data, v15 n3 p1087-1289 1986. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036. Keywords: *Methane, *Combustion, Chemical reactions, Thermodynamic properties, Oxidation, Pyrolysis, Transport properties, Aromatic hydrocarbons, Aliphatic hydrocarbons, Chemical reaction kinetics. The document contains evaluated data on the kinetics and thermodynamic properties of species that are of importance in methane pyrolysis and combustion. Specifically, the subsets are: reagents include H, H2, O, O2, OH, H2O, H2O2, H2, CH4, C2H6, CH2O, CO2, CO, HCO, CH3, C2H5, CH4, C2H3, CH2OH, CH2O, CH2O2; products include H2O, CH4, C2H2, CO2, CO, C2H2. All possible reactions are considered. In arriving at recommended values, first preference is given to experimental measurements; data now do not exist, a best possible estimate is given, in making extrapolations, extensive use is made of RRKM calculations for the pressure dependence of unimolecular processes and the BERGE model for hydrogen transfer reactions. In the total absence of data, recourse is made to the principle of detailed balancing, thermokinetic estimates, or comparison with analogous reactions. The temperature range covered is 300-2500 K and the density range 1 x 10 to 10 -16 to 1 x 10 to 21 the 4th power of the MCC. This data base forms a subset of the chemical kinetic data base for all combustion chemistry processes.

600.677 PB87-123196 (Order as PB87-123195, PC A04/MF A01) National Bureau of Standards, Gaithersburg, MD. Multi-kilogram Capacity Calorimeter for Heterogeneous Materials. K. L. Chung, A. E. Ledford, M. L. Reilly, and E. S. Domalski. 24 Apr 86, 22p Included in Jnl. of Research of the National Bureau of Standards, v41 n5 p377-378 Sep-Oct 86. Keywords: *Enthalpy, *Combustion, *Calorimeters, Thermodynamic properties, *Solid wastes. A large capacity calorimeter was designed and constructed in order to determine the enthalpies of combustion of kilogram-size samples of municipal solid waste (MSW) in flowing oxygen near atmospheric pressure. The combustion of the organic fraction of the samples was complete to greater than 99.9 %. The power coefficient of variation (100 X standard deviation/average), % CV, of calorimetry measurements using microcrystalline cellulose was 0.2%. The % CV of the measurements of the enthalpy of combustion of a processed MSW sample was 0.4%. The combined systematic errors due to departure from usual design standards and conventional operating procedures is estimated to be less than 0.4 % of the calorific value.


Keywords: *Ignition, *Combustion, Aluminum alloys, Nickel steels, Stainless steels, Reprints, Laser-radiation heating, Steel $9300/0, Nickel alloy N7/11, Nickel alloy N6/4400, Aluminum alloy A38601.

A laser heating technique and facility have been developed to study metal ignition and combustion in high-pressure oxygen. The ignition and combustion temperature, estimates of oxidation rates, and ignition and combustion mechanisms are presented for a variety of metal alloys. The facility and the laser heating techniques are described. Examples of the type of data obtained are presented and discussed. The ignition temperature of a nickel aluminum alloy-Unified Numbering System (UNS) A96001, a stainless steel-UNS S330/02, and two nickel alloys-UNS N07718 and N04400 are given.


The principles of tomography, or multiplanar measurements, have only recently been implemented using
Combustion & Ignition

visible light. Tomographic absorption measurements, in particular, have a number of advantages over optical point measurement techniques. In addition to the evident potential for rapid two or three dimensional imaging with limited measurement time, the technique is also attractive in terms of the signal to noise ratio, due to multiple measurements of any single spatial point. These benefits have led to the development of high speed optical tomography systems is presented, demonstrating the capability to measure the temporal evolution of temperature and OH concentration in a premixed methane flame within five milliseconds.

600.687  PB87-140190  PC A04/MF A01
California Univ., Berkeley. Dept. of Mechanical Engineering.

A. C. Fernandez-Pello. Nov 86, 66p NBS/GCR-86/518
Contract NBS-NADA-04020
See also PB86-181849. Sponsored by National Bureau of Standards (NBL), Gaithersburg, MD. Center for Fire Research.


A research program is being carried out to study the mechanisms controlling the spread of fire in a concurrent regime of flames. A brief treatment shows the numerical analysis of the flow assisted spread of flames over the surface of a thermally thick fuel, an experimental study of the extinction and stabilization of a diffusion flame over a flat combustible surface, and a theoretical study of the forced ignition of a vaporizing combustible. The flow assisted flame spread analysis incorporates finite rate kinetics in the formulation of the problem. This provides a more accurate description of the reactions with slow chemistry such as the upstream leading edge of the flame and the flame tip. The flame extinction experiments compliment a previously developed program to study the extinction of the problem. The study adds the processes controlling the structure and stabilization of the upstream leading edge of the flame. The ignition study as far as objective the description of the ignition by a hot particle (firebrand), or by gas absorption of radiation, of a vaporizing surface in a convective flow. During this period, a one-dimensional model of ignition has been developed.

600.683  PB87-140240  PC A04/MF A01
Factory Mutual Research Corp., Norwood, MA.
Sponsored by National Bureau of Standards (NBL), Gaithersburg, MD. Center for Fire Research.


Combustion behavior of 82 aliphatic and aromatic hydrocarbons and related polymers has been examined for application to fire models. Quantitative predictions have been made for the following fire properties: combustion efficiency and its convective and radiative components, fraction of un consumed hydrocarbon and polymer vapors present as hydrocarbons; and generation efficiencies of CO2, CO, particulates and smoke of different carbon compounds.

600.684  PB87-140257  PC A03/MF A01
National Bureau of Standards (NBL), Gaithersburg, MD. Center for Fire Research.

Time-Dependent Simulation of Small-Scale Turbulent Mixtures. Final report.
Contract AFOSR-ISA-85-0026
Sponsored by Air Force Office of Scientific Research, Boeing, WA. DC.


Rocket Engines & Motors

600.685  PB87-134342  PC A05/MF A01

Vortex Shedding Flow Meter Performance at High Flow Velocities.
J. P. Siegel. Oct 86, 97p NBS/TN-1302
Also available from Supt. of Docs. as SN003-003-0277-4. Sponsored by National Aeronautics and Space Administration, Huntsville, AL. George C. Marshall Space Flight Center.


In some of the ducts of the space shuttle main engines (SSME), the maximum liquid oxygen flow velocities approach 10 times those at which liquid flow measurements are normally made. The hydrogen gas flow velocities in other ducts exceed the maximum for gas flow measurement by more than a factor of 3. The results presented here show from water flow tests that vortex shedding flow meters of the appropriate design can measure water flow to velocities in excess of 55 m/s, which is a Reynolds number of about 2 million. Air flow tests with a pitot tube and meter can measure flow to a Reynolds number of at least 22 million. Vortex shedding meters were installed in two of the SSME ducts tested with water flow. Narrow spectrums were obtained and the meter output frequencies were proportional to flow plus 0.5% or better over the entire range with no hysteresis. These results, even though the ducts had multiple bends preceding the meter location. On the ducts with the shedding elements added to the ducts, the size and shape of the inlets with those who can create shedding elements were also tested.

Communication

600.686  PB86-196391  PC A04/MF A01
National Bureau of Standards (NBL), Gaithersburg, MD. Law Enforcement Standards Lab.

Prepared in cooperation with National Telecommunications and Information Administration. Sponsored by National Inst. of Justice, Washington, DC.

Keywords: *Compass transmission. *Amplitude modulation. *Single sideband transmission. *Land mobile radio.

Amplitude compressed sideband (ACSB) has been proposed as a useful technique for the land mobile communications needed by law enforcement agencies. These users have certain requirements that their current analog systems do not meet for them to be effective; one of these requirements is for adequate speech intelligibility under a variety of conditions. This report describes the basic principles of operation and those technical aspects of ACSB that may affect speech quality, and then proposes a measurement method to determine whether performance measures are appropriate to characterize the aspect of ACSB performance. It is assumed that the intelligibility of a code system operating at the condition of 12 dB SINAD represents a reference level of intelligibility. The measurement program will attempt to determine, using the proposed measurement method, the values of the chosen performance measures for ACSB that correspond to the reference level of intelligibility.

600.687  PB86-197209  PC A03/MF A01
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.

Electronic Bulletin Boards.
T. Landberg. Apr 86, 38p NBSIR-86/3356

Keywords: *Information systems. *Computer applications. *Electronic message systems.

Many organizations have established electronic bulletin boards to distribute information products electronically. For organizations that need to rapidly distribute press releases, product information, provide customer support or transfer data to a geographically dispersed constituency, electronic bulletin boards are proving to be an effective medium. Building board software is a highly specialized application designed to accomplish a rather limited function of peer to peer communication. Each feature of a bulletin board has been developed to accomplish a different aspect of peer to peer communication. These features include sending and receiving messages, selecting a user's frame sending with the system operator. However, bulletin board systems can not search a textual data base by keyword, initiate other computer jobs or create and edit new data files.

600.688  PB86-230305  PC A03/MF A01
National Bureau of Standards, Gaithersburg, MD. Center for Computer Systems Engineering.

GRIDNET: A Highly Available Digital Communications Network for the National Airspace System.
A. Mink, G. G. Nacht, A. L. Koenig, and A. W. Holt. Apr 86, 33p NBSIR-86/3361
Sponsored by Defense Nuclear Agency, Washington, DC.


GRIDNET is a highly reliable and survivable packet switched, wide area communication network that may consist of thousands of nodes and may span thousands of miles. The reliability of GRIDNET is based on redundant transmission of data via two distinct paths and bitwise comparison of the duplicate received data in addition to error detection codes. The survivability of GRIDNET is based on the selection of the phases which provides for a number of alternative paths between pairs of nodes. A feasibility prototype of a GRIDNET was proposed as a multi-phase research project. The report describes the design of the phase I GRIDNET prototype which was constructed. This prototype satisfies most of the Phase I operational performance objectives.

600.689  PB87-105185  Not available in NTIS

Optical Fiber Power Meters: A Round Robin Test of Units.

The proliferation of optical fiber systems has spawned a variety of optical power meters. These meters are important to the analysis and maintenance of fiber communication systems. One obvious attendant concern is with the uncertainty of the meter readings. In the paper, authors give the results of five interlaboratory test conducted to circumscribe and define the extent of the problem. The test yielded 46 data points from 11 participants collected over a period of about 9 months. The results indicate that the variance in power meter readings taken in different laboratories is reasonably large. The variance improved when measurements taken with very small detectors were made directly from the data base. This suggests that errors are being made in the collection of power in typical laboratory environments.

**Keywords:** Fiber optics, Power meters, Optical fiber systems, Interlaboratory test, Uncertainty, Power meter readings.

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**References:**

ensure that interface parties can reliably inter- change data files between information processing systems. This standard incorporates by reference (with qualifications as noted) the technical specifications of ISO 5654/2.


Keywords: Electric drives, Data processing equipment, Flexible disks, Federal information processing standards, Cartridges.


Keywords: Electric drives, Data processing equipment, Flexible disks, Federal information processing standards, Cartridges.


Keywords: Electric drives, Data processing equipment, Flexible disks, Federal information processing standards, Cartridges.


Keywords: Electric drives, Data processing equipment, Flexible disks, Federal information processing standards, Cartridges.


Keywords: Data converters, Digital to analog converters, Mathematical models, Tests.

Methods for generating efficient testing strategies for data converters are presented. Linear modeling techniques based on circuit analysis and empirical test data are included, as well as algorithms for selecting optimal test points. Using these tools, converter errors can be accurately estimated for all code states from a relatively small number of measurements.


Keywords: Systems management, Reliability, Guide lines, Computer systems design, Computer program reliability.

The paper is an abbreviated version of a NBS publication of the same name and is part of the Computer Systems Selection and Evaluation Program within the Bureau’s Institute for Computer Sciences and Technology. It is intended to assist the system manager in acquiring a basic understanding of computer system reliability concepts, techniques, and controls.


Keywords: Bench marks, Measurement, Workshops, Laboratories, Universities, Industries, National government, Parallel computers, Computer performance evaluation, National Bureau of Standards.

The Systems Components Division of the Institute for Computer Sciences and Technology at the National Bureau of Standards is actively engaged in the development of techniques to evaluate the performance of parallel computers. As a preliminary step, a workshop on performance evaluation was held in Gaithersburg, Maryland on June 5th and 6th, 1985. The goal of the workshop was to define the issues and problems involved in the development of benchmarks for large parallel computers. Thirty-six talks were given by representatives of government, industries, universities and research laboratories. The topics presented ranged from specific measurements of large parallel machines to the philosophical issues concerned with the development of universally applicable benchmarks. The document is a report on the workshop.


Keywords: Life(Durability), Archives, Data processing, Information retrieval, Drives, Servomechanisms, Lasers, Chemical tests, Physical properties, Dynamic tests, Information systems, Optical disks, Computer storage management, Failure(Electronics), National Bureau of Standards.

The Institute for Computer Sciences and Technology at the National Bureau of Standards (NBS/ICT) is embarking on a research program into the life expectancy properties of optical digital data disks (OD3). The paper discusses lifetime concepts in a general sense and some philosophies and objectives which will underlie the NBS/ICT archival program when it is initiated. Whereas the associated OD3 systems including optical disk drives, servos, lasers, and optics are usually replaceable (providing that they do not fall into the one-of-a-kind category), data contents which are lost due to the OD3 media failure may be irretrievable. Therefore, the principal archival lifetime factors to be investigated by NBS are related primarily to the life expectancies of the OD3 media and media structures. The initial program efforts will be towards determining the system independent degradation and failure mechanisms in the media. Subsequently, where possible these static test results will be correlated with the results derived from system level testing and with the system dependent degradation and failure mechanisms of the media.

600,717 Computer Software


Keywords: Man computer interface, Integrated systems, Computer programming, High level languages, Syntax, Microcomputers, Programmers, Editing, User modes, Interactive systems, Syntax directed editors, Pascal programming language.

No abstract available.

600,717 PB86-162047 Not available NTIS National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Network Architecture Div.


At the Institute for Computer Sciences and Technology (ICST), test architecture has been specified for testing, producing, and integrating through seven within the ISO Basic Reference Model for Open Systems Interconnection. The paper describes specific tools within the test architecture which have been developed and refined using a prototype implementation of the NBS Class 4 Transport Protocol. The language which drives the tool provides the mechanisms to edit protocol data units.


Problems associated with protocol test design, semantics and completeness are explored. A linguistics approach utilizing a generative grammar augmented with probability distributions associated with the production rules and random selection is used to produce test sequences for the NBS/ICST implementation of ISO Class 4 Transport Protocol. Advantages and limitations of the methodology are presented.


Keywords: Microcomputers, *Computer software, *Integrated systems, Application programs(Computers), Operating systems(Computers).

Integrated software products combine several applications within a single program and enable information to be shared between the applications. The report defines five approaches to integration: the all-in-one, product specific software integrator, operating environment, and background utility. Each of these approaches is designed to achieve different objectives by emphasizing the power and importance of the features of each approach. Consequently, there is no best approach to software integration. The selection of an approach is dependent upon the requirements, current system configurations, and personal preferences. Selecting an integrated product begins by considering the various approaches to integration and determining which one is most appropriate. Subsequently, the products within the chosen approach are evaluated against a preestablished set of criteria relating to the product design, technical capabilities, and product quality. Careful selection of an integrated product will ensure that the benefits to be gained from its use can be achieved.

600.720 PB86-200344 PC A03/MF A01 National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.


Keywords: Acceptability, Tests, Proving, Planning, Guidelines, *Computer program verification, Validation, User needs.

The document provides guidance in planning and managing acceptance testing of computer software. It emphasizes the need for quantitative acceptance criteria and standardizes test cases and procedures. It provides a checklist of activities to be performed for planning and managing acceptance testing.


Keywords: *Computer networks, Automation, Tests, Reprints, *Open system interconnections, Protocols.

The Institute for Computer Sciences and Technology (ICST) has established a methodology and architecture for testing implementations of standard open systems interconnection protocols. The ICST has also developed a set of automated tools to support the testing of protocols. The document describes the methodology, architecture, and test tools; provides a summary of experience to date; and outlines future plans for testing implementation of standard open system interconnection protocols.


Keywords: Performance, Measurement, *Multicomputers, *Computer performance evaluation.

A wide range of possible measures for multiprocessor computer systems is discussed, along with the realizability of each class of measurement technique and the applicability of the results.


Keywords: Algorithms, Random numbers, Generators, Traffic, Sequencing, Replicates, *Local area networks, *Computer performance evaluation.

Effective testing and performance evaluation of a local area computer network requires the ability to generate artificial traffic. This is turn requires algorithms for generating random number sequences. The article evaluates several random number generation algorithms for generating traffic over NBSNET, a local area computer network at the National Bureau of Standards. The table-based method, using an additive shift method, was selected for comparison from the table, was determined to be a satisfactory method considering NBSNET's constraints, and is being used to generate artificial traffic for continuing local network research experimentation.


Keywords: *Standards, Reprints, *Software engineering, *Computer software.

Software Engineering Project Standards (SEPS) and their importance are presented in the article by looking at standards in general, then progressively narrowing the view to software standards, to software engineering standards, and finally to SEPS. After defining each standard associated with the selection, support, and use of SEPS are examined. A brief overview of existing software engineering standards is presented and trends are discussed.


Keywords: Quality, Requirements, *Software engineering, *Computer program reliability, Software tools, Analysis.

The paper addresses software requirements analysis from a management point of view with the goal of producing a complete, consistent, and unambiguous set. Three type of analysis are mentioned, static, dynamic and formal, to promote a more systematic approach to requirements analysis. Among the benefits which can be derived from this approach are confidence raising that the requirements are complete and consistent, improving the quality of the software, and promoting reliability.


Keywords: *Search structuring, *Data retrieval, *Addressing, Tables(Data), Searching, Algorithms, Performance, *Memory devices, Computer software, Access time, Real time, Cost.

Hashing is a software realization of content-addressable memory. Average hash retrievals are swift but worst cases, especially failed-lookups, are often unacceptably slow. Yet open-addressing hasing with mild restrictions can limit all searches to two probes: Attractive as this may be, available construction methods have been computation-bound and impractical. A new, fast algorithm can provide an open-addressing hashing scheme in tables in linear time with a size. In describing improved design objectives for the A-tree hash hash tables, increased memory and hashing values, in one or two probes: economical memory construction; good average retrieval; easy cooling; light memory demands.

ware and Applications Conference (7th), COMPSAC 83, Chicago, IL, November 7-11, 1983, p83-84.

Keywords: Management, Guidelines, *Software maintenance, Software engineering.

The paper develops the thesis that a software maintenance manager must not only be a good manager, but also a good manager. It presents an overview of some of the key findings of a National Bureau of Standards' Institute for Computer Sciences and Technology project to investigate and develop guidance on software maintenance.


Keywords: Computer software, *Software maintenance, Software engineering, User needs.

The paper addresses three issues necessary for controlling software change: centralized approval, formal requests, and involvement of the user, management, and maintenance staff in the maintenance change process.


Keywords: *Computer programming, *Binary digits, *Machine coding, Abandonment, Bits, Variables.

In expanding the efficiency and flexibility of variables shared among tasks, it is not uncommon to allow 'read-lock' as a variable flag. Once this accommodation is made, there are three states: unlocked, read-locked, and write-locked. Since both states allow multiple processes to be introduced. 'Abandoned' is then assigned whenever a task owning a write-locked variable terminates abnormally. A problem arises because recovery of abandoned variables can engender problems in writing secure, error-free programs. Addressing this unimportant flag, the approach presented is to use multiple copy flags of abandoned objects (variables) slipping into unlocked status through programming error or oversight.


The explosive push of microcomputers will render many computational services almost free. Accordingly, there exists an excellent opportunity for improving the productivity of programmers, while at the same time enhancing the quality of the programs produced. One component of a microprocessor based software development system is an interactive program constructor-executor similar to, but more powerful than, a BASIC editor-interpreter. Our purpose here is to (i) give a brief survey of characteristics of existing constructor-executor systems; (ii) to discuss a spectrum of useful enhancements to the characteristics of such systems; (iii) to discuss a spectrum of useful enhancements to the characteristics of such systems.


Keywords: *Programming languages, Data processing, Services, *Fourth generation programming languages, *Computer software, Data management, High level languages, On line systems, User needs, Applications programs(Computers).

The Fourth Generation Language (4GL) functional model places 4GL in the context of programming language evolution, and describes the functions provided within the context. A 4GL is a software system that provides integrated functions for developing interactive on-line data processing applications. These functions are defined as: (l) user functions that define those services and capabilities necessary to provide a high level dialogue between the 4GL and the users of the 4GL; (2) data management functions that provide capabilities to describe, store and retrieve, and perform ancillary tasks in the management and safeguarding of application data; and (3) system functions that provide the support services necessary to allow the user of 4GL to define and access applications in relation to the constraints of the 4GL's environment. A typical implementation of 4GL distributes pieces of these functions over various components, such as a DBMS, query language, data dictionary, screen formatter, report generator, and high level procedural language.
Computers, Control & Information Theory

Computer Software

describes the method and standards applied in this study in software acceptance testing. The report also discusses the difficulties encountered during the study and proposes research directions for software accept-
ance testing.

600.738
PB87-109951
PC A04/AF A01
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology. Guide to the Selection and Use of Fourth Genera-
tion Languages.

Special pub. (Final). M. M. Lieberman, ed. 70p NBS/SP-500/143
Also available from Suppt. of Docs as SN003-003-02758-8. Library of Congress card no. 86-600582.

Keywords: "Programming languages, "Fourth Genera-
tion programming languages, "High level languages, End use.

The report provides guidance on the selection process for Fourth Generation Languages (4GLs). It also gives a description of the features, functions and capabilities of 4GLs; and a brief discussion on the use of 4GLs. A ten step selection process is suggested: (1) describing the application environment; (2) deciding on selection approach; (3) selecting the desired features; (4) developing the list of desired 4GL features; (5) rating desired features; (6) selecting each data package; (7) rating 4GLs; (8) analyzing each in detail; and (10) selecting 4GL. Check lists are pro-
duced for screening 4GLs and analyzing the application environment.

600.739
PB87-109949
PC A07/AF A01
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology. Annotated Bibliography on Software Maintenance, W. M. Proctor and R. Haagrock. Sep 86, 142p NBS/5P-500/141
See also PB87-109686. Also available from Suppt. of Docs as SN003-003-02756-1. Library of Congress card no. 86-600579.

Keywords: Bibliographies, Maintenance, Productivity, Errors, Measurement, Technical reports, Periodicals, Software maintenance, Computer software, Software tools, Software configuration management, Software quality control, Life-cycle cost, Cost, User needs.

The annotated bibliography contains summaries of two hundred and eighty-five software maintenance articles or papers from computer science journals, books, proceedings, Federal publications, computer newspapers, and other technical reports. It covers a fifteen year period between 1972 and 1986, and pres-
ents an overview of the various aspects of software maintenance including problems and issues faced in software maintenance environments. It identifies techniques, procedures, methodologies, and tools that have been effectively employed throughout the soft-
ware system lifecycle to improve the quality of that system.

600.740
PB87-109881
PC A03/AF A01
See also PB87-109849. Also available from Suppt. of Docs as SN003-003-02757-0. Library of Congress card no. 86-600581.

Keywords: Organizations, Management, Productivity, Economic analysis, Reusable software, Software engineering, Software quality control, Costs.

With skyrocketing software costs, both Federal and private sector organizations are increasingly interested in finding ways to improve software quality and produc-
tivity, and reduce software risks. Software reuse is one promising approach to reducing the duplication of effort. The report presents a management overview of the prob-
lems and issues related to software reuse. It provides a description of software reusability and its scope. The necessity of technical and management involvement to achieve greater levels of software reuse is empha-
sized.

600.741
PB87-122669
Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.

SETKY-GETKY, Keyed Access System for the NML Computer Software.


Keywords: Data processing, Data files, Data displays, Data bases, Information retrieval, Data storage, Chemistry, Access methods, "HP"1000 computers, "SETKY-GETKY", Data control, output devices, On line systems, User manuals/computer programs, Formats, User needs, Minicomputers.

SETKY-GETKY is a keyed access system written for the HP1000 mini-computer. Its main function is to pro-
vide rapid access to free formatted textual or tabular material stored in large data files. It provides a choice among output devices and some user control over the format of the data display. Three examples are pre-
sented to demonstrate the use of SETKY-GETKY. The first is a simple example of a database of computer users. The second example shows the development of an online help system and user's manual. The last ex-
ample involves the storage and retrieval of tables of chemical thermodynamic functions.

600.742
PB87-140810
PC A06/AF A01
Also available from Suppt. of Docs as SN003-003-02777-1. Library of Congress card no. 86-600593.

Keywords: Evaluation. Guidelines, Computer software, Applications programs (Computers).

The report describes a systematic procedure for identifying and evaluating off-the-shelf software packages, and includes a package selection into the orga-
nizational environment. Its purpose is to enable the layperson to choose and implement software pack-
ages with a minimum of dependence on technical per-
sonnel. The report provides guidance on each phase of the package selection and implementation process.

600.743
PB87-196268
CP T03

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cludes documentation, PB85-233849, PB85-233831 and PB83-175075.

Keywords: Models-simulation, Control simulation, Automation, Emulator, Cyclic tapes, Real time operations, Production plants, Processing control, Automation, Format, Hierarchical control, Control systems, Computer aided design, Computer aided manufacturing, Emulators (Computers), Praxis programming language, VAX-11/780 computers.

The Hierarchical Control System Emulator is a collection of computer programs written in the high-level Praxis language for use on a Digital Equipment Company VAX-780 processor under the VMS operating system. These programs allow the user to write, debug, and concurrently emulate modules of a hierar-
chical control system and to simulate a physical plant which is controlled. The simulation executes in real time and interactive display and data logging ca-
pabilities are currently implemented at the NBS Automated Manufacturing Research Facility as a computer-aided control system.

design tool. The magnetic tape contains a copy of ver-
sion 3.2 of the entire HCSE software package. In addi-
tion, the tape is accompanied by an instruction sheet which describes the procedures for using the HCSE from magnetic tape to a VAX/VMS system. Software Description: The model is written in COFF and includes the programming language for implemen-
tation a Digital VAX-11/780 computer using the VAX/
VMS operating system.

Information Processing Standards

600.744
FPS PUB 104-1
PC A02/AF A01
National Bureau of Standards, Gaithersburg, MD. American National Standard Codes for the Repre-
sentation of Names of Countries, Dependencies, and Areas of Special Sovereignty for Information Interchange. Category: Data Standards and Guideline. Subcategory: Representations and Codes. Federal Information Processing Standards (Final). R. G. Saltman. 12 May 86, 2g

Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: Geography, Standards, Information, Ex-
changing, Data, Dependence, "Federal information processing standards, Nations, Sovereignty, Alphanumeric data, Codes, Information processing.

The Federal Program Standard implements American stan-
dards for the Representation of Names of Countries, Dependencies, and Areas of Special Sovereignty for Information interchange. ANSI Z39.87-1981, the draft standard, defines the entities, names, and codes provided by ISO 3166-1981, Codes for the Representation of Names of Countries, Dependen-
cies, and Areas of Special Sovereignty for Standardization (ISO). The qualifications provide for coverage of the total land area of the earth without duplication, and provide for entity names that, to the maximum extent possible, are approved or accepted by the U.S. Board on Geographic Names. Both two-letter and three-letter alphabetic codes are provided for each entity adopted from ISO 3166-1981. The two-character codes are adopted as the Federal Program Standard and they are recom-
manded by ISO for international standards (Final). The three-character codes are available for special appli-
cations when their use would provide a particular ad-
vantage.

600.745
FPS PUB 112
PC A04/AF A01
National Bureau of Standards, Gaithersburg, MD. Inst. for Standardization & Technology. Password Usage. Category: ADP Operations. Sub-
category: Computer Security. Federal Information processing standards (Final). D. K. Branstad. 30 May 85, 60p

Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: Data processing, Identification systems, Authentication, Guidelines, "Federal information proc-

The document specifies basic security criteria for two different uses of passwords in an ADP system, (1) per-
sonal designates passwords as user identification, and (2) personal and password authentication and author-
ization. It establishes the basic criteria for the design, implementation and use of a password system in those systems where passwords are used. It identi-
fies fundamental ADP management functions pertaining to passwords and specifies some user actions re-
quired to satisfy these functions. In addition, it speci-
fies several technical features which may be imple-
mented in an ADP system in order to support a pass-
word system. An implementation schedule is estab-
lished for compliance with the Standard. Numerous guidelines are provided in the Appendices for manag-
ers and users seeking to comply with the Standard.

600.746
FPS PUB 120
PC E13
National Bureau of Standards, Gaithersburg, MD.

Computers, Control, and Information Theory

Information Processing Standards

Keywords: *Standards, Groups, Workshops, "Software engineering.*

In recent years there has been an increased interest in software engineering (SWE) standards. Many groups are establishing standards, often as an apparently independent activity. The paper discusses standards in general and software engineering standards in particular, the groups who are developing software engineering standards, the needs that drive their standardization efforts, and the forces that influence and constrain the standards.

600,752
PB86-232097
Not available NTIS


600,753
PB86-233111
Not available NTIS


Keywords: *Standards, Vendors, Competition, Utilization, Computer information transfer, Computer software, International organization for Standardization, User needs.*

Although computer technology standards have been under development for over two decades, all too often the results of these activities were overlooked or undervalued. Now users are faced with differing proprietary products that inhibit transfer of information. Meanwhile, computer industry is facing increased international competition, coupled with the threat of a variety of restrictive national standards. As a result, the demand for communications and software standards has surged—not only from users, but from vendors as well. Fortunately, a number of needed standards are flowing out of national and international standards organizations to meet this demand. The paper will consider emerging software standards and efforts to speed their development and use.
The Institute for Computer Sciences and Technology at the National Bureau of Standards has developed an architectural description of OSI protocols, to establish conformance with the appropriate Federal Information Processing Standards. The paper gives an input for test design and describes architectural elements and gives an example of a test language used to drive the test system.


Keywords: *Images, Quality, Reprints.
No abstract available.


Keywords: *Image processing, Computer vision, *PIPE(Pipelined Image Processing Engine).

The Sensory-Interactive Robotics Group of the National Bureau of Standards' Industrial Systems Division is designing a multi-stage pipeline image processing device for research in machine vision. The device can acquire images from a variety of sources, such as analog or digital television cameras, ranging devices, and conformal mapping arrays. It can process sequences of images in real time, through a serial pipeline of operations, under the control of an external device. Its output can be produced to such devices as monitors, robot vision systems, diagnostic symbolic mapping devices, and image processing computers. In addition to a forward flow of images through successive stages of operations in the pipeline, other paths between the stages of the device can permit recursive operations within a single stage, and feedback of the results of operation from a stage to the preceding stage. The architecture facilitates a variety of relaxation operations, interactions of images over time, and other interesting functions. Numerous operations can be supported.


The Sensory-Interactive Robotics Group of the National Bureau of Standards is producing PIPE (Pipelined Image Processing Engine), an experimental, multi-stage pipelined image processing device for research in low-level machine vision. The device can acquire images from a variety of source, such as analog or digital television cameras, ranging devices, and conformal mapping arrays. It can process sequences of images in real time, through a series of local neighborhoods and point operations, under the control of a host device. Its output can be presented to such devices as monitors, robot vision systems, symbolic mapping devices, and image processing computers. Security of Personal Computer Systems: A Management Guide. Final rept., D. D. Steinacker, Jan 85, 65p NBS/SP-500/120 Also available from Supt. of Docs as SW003-003-0209 library of Congress catalog card no. 84-601156.

Keywords: Guidelines, *Personal computers, *Computer security, *Computer information security, Home computers, Cryptography, Office automation, Access control.

This document is a security guide for managers and users of personal computer systems. It describes the nature of information security problems involved in the use of personal and other small computer systems and provides guidance for addressing those problems.

The paper analyzes the traffic on a local area network in its third year of operation at the National Bureau of Standards. NBSNET is a one megabit per second broadcast packet network that uses a carrier sense multiple access with collision detection (CSMA/CD) protocol. It is approximately four kilometers in length. The network has over 250 user devices connected to it; these devices fall into six different categories—main computer, minicomputer, microcomputer, word processor, graphic terminals, and ordinary terminals. Over 2 million packets were observed during 32 weeks of continuous traffic runs. Each fourth of the packets and one third of the data are local, i.e. the source address and the destination address of the packets are located in the same building. The rest of the traffic is between buildings. The network is growing continuously and network traffic increases as the network grows.

600.764
PB86-210397
PC A04/MF A01
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.

Security for Dial-Up Lines.

Critical issues that should be used in all systems that have dial-up communications. These techniques can usually be provided by a computer's operating system. If the computer, augmented by new security procedures, does not have the capability to provide adequate protection against dial-up intruders, then additional software or hardware should be used to shore up the system's access control security. There are several types of hardware devices which can be fitted to computers or used with their dial-up terminals to provide additional communications protection for non-classified computer systems.

600.765
PB86-231172
Not available NTIS

Using DES (Data Encryption Standard) in IBM PC Compatible Workstations.


The Data Encryption Standard (DES) cryptographic algorithm can be implemented in International Business Machines Corporation (IBM) PC compatible workstations to protect data from unauthorized disclosure and to deter unauthorized modifications. Commercial products are now available, or will soon be available, to perform the required cryptographic processing. System designers should consider several issues, including the fact that applications tasks are to be performed, which cryptographic processes are needed, what configuration is best for the required tasks, what requirements will be placed on the system by the connected networks, how will cryptographic keys be managed, and which standards should be met by the cryptographic equipment.

600.766
PB86-247897
PC A04/MF A01
National Bureau of Standards, Gaithersburg, MD Inst. for Computer Sciences and Technology.


The report describes a high level risk analysis for Automated Information Systems (AISs) that can be used by computer security reviewers and EDP auditors to prioritize the non-discretionary and discretionary review activities for these AISs. It divides the risk analysis problem into five areas of risk concern (called dimensions), each with a set of characteristics. The five dimensions are: Criticality/Insight Impact, Size/Scale/Complexity, Environment/Stability, Reliability/Integrity, and Technology Integration. The report presents a possible two-level scoring scheme which calculates the level of risk for each dimension so that a Criticality score is first assigned to each system risk score, and then combines all five dimension scores for a second order system risk score. An approach for deriving an EDP audit or computer security review plan using these scores is outlined.

600.767
PB86-160140
Not available NTIS

Array of Dipoles for Plane Wave Synthesis.


Phased arrays can be used to produce a nearly uniform plane wave in the near field. The paper describes a small array of dipoles which we have studied theoretically and experimentally. The elements' excitation functions are determined from a near-field synthesis technique that optimizes the field uniformity throughout the test volume.

600.768
PB86-162021
Not available NTIS

Measured Vehicular Antenna Performance.


Power gain radiation patterns of mobile antennas mounted in six different locations on a test vehicle were measured with and without typical lights and sirens mounted on the roof. The measurements were performed on a variety of antennas representing the frequency bands of 25 to 50, 50 to 174, 400 to 512, and 806 to 866 MHz. In addition, special antennas consisting of three isolated dipoles on discrete frequencies of 40.27, 162.475, and 415.975 MHz and one slot antenna operating at 413 MHz were also measured. Plots of power gain radiation patterns are given for the mobile antennas mounted in six different loca-

600.771
PB86-181963
PC A03/MF A01

Efficient and Accurate Method for Calculating and Representing Power Density in the Near-Zone of Microwave Antennas.

R. L. Lewis, and A. C. Jewell. Dec 85, 44 p. NBSIR-85/3036


An algorithm is presented for calculating near-zone and Fresnel-region fields in front of microwave antennas from discrete numerical values of the radiated plane-wave spectrum (complex far-field pattern). That is, the near fields are calculated by numerically integrating the plane-wave spectrum representation of the field. The crux of the analysis consists of handling a number of convolution integrals that arise from integrating discrete data. A criterion is developed for limiting the integration domain in order to exclude highly oscillatory regions. An example of integration, in turn, shows the applicable output range over which the field can be computed. With the numerical instability problem thus resolved, fast Fourier transform techniques are used to assure efficient numerical integration over a large (but restricted) output range.

600.770
PB86-189214
Not available NTIS

Input Impedance of a Probe Antenna in a TEM (Transverse Electromagnetic) Cell.


The input impedance of a probe antenna exciting a transverse electromagnetic (TEM) cell is formulated via a variational approach. The resulting impedance is shown to consist of two distinct parts: rectangular waveguide contribution and a gap perturbation. Numerical results for both are given and suggest that a simple algebraic approximation for the input impedance should be sufficient for practical purposes. The resonant point is found to be proportional to the square of the probe length, while the reactive portion is largely capacitive.

600.771
PB86-214731
Not available NTIS

Factors Influencing Material Shielding Effectiveness Measurements.


A material's shielding effectiveness is often measured in terms of insertion loss; that is, the field reduction between transmitter and receiver achieved by introducing the shield material. The insertion loss concept is simply stated; however, ambiguities arise when one attempts to measure the specific insertion loss measurements. Insertion loss measurement techniques depend not only on the shield material tested, but also on the measurement equipment and procedures. Antenna types used and their position in the incident waveform and its wave impedance, and the contact resistance between the test material and its mount (if any) can all affect insertion loss measurements. Concepts are discussed based on the simple model of coupling through an electrically small aperture, loaded and unloaded, with the shield material.

83
ELECTROTECHNOLOGY

Antennas

600.772
PB88-230034
PC A02/MF A01
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.
10-60 GHz G/T Measurements Using the Sun as a Source—A Preliminary Study.
Sponsored by Air Force Satellite Control Facility, Sunnyvale, CA.

Keywords: *Microwave antennas, Solar radio emission, Microwaves, Atmospheric attenuation, Sun, Error analysis, Gradient of electromagnetic noise, Amplification, Atmospheric correction, Earth terminal measurement system, G/T.

Preliminary studies show that it may be possible (1) to determine the flux density incident on the earth's atmosphere using a simple algorithm with an uncertainty less than 6 percent; (2) to overcome a deteriorating accuracy in atmospheric loss calculations by using a 'tipping curve' measurement; and (3) to reduce star-shape correction factor uncertainty by using an equivalent solar diameter.

600.773
PB86-231438
Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.

In IEEE Transactions on Antennas and Propagation AP33, n11 p1175-1185 Nov 85.

Keywords: *Antennas, Electromagnetic fields, Measurement, Scanning, Reprints, *Near field.

The general relationship among fields is presented as a linear differential operator converting the incident field and its spatial derivatives at a single point in space to an output voltage. The differential operator is specified explicitly in terms of the multipoles coefficients of the antenna's complex receiving pattern. When the linear operator representation is applied to the special problem of near-field scanning, a probe-corrected spherical transmission formula is revealed that retains the form, applicability, and simplicity of the non-probe-corrected equations. The new spherical transmission formula is shown to be consistent with the previous transmission formula derived from the rotational and translational addition theorems for spherical waves.

600.774
PB86-237203
PC A03/MF A01
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.
Also available from Supt. of Docs. as SN003-002-0715-4.

Keywords: *Phased arrays, Antenna radiation patterns, Interactions, Reflectance, Impedance.

The authors review theoretically the effects of multiple reflections and mutual impedances in array environments and study possible methods of far-field pattern data analysis to recover interaction effects. The authors use theoretical expressions derived earlier to calculate co- and cross-modulus linear array coefficients for far-field patterns and correct the effective aperture approach. An average value of effective aperture can be obtained by averaging the incidence angle and the phase of the incidence of the field. Far-field pattern terms have been calculated for treating the array elements excitations as random variables. The randomness in excitation causes a decrease in directivity and an increase in sidelobe level. Out-of-band measurements of reflection coefficient and near-field response have been made on two large slotted-waveguide arrays for frequencies from 2 to 18 GHz. Both arrays are narrow band, and this is easily explained by the large impedance mismatch at out-of-bound frequencies.

600.775
PB86-247491
PC A03/MF A01
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.
Also available from Supt. of Docs as SN003-002-07276-7.

Keywords: *Antennas, Amplification, Standards, Ultrahigh frequencies, High frequencies, Very high frequencies, Medium frequencies.

Gain and antenna parameters related to input impedance are calculated using a computer program called HVD5. The program uses well documented equations to compute these parameters for gain-standard antennas, including far-field measurements at frequencies below 1000 MHz. The utility of the program is that it calculates gain and input impedances for model antennas and for field measurements in one program. Uncertainties in the calculated parameters are estimated to be less than those of the measured parameters.

600.776
PB87-106407
Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.

In IEEE Transactions on Electromagnetic Compatibility EMC-27, n4 p201-211 Nov 85.

Keywords: *Phase arrays, Antennas, Electromagnetic fields, Numerical analysis, Plane waves, Reprints, Near field.

A numerical method for near-field array synthesis is developed for arbitrary antenna geometries. The intended application is for calculating a plane wave at a test volume for electromagnetic susceptibility testing, but the method is valid for arbitrary field distributions. A uniqueness theorem is used to allow the field conditions to be enforced on the surface rather than throughout the volume. The synthesis method is based on an interface solution with a constraint on the source norm: the constraint keeps the field small outside the test volume. Numerical results are shown for the case of synthesizing a plane wave in the near field of an array of line sources.

600.777
PB87-125746
PC A03/MF A01
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.

Sponsored by Defense Nuclear Agency, Washington, DC.

Keywords: *Antenna arrays, Orientation, Impedance matching, Polarization, Near field, Sidelobes, Waveguides, Out of band.

The response of antenna arrays to out-of-band frequency excitations has been treated for an effective aperture approach. An average value of effective aperture can be obtained by averaging the incidence angle and the phase of the incidence of the field. Far-field pattern terms have also been calculated for treating the array elements excitations as random variables. The randomness in excitations causes a decrease in directivity and an increase in sidereal level. Out-of-band measurements of reflection coefficient and near-field response have been made on two large slotted-waveguide arrays for frequencies from 2 to 18 GHz. Both arrays are narrow band, and this is easily explained by the large impedance mismatch at out-of-band frequencies.

600.778
PB87-134375
PC A03/MF A01
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.
Also available from Supt. of Docs as SN003-002-0778-6.

Keywords: *Antenna radiation patterns, Error analysis, Far field, Electrical measurement, Near field.

The effects of probe displacement errors in the near-field measurement procedure on the far-field spectrum are studied. Expressions are derived for the displacement error functions that maximize the fractional error in the spectrum both for the on-axis and off-axis directions. Planar y-z-superposition error terms are studied first and, consequently, the results are generalized to errors in spherical scanning. Some simple near-field models are used to obtain order of magnitude estimates for the fractional error as a function of relevant scale lengths of the near field, defined as the lengths over which significant variations occur.

Circuits

600.779
AD-1213 554/8
National Bureau of Standards, Washington, DC.


Keywords: *Microwave amplifiers, *Mixers (Electronics), *Tunneling (Electronics), *Junctions, Quantum electronics, *Coupling (Interaction), Gain, Detectors, Superconductors, Leakage (Electronics), Microwave mixing, Quadruplets.

Quasiparticle mixers have shown strong quantum effects, conversion gain, and noise levels approaching the quantum limit, but only in tunnel junctions with very low sub-gap 'leakage' conductance. It has been suggested that SIS tunnel junctions, made from two different conductors with unequal gaps, will function as high gain mixers since the dynamic conductance below the gap is negative.

600.780
PB86-160686
Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD.
Electronic Devices Div.

In IEEE (Institute of Electrical and Electronic Engineers), Transactions on Instrumentation and Measurement IM-34, n4 p639-643 Dec 85.

Keywords: *Current amplifiers, Transconductance, Calibrating, Electric currents, Phase measurement, Reprints.

A wide-band transconductance amplifier for current calibrations to be used in the NBS electron beam test is described. The amplifier will deliver a ground-referenced constant current of 5 A from dc to over 100 kHz. Its stable magnitude and phase permit use with common calibrating systems to provide the current component of a phantom power source. The amplifier also provides a ground-referenced voltage output of 1 V for monitoring the magnitude and phase of the output current.

600.781
PB85-202991
PC A03/MF A01
National Bureau of Standards, Gaithersburg, MD.
Office of Product Standards Policy.

600, 850 NBS/TN-1098.
Also available from Supt. of Docs as SN003-003-02728-6. Sponsored by Army Communications-Electronics Command, Fort Monmouth, NJ.

Keywords: *Signal generators, *Frequency response, Frequency modulation, Measurement, Remote control, Measuring instruments, Bessel null.

The paper describes a Bessel null technique to measure the frequency response of a frequency-modulated signal and a program to automate frequency response measurements of signal generators with output frequencies from 0.5 to 2000 MHz. The measurements obtained using the technique are more precise than those obtained by a highly trained technician using a manual system. Automated measurement of the frequency response since the manual method is subject to the following problems: (1) excessive time, (2) error in finding the null, and (3) lack of assurance that the null is the first Bessel null. Automated measurements can be performed using a system controller,
Electroconventional Devices

Not available NTIS National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

706,786
PB86-231453

Not available NTIS National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.


N. J. Sladek, and R. L. Jesch. 1986, 5p

Published in IEEE Transactions on Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques MTT-33, n2 p149-1500 Dec 85.

Keywords: "Mixing circuits, Josephson junctions, Superconductivity, Millimeter waves, Radio astronomy, Reprints.

An integrated superconducting microstrip is shown to be a convenient, flexible, and well-characterized matching element for a super-conductor-insulator-superconductor (SIS) quasi-particle heteronve mixe. The resonant interaction (Fiske modes) between the Josephson oscillations of a voltage-biased junction and the microstrip provides a convenient method for determining the electrical length of the microstrip line. An open-circuited microstrip stub that reflects a parallel induction across the junction is used to broaden the bandwidth of the RF match of a 30-40 GHz SIS mixer. Measurements with Pb-alloy junctions in a full-height waveguide mixer with fixed mechanical tuning give an instantaneous bandwidth of 10 to 15 percent with a mixer noise temperature (T sub M) (DSB) = 10 + or - 2.5 K.

Electrooptoelectronic Devices

706,786
PB87-110243

Not available NTIS National Bureau of Standards (NML), Boulder, CO. Circuits.

Time and Frequency Div.

Errors in Servo Systems Using Sinusoidal Frequency (Phase) Modulation.

F. L. Walls. 1986, 5p


Keywords: "Servo motors, Errors, Phase modulation, Frequency modulation, Pulsed laser.

The paper reviews the errors in determining the center of a resonance line which are due to residual imperfections in practical electronic systems using sinusoidal frequency or phase modulation. In particular the effects of residual amplitude modulation, baseline distortion, and harmonic distortion in the modulation process and the demodulator are qualitatively analyzed for a Lorentzian line in the limit of small modulation index. This permits one to easily calculate analytically the frequency offsets as a function of modulation index and the transfer function of the fundamental and various harmonics of the modulation frequency. Using this model one can easily format accurate tests for experimentally measuring the frequency errors in practical servo systems, even if the original assumptions about small modulation index and a pure Lorentzian line are not exactly fulfilled.

Future productivities and optoelectronics device design will come from integration of the various signal processing functions and from improved manufacturing technologies. Optoelectronic device devices, which offers oxide-defined materials and integrates some of the signal processing functions, is close to commercialization. Total or monolithic integration, based on laser animes, may not reach commercialization for another 8 - 10 years. In both cases, the economic impact will be substantial. As a result, the U.S. and its major competitors, especially Japan, are making major R&D investments in optoelectronics. Worldwide R&D expenditures are expected to reach $1 billion by 1987. In terms of market penetration, the fiber optic systems will attain annual sales of more than $3 billion by 1990. The Japanese have made an international commitment to becoming the world leader in the market. Competitive positions in world markets will be determined by which countries rapidly advance all elements of the overall technological base. The base includes measurement-related methods and data which have been shown to have significant effects on productivity growth in other technological areas. Optoelectronics is projected to be equally dependent on the technology element for rapid development and market penetration.

Optoelectronic Devices & Systems

706,790
PB86-183555

PC A02/MF A01


Low-Level Germanium Detector Transfer Standard at 1.064 micrometers.

A. L. Rasmussen, and D. L. Franzen. Jan 86, 15p

NBSIR-85/3041

Sponsored by Air Force Geophysics and Metrology Center. Newark AF.S, OH.

Keywords: "Infrared detectors, "Photodiodes, "Calibrating, "Stardards, Near infrared radiance, Light photodiodes, Germanium, "Transfer standards, Laser radiations, YAG lasers, Light emitting diodes.

Two germanium PIN photodiodes have been calibrated in the 1 to 250 fs/sq cm range with 15 percent uncertainty for 1.064 micrometer laser pulses of 10 to 100 ns duration. To do these calibrations, the authors used (1) an acousto-optically modulated cw N-DYAG laser beam and a silicon PIN photodiode transfer standard, and (2) a time-resolved, direct modulated cw N-DYAG laser beam and a known energy and (2) a pulsed micromodulator LED. A 1 sq cm collecting lens and a ground glass diffuser were placed in front of each detector to improve sensitivity and spatial uniformity, respectively. In the future, these detectors may also be useful as transfer standards at wavelengths out to 0.7 micrometers.

Optoelectronic Devices & Systems

706,790
PB86-195567

Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Optical Spectroscopy and Laser Diode Sources. Diamond Opto-Electronic Switch.

PC A05/MF A01

National Bureau of Standards, Gaithersburg, MD. Technology and Economic Assessment of Optoelectronics.

Planning rept. 23.

G. Tassey. Oct 85, 93p NBSIR-86/3369

Keywords: "Electrooptics, Technology, Economic analysis, Markets, Trends, "Foreign technology, "Optoelectronics, Research and development.

Future productivity advances in optoelectronics will come from integration of the various signal processing functions and from improved manufacturing technologies. Optoelectronic devices, which offers oxide-defined materials and integrates some of the signal processing functions, is close to commercialization. Total or monolithic integration, based on laser animes, may not reach commercialization for another 8 - 10 years. In both cases, the economic impact will be substantial. As a result, the U.S. and its major competitors, especially Japan, are making major R&D investments in optoelectronics. Worldwide R&D expenditures are expected to reach $1 billion by 1987. In terms of market penetration, the fiber optic systems will attain annual sales of more than $3 billion by 1990. The Japanese have made an international commitment to becoming the world leader in the market. Competitive positions in world markets will be determined by which countries rapidly advance all elements of the overall technological base. The base includes measurement-related methods and data which have been shown to have significant effects on productivity growth in other technological areas. Optoelectronics is projected to be equally dependent on the technology element for rapid development and market penetration.

Optoelectronics Devices & Systems

706,792
PB86-195685

Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.

Induced Junction (Inversion Layer) Photoiodide Self-Calibration.

Final rept., R. L. Booker, and J. Geist. 1984, 6p

ELECTROTECHNOLOGY

Optoelectronic Devices & Systems

Keywords: *Photodiodes, Calibrating, Standards, Reprints.*

The potential of a newly available oxide-n-p inversion layer silicon photodiode as a radiometric standard is discussed. Data are presented relating the QE of these diodes as a function of oxide and reverse bias. The theory of a simple absolute reflectometer/detector device is described and reflectance corrections for one of the diodes is determined to establish its absolute response. Radiant power measured with this diode at 10 wavelengths between 255 and 1014 nm, was then compared with that measured by reference to electrical substitution radiometry.

600.793
PB87-104949 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.
Low-Cost LCD Video Display for Optical Processing.
Final rept. M. Young, 1 Apr 86, 3p
Pub. in Applied Optics 25, n7 p1024-1026, 1 Apr 86.
Keywords: *Holography, Holograms, Pattern recognition, Reprints.* Liquid crystal displays, Image processing.

The paper shows that a liquid gate and a low-pass filter are needed to use a new LCD video monitor effectively in a different-processing system, and demonstrates the results of some simple spatial-filtering experiments.

600.794
PB87-106688 Not available NTIS
National Bureau of Standards (NLM), Gaithersburg, MD.
Photodetectors, Photodiode
Photodiode Operating Mode Nomenclature.
Final rept. J. Geist, 1 Apr 86, 2p Pub. in Applied Optics 25, n13 p2033-2034, 1 Jul 86.
Keywords: *Photodiodes, Optical measurements, Reprints.*

Use of the word photoamperic is suggested as applicable to the configuration of photodiode, operational amplifier and feedback resistor that is used for high accuracy optical radiation measurements with silicon photodiodes.

Power & Signal Transmission Devices

600.795
PB86-164571 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.
Mode Coupling by a Longitudinal Slot for a Class of Planar Waveguiding Structures, Part 2. Applications.
Final rept. P. F. Wilson, and D. C. Chang, Oct 85, 6p See also PB86-164689
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques MT-33, n10 p983-993 Oct 85.
Keywords: *Waveguide slots, Waveguide couplers, Trip transmission lines, Reprints, Planar waveguides.*

Coupling between two parallel-plane waveguides is investigated. Mutual excitation is due to a longitudinal slot in a common plate. The introduction of reflecting boundaries parallel to the slot allows one to model a number of planar waveguiding structures featuring a coupling slot. Part II of this paper presents specific examples of the above approach along with numerical results. Examples include a rectangular cross-section transmission line, broad-wall-coupled rectangular waveguide, coupled microstrip, and coupled microstrip and rectangular waveguide.

600.796
PB86-164589 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.
Mode Coupling by a Longitudinal Slot for a Class of Planar Waveguiding Structures, Part 3. Theory.
Final rept. P. F. Wilson, and D. C. Chang, Oct 85, 7p See also PB86-164571.

621
See Coupling networks, PB86-16457l, 104949, 106688.

Power, Signal, & Electrical Transmission Devices

600.797
PB87-209319 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD.
Electromagnetic Fields Div.
Influence of Oxygen on the Decomposition Rate of SF6 in Corona.
Final rept. M. C. Siscoangappa, R. J. Van Brunt, and A. V. Phelps, 1986, 5p
Keywords: *Sulfur hexafluoride, Electrical insulation, Decomposition, Coroans, Oxygen.*

The absolute charge rates-of-production of discharge generated gaseous by-products SOF4A, SOF2, SOF2F, SO2, and CO2 have been measured in compressed SF6/O2 mixtures at a constant pressure. The normalized total rate of oxfluorides plus SO2 production per SF6 molecule is not increased significantly with the addition of O2 up to 50% in SF6 and increases slowly for (O2) > 50%. The formation of SO2 in all SF6/O2 mixtures was invariant. Instead, the deposition of sulfur (Si+ ions) on the anode increased with O2 concentration. The yield of CO2 from oxidation of carbon on the electrode was also observed to increase, with O2 content. Probable mechanisms for the formation of SOF2, SOF2F, SOF4, Si+ ions, and CO2 are discussed. The measured by-product yield as a function of percent O2 are compared with the calculated maximum rate of SF6 decomposition induced by electron collision in the discharge. The theoretical model used to calculate the rate of SF6 decomposition is briefly discussed. As observed for SF6/N2 and SF6/Ne mixtures, the primary effect of O2 on SF6 decomposition appears to be the retardation of the recombination of SF6 dissociation products due to dilution.

600.798
PB86-264154 PC A02/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD.
Electromagnetic Fields Div.
W. E. Anderson, J. D. Ramboz, and A. R. Ondrejak, Apr 86, 84p NSRIR-86/3392 See also PB81-188005, Sponsored by Department of Energy, Washington, DC.
Keywords: *Electrical fault location, Power transmission systems, Computer programs, Power lines, Electrical faults, Detection, Underground power transmission.*

The transmission of electrical energy by use of underground cables is increasing. Fault location techniques have certain limitations; incipient fault detection and location would help to reduce the maintenance cost of these systems as well as improve the reliability of service. The report discusses some test results related to RF-probing techniques applied to high-voltage transmission lines. The high frequency losses and attenuation in high voltage cables places certain ultimate limits on RF-probing techniques for incipient fault detection. Time domain reflectometry methods were employed to assess the RF-transmission properties of high voltage cables at frequencies as high as 6 GHz. Fast Fourier transform deconvolution were used to obtain loss measurements as a function of frequency. The loss mechanisms were identified. The measurement hardware and methods are discussed as well as analysis approach leading to the conclusions.

600.799
PB87-106399 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.
Final rept. D. A. Wall, 1986, 3p
Keywords: *Adapters, Waveguide couplers, Microwave equipment, Responses, Reprints.*

The input impedance and transmission coefficients of a coax-to-waveguide adapter are analyzed for out-of-band frequencies. Numerical results are shown for an S-band adapter for frequencies from 2 to 10 GHz. The above-band response is frequency sensitive because of the presence of higher order propagating modes in the waveguide.

Resistive, Capacitive, & Inductive Components

600.800
AD-302479/4 PC A02/MF A01
National Bureau of Standards, Washington, DC.
Excess Noise in Quartz Crystal Resonators, J. J. Gagnepain, M. Oliver, and F. L. Walls. 1983, 6p
Keywords: *Quartz resonators, Noise (Electrical and magnetic), Crystal oscillators, Resonant frequency, Frequency response, White noise, Measurement, Foreign technology, Component Reports.*

Frequency and phase noise in quartz crystal resonators are studied as a function of the driving power. At low power, where the crystal behaves linearly, 1/f fluctuations of the resonance frequency are observed. At medium power the nonlinearities of the crystal signifi- cantly increase the phase fluctuations at low Fourier frequencies. At high power, thermal instabilities and chaotic behavior occur characterized by the generation of high level white noise.

600.801
PATENT-4 575 690 Not available NTIS
Department of the Army, Washington, DC.
Keywords: *Crystal oscillators, Patents, Sensitivity, Acceleration tolerance, PAT-CL-331-162.*

A crystal oscillator, including two crystals of unequal acceleration sensitivity magnitude and mounted such that their respective acceleration sensitivity vectors are aligned in an anti-paral-lel relationship, further includes at least one electrical reactance, such as a variable capacitor, coupled to one of the crystals for providing cancellation of acceleration sensitivities. After the acceleration sensitivity vectors of the two crystals are aligned anti-parallel, the variable capacitor is adjusted until the net or resultant acceleration sensitivity vector of the pair of resonators is reduced to zero. A second electrical reactance, such as a variable capacitor, is utilized as a tuning capacitor for adjusting the oscillator's output frequency to the desired value, while maintaining the cancellation of acceleration sensitivities.

600.802
PB86-193810 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD.
Electromagnetic Fields Div.

International Comparison of Current Transformer Calibrations.

A.1:

Not

Not number

Not

87
de- for transfer
determining the cal- equiva

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phon
easurements also be conducted.
The measurements were made at current ratios ranging from 1 A: 1 to 200 A: 1 at 10, 100, and 200 percent of rated current and 5 A: 1 to 200 A: 5 A at 1, 10, 100, and 200 percent of rated current, at a frequency of 50 Hz. Several ratios have also been compared at 60 Hz.

600.803
PB86-210259 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.


Final rep.


Keywords: *Thermistors, Flowmeters, Flow measurement, Calibrating, Dissipation factor, Solar water-heaters, Thermosyphons.

The development and calibration of a self-heated thermistor anemometer is described. The variation in thermistor power dissipation as a function of fluid temperature and velocity is presented. A thermal analysis of the glass-encapsulated thermistor bead is described which leads to an experimental technique for determining the effective radius and thermal conductiv

600.804
PB86-214228 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Inst. for Materials Science and Engineering.

Fourier Analysis of Radiance Spectra for Electro
de Solid Electrolytes.

Final rep.


Sponsored by National Science Foundation, Washington, DC.


Keywords: *Solid electrolytes, *Electrolytic cells, Fou- rier analysis, Impedance, Spectra, Electrical proper-
ties, Frequency response, Reprints.

The electrical properties of a solid conductor with its attached electrodes can often be represented by an equivalent circuit involving only a few parameters. The cell's frequency response, which is imposed by its ma-
tenants' behavior, can then be expressed in terms of these circuit parameters. Critical elements in the logical chain then are the degree of the equivalent circuit to the data, and the relationship of the circuit parameters to the material properties. The paper will be concerned with the first of these critical elements, the fitting of the circuit to the data.

600.805

Measurements of the Electromagnetic Shielding Capabilities of Materials.

Final rep.


Pub. in IEEE [Institute of Electrical and Electronics En-
geers] Special Issue on Radio Measurement Meth-
ods and Standards 74, n1 p112-115 Jan 86.

Keywords: *Electromagnetic shielding, Measurement.

Electromagnetic shielding is typically measured in terms of insertion loss, that is, the reduction in the fields coupled between a transmitter and a receiver which results from interposing the shield material. Although for insertion loss concept is simply stated, questions arise when one attempts to interpret specific insertion loss measurements. Insertion loss data depend not only on the inherent shielding effective-

600.806
PB86-244183 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mfg. Engineering.

Ultrasonic Transducers.

Final rep.


Pub. in Encyclopedia of Materials Science and Engineer-
ing, V7, p130-321 1986.

Keywords: *Transducers, Ultrasonic frequencies, Reprints.

No abstract available.

600.807
PB86-221007 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

Discussion on 81 SM 322-7 *Breakdown of Rod-Plane Gaps in SF6 under Positive Switching Imp-
ulses* by H. Aris and K. D. Srivastava.

Final rep.


Pub. in Institute of Electrical and Electronics Engineers Transactions on Power Apparatus and Systems PAS-101, n.3 p546 Mar 82.

Keywords: *Sulfur hexafluoride, Dielectric breakdown, Electric insulation, Surfges.

No abstract available.

600.809
PB87-114914 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

Use of Deconvolution Methods in Characterizing Electrical Sensors.

Final rep.


Sponsored by Department of Energy, Washington, DC.

Pub. in Proceedings of Institute of Electrical and Elec-
tronics Engineers Pulsed Power Conference (5th), Ar-

Keywords: *Detectors, *Electronic engineering, *Voltage divider circuits, Resistors, Capacitors, Measurement.

Decomposition methods have been applied to mea-
surements made with different electrical sensors includ-
ing resistive and capacitive dividers. Deconvolved and directly measured waveforms have been compared with good results.

600.810
PB87-115416 Not available NTIS National Bureau of Standards, Boulder, CO. Electromagnetics Laboratory.

Onset of Chaos in the R-Biased Josephson Junction.

Final rep.


Pub. in Physical Review A 33, n1 p498-509 Jan 86.

Keywords: *Josephson junctions, Superconductivity, Reprints, Chaos, Melnikov method.

The onset of chaos in the R-biased Josephson junction is studied through numerical simulations. It is shown that the chaotic region predicted by the method of Mel-
kikov spans only a narrow region of r amplitudes and consists of weakly chaotic solutions which maintain phase lock with the r bias. The experimentally ob-
served threshold of chaos is shown to coincide with the onset of unlocked chaotic behavior at higher r am-
plitudes.

600.811
PB87-132734 Not available NTIS National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.

Irradiation Effects on Organic Insulators.

Final rep.

1 Oct 81-1 Oct 85.

M. B. Kasen. 1986, 8p.


Keywords: *Electrical insulation, Cable insulation, Su-
perconducting magnets, Cryogenics, Neutron ir-

Progress in development of specimens and test meth-
ods required for studies of the significant parameters influencing mechanical property degradation of organ-
ics and superconducting magnets. A neutron and use.

600.812
PB86-164480 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.

High-Accuracy Physical Modeling of Submicron- meter MOSFETs.

Final rep.


Pub. in IEEE [Institute of Electrical and Electronics En-

Keywords: *Metal oxide transistors, *Field effect tran-
sistors, *Mathematical models, Finite element analy-
isis, Simulation, Reprints, *MOSFET.

When short-channel MOSFET transistor models are compared against experimental data, the uncertainty in some of the physical input variables often requires that some of the input variables be adjusted to fit the data. This uncertainty is increased by a lack of knowledge of process sensitivity information on critical parameters. These uncertainties have been eliminated using a two- dimensional finite-element model of a MOSFET with no free parameters. The model is compared to four self-aligned silicon-gate n-channel MOSFET's with channel lengths of 0.9, 1.5, 2.9, and 8.1 microme-
ELECTROTECHNOLOGY
Semiconductor Devices

ters. The 0.80, 1.83, and 8.17 micrometers devices have phosphorus sources and drains. The 2.19-micrometer device has an arsenic source and drain. Using the data obtained from the measurements described in the work, it is possible to model the drain current. This work was studied under adjustable parameters. If sufficiently accurate parameters are available, these models allow the characteristics of submicron silicon oxide interfacial traps to be predicted with 5-percentage accuracy. These simulations show that the observed short-channel effects can be accounted for by existing mobility data and a simple empirical model of these data.

600.812
PB86-182482
CA 02/03/MA A01
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Release Notes for STAT Version 2.00A: An Addendum to NBS Special Publication 400-75. Documentation,
NBSIR-85-39292, NBS/SW/DK-86/005A
STATZ is a FORTRAN program which is used to analyze and display data from microelectronic test structures fabricated on semiconductor wafers. The program reads data as a two-dimensional array, extracts sample statistical values, identifies outliers, calculates replacement values for outliers, and makes histograms and circular plots as a function of one of the two types of systems described above as "equivalent" based on the principle of reciprocity. More recent research has shown that the response of these two types of systems is not equivalent for imaging of structures patterned in thin films such as those found in integrated circuit wafer fabrication. The lack of reciprocity is the result of the degradation of the diffraction pattern on the angle of incidence of the illumination. The impact of the lack of reciprocity on the design and calibration of critical dimension measurement systems is discussed.

600.813
PB86-193851
Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
Brightness-Field Scanning Microscopy for Integrated Circuit Metody.
Final rept., D. Nyvospen, 1985, 6p
In SPIE Micron and Submicron Integrated Circuit Metrology II, 565, p102-107 1985
Current optical instrumentation being developed for critical dimension measurements in the integrated circuit industry is following one of two very different optical designs, i.e., either a focused laser beam which scans the wafer or the more conventional bright-field microscope. Traditional optical designs are the basis for these systems as "equivalent" based on the principle of reciprocity. More recent research has shown that the response of these two types of systems is not equivalent for imaging of structures patterned in thin films such as those found in integrated circuit wafer fabrication. The lack of reciprocity is the result of the degradation of the diffraction pattern on the angle of incidence of the illumination. The impact of the lack of reciprocity on the design and calibration of critical dimension measurement systems is discussed.

600.816
PB86-202561
Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
VLSI Package Reliability Workshop Report.
Final rept., D. J. Benham, and H. A. Schiffit, 1983, 4p
The report summarizes remarks made by six panelists in an evening workshop meeting held as part of the 1983 Annual Symposium on Reliability Physics. The panelists provided an overview of package design and measurement considerations that arise because of special features of VLSI semiconductor chips. Considerations in the following areas were discussed: package materials, design, and construction; thermal management and characterization; and moisture and hermeticity measurements.

600.817
PB86-214723
Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Center for Electronics and Electrical Engineering.
Model for the Charge-Pumping Current Based on Small Rectangular Voltage Pulses.
Final rept., R. A. Wachnik, and J. R. Lowney 1986, 14p
The charge-pumping current results from recombination of electrons and holes at the gate of a MOSFET when a voltage pulse is applied to the gate. A model is proposed which predicts the pulse current waveform, the number of pulses, and the average voltage of pulses with peak-to-peak amplitudes less than the difference between the flatband and inversion voltages and with pulse transitions fast enough so that negligible charge or emission occurs during the transition. The model is based on Shockley-Read-Hall recombination and capture cross section into traps which capture only and traps which tend to emit before capture. It predicts the dominant behavior of the measured current and with the inclusion of surface potential fluctuations and a distribution of cross sections it agrees well with experiments.

600.819
PB86-231107
Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Accurate Current Calculation in Two-Dimensional MOSFET Models.
Final rept., C. L. Wilson, and J. L. Blue, 1985, 9p
Two-dimensional simulations of MOSFET's are widely used for the design of short-channel transistors used in VLSI circuits. These models use low order methods of discretization of solution variables. In the paper, a more accurate method of current calculation is presented which works with these methods and yields good accuracy. The method uses integration of the solution variables, rather than differentiation, and is similar to Qum's law in two dimensions.

600.820
PB86-231115
Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Boron Diffusion in Silicon.
Final rept., J. F. Rehiohando, P. Rothman, and J. Albers, 1985, 9p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices ED-32, n1 p2322-2330 Nov 85.
Well-defined control of high- and low-temperature anneals of boron implanted in silicon is important in the calculated fabrication of p-type junctions used in MOSFET'S. Here, a sample matrix of boron implanted into silicon over a range of fluxes and annealing temperatures is considered. The matrix of samples was measured by SIMS (secondary ion mass spectrometry). The measured profiles were compared with simulations from an annealing/diffusion model. Calculations of the annealed profiles were found to be in agreement with the SIMS data at temperatures greater than 1500°C. At lower temperatures, the profiles exhibit effects due to implantation damage which are not included in the diffusion model.

600.821
PB86-239266
Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
Modeling GaAs/AlGaAs Devices: A Critical Review.
Final rept., H. S. Bennett, Jan 85, 8p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Circuits Devices Magazine 1, n1 p35-42 Jan 85.
Device models for GaAs devices and GaAs/AlGaAs heterostructures are much less advanced than those for silicon devices. The paper critically reviews recent advances in the modeling of GaAs/AlGaAs devices. It is based on an examination of five selected device models which contain features common to the majority of device models for heterostructure bipolar and field effect transistors. Areas requiring improved measurement techniques on processed GaAs and improved physical concepts for GaAs/AlGaAs device models are identified.

600.822
PB86-239274
Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.

88

Keywords: *Field effect transistors, Semiconductor doping, Mathematical models, Reliability*

The conventional device physics in most numerical simulations of bipolar transistors may not predict correctly the measured electrical performance of shallow, heavily doped emitters and bases. The paper presents improved device physics for numerical simulations of solid-state devices with densities up to about 3 x10^20 in 20th power/cm^2 and with junction depths as small as 0.1 micrometers. This improved device physics pertains to bandgap narrowing, effective intrinsic carrier concentrations, carrier mobilities, and lifetimes. When this improved device physics is incorporated into device analysis codes such as SEDAN and then used to compute the electrical performance of npn transistors, the predicted values agree very well with the measured values of the current-voltage characteristics and dc common emitter gains for junction depths between 10 micrometers and 0.16 micrometers.

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600,823


Keywords: *Interfaces, Metal oxide transistors, Radiation effects, Field effect transistors, Traps, Density(Mass/volume), Reprints.*

A simple model to describe radiation effects on MOSFETs and their characteristics is presented. The key assumption is that mobility degradation in an enhancement mode MOSFET is predominantly due to charged interface traps. Model predictions are compared with measured values of interface trap density and device I-V curves.

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600,824


Keywords: *Radiation effects, Traps, Interfaces, Measurement, Gamma irradiation, Irradiation, Silicon, Silicon oxides, Density(Mass/volume), Metal oxide transistors, Field effect transistors, Reprints.*

The effect of gamma irradiation on the density of SiO2/Si interface traps was measured using n- and p-channel MOSFETs. The density of traps was measured by a charge pumping measurement method and by a technique based on the slope of the transistor in (Id) vs (g) characteristics in weak inversion. An increase in the density of interface traps with dose is observed with a gate length above compared to just below the center of the silicon bandgap.

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600,825


Keywords: *Standards, Semiconductor industry, Test methods, International cooperation.*

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The unique characteristics of the U.S. voluntary standards system, as distinct from the standards systems of most other countries, are described. The roles of JEDEC, ISHM, SAE, and the MIL standards system are briefly reviewed. The work of ASTM Committee F-1 over the past 24 years in developing standards for the semiconductor industry is described in detail. The procedural aspect of standards development is described, and the value of inter-laboratory tests in evaluating the precision and accuracy of test methods is pointed out. The role of collaboration, which has been maintained with both DIN Normenausschuss Materialprüfung 221 and the Semiconductor Equipment and Materials Institute (SEMI), is emphasized. The paper concludes with a list of contact persons and publication addresses.

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600,826


The basic premise underlying the use of the scanning electron microscope for linewidth measurement for semiconductor research and production applications is that the video image acquired, displayed, and ultimately measured reflects accurately the structure of interest. The paper demonstrates that depending upon the mode of electron detection (secondary, backscattered, or converted backscattered secondary electrons) and accelerating voltage used to image and measure the structure of interest, a variety of results can be obtained. The reasons for these differences are described. The coupling of the type of work with electron beam/sample interaction modeling to enable the acquisition of more precise linewidth measurements. SEMs.

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600,827


Keywords: *Wafers, Mapping, Defects, Semiconductor devices, Measurement.*

Although deep level measurements on packaged devices are common practice, these measurements cannot generally be made at the water level because the required apparatus has not been available. However, the use of a backscattered technique would provide to the process engineer a valuable analytical tool for process control or process diagnostics. Appropriate apparatus and methodology for the development of techniques for evaluating the detected wafer has been designed and constructed. Its use is illustrated by the measurement of water maps showing the variation of water concentration across a wafer and the correlation of defect density with device electrical characteristics.

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600,828


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Since thermally stimulated current and capacitance measurements (TSM) can utilize a metal-oxide-semiconductor (MOS) capacitor as the test vehicle for defect characterization, an MOS capacitor fabricated with relatively low temperature processes should be useful for studying defects in starting material. Several processes were investigated. The process which yielded the most consistent devices utilized chemical vapor deposition (CVD) of silicon dioxide at 450°C along with a simultaneous thermal oxidation. Thermally stimulated current measurements on MOS capacitors fabricated in this way were successful in detecting gold which was purposely introduced into a starting wafer.
Semiconductor Devices

Modeling MOS Capacitors to Extract Si-SiO2 Interface Trap Densities in the Presence of Arbitrary Doping Profiles.

Final rept., H. S. Bennett, M. Gaitan, P. Roitman, T. J. Russell, and J. S. Suhelie. 1986, 7p
Sponsored by Defense Nuclear Agency, Washington, DC.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices ED 33, n6 p759-765 Jun 86.

Keywords: *Electron traps, *Hole traps, *Capacitors, *Interfaces, Gamma rays, Semiconductor doping, Silicon dioxide, Silicon, Reprints, Metal oxide semiconductor.

A conventional Poison solver has been used to calculate the quasi-static capacitance of an MOS capacitor. The effects of an energy dependent Si-SiO2 interface trap profile on the charge built up with those measured using Kub's technique for as-received and for gamma-irradiated p-type and n-type silicon MOS capacitors. The substrate doping profiles were obtained from high-frequency C-V curves. Experimental and theoretical C-V curves were made to agree by varying the voltage offset due to fixed charge and both the magnitude and the energy distribution of interface trapped charge.

600.832
PB87-144896 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Semiconductor Electronics Div.
Performance Trade-Off for the Insulated Gate Bipolar Transistor: Buffer Layer Versus Base Lifetime Reduction.
Final rept., A. R. Hefner, and D. L. Blackburn. 1986, 12p

Keywords: *Transistors, Mathematical models, *Bipolar transistors, Power transistors, One dimensional, Transients.

A one-dimensional analytic model for the insulated Gate Bipolar Transistor (IGBT) which includes a high-doped buffer layer in the low-doped bipolar transistor base is developed. The model is used to perform a theoretical trade-off study between IGBTs with and without the buffer layer. The study is performed for devices of equal breakdown voltages, and the critical parameters are varied by: (1) adjusting the doping concentration and thickness of a buffer layer included as part of the bipolar transistor base, (2) adjusting the doping parameters of the newly developed bipolar transistor base with no buffer layer included, or by (3) a combined of (1) and (2). The results of the model predict that for equal breakdown voltages, an optimized device with a buffer layer has less switching energy loss for a given on-state voltage than an optimized device with no buffer layer.

600.833
PB87-134904 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Semiconductor Electronics Div.
Power MOSFET Failure during Turn-Off: The Effect of Forward Biasing the Drain-Source Diode.
Final rept., D. W. Berning, and D. L. Blackburn. 1986, 5p


The effects on the turn-off failure of power MOSFETs which result from forward biasing the intrinsic drain-source diode immediately prior to turn-off are discussed. A nondestructive test circuit is used to measure the turn-off characteristics of individual devices under a variety of conditions. It is shown that the drain voltage at which the device fails decreases as either the diode forward current or the reverse recovery current is increased. If the diode is forward biased, the voltage at failure can be less than one-half of the voltage at which the device fails if the diode has not been forward biased (and often less than one-half the manufacturer-rated voltage capability for the device). Also, if turn-off of the MOSFET is attempted with the diode conducting, the device loses its fast turn-off capability due to charge storage effects. A parallel resonant power converter circuit is employed to demonstrate how the intrinsic drain-source diode may and may not be used safely in practical applications.
On June 24-25, 1985, NBS and IEEE cosponsored a seminar at NBS to examine the need for improved access to Japanese technical information and to explore possible approaches to satisfy those needs. To limit the discussion to practical dimensions, the technical subject matter was restricted to electrical and electronics engineering. The program was designed to provide an opportunity for individuals representing Congress, the practicing engineering community, industry, and the educational community to voice their concerns and their needs.

**Keywords:** Electric power, Electric measuring instruments, Dielectrics, Dielectric breakdown, Sulfur hexafluoride, Electrical insulation, Interfaces, Space charge, Insulating oil, Electric fields, Magnetic fields.

The report documents the technical progress in the five investigations which make up the project's Support of Research Projects for Electrical Engineering Systems: Division of Energy Technology Task Order Number 137, funded by the U.S. Department of Energy's Office of Energy Systems Research and performed in the Electronics and Electrical Systems Research and Development of the U.S. National Bureau of Standards.

**Keywords:** Capacitance bridges, Audio frequencies, Reprints.

A compact transformer-ratio-arm bridge has been built in which the balance point is automatically determined with the aid of an internal microprocessor. The instrument described in the paper can operate from 20 Hz to 20 kHz, and has three ranges: 12, 120, and 1200 pf.

**Keywords:** Standards, Calibrating, Frequency measurement, Waveform, Radiofrequency signals, Phase angle, Phase meters, Reprints.

The issue of the first quarterly abstract journal covering the work of the National Bureau of Standards Centers for Electrochemical and Electrical Engineering. The issue of this Technical Public Announcement contains the work described in the Technical Public Announcements for the calendar quarter.

**Keywords:** Standards, Descriptors, Abstracts, Research projects, Semiconductors (Materials), Metrology, Signal processing.

The first issue of a quarterly abstract journal covering the work of the National Bureau of Standards Centers for Electrochemical and Electrical Engineering.

**Keywords:** Standards, Descriptors, Abstracts, Research projects, Semiconductors (Materials), Metrology, Signal processing.

The effects of phosphorus-contact doping and sheet resistance variations on Al/Si Interfacial Contact Resistance.

**Keywords:** Integrated circuits, Semiconductor doping, Additives, Contacting, Reliability, Silicon, Aluminum, Phosphorus, Metalization, Contact resistance, Very large scale integration.

<table>
<thead>
<tr>
<th>Title</th>
<th>nirance of Micron and Submicron Integrated Circuit Metrology, San Diego, CA, August 22-23, 1985, v565 pB3-87.</th>
</tr>
</thead>
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<tr>
<td>Title</td>
<td>Keywords: &quot;Thin films, Metrology, Measurement, Incidence, Error analysis, Substrates, Silicon, Ellipsometric properties, Ultraviolet thin films. Single angle of incidence ellipsometric measurements have been extended to dual angle measurements on uncoated multilayer precision gold film and a Mo/Si multilayer film to determine more accurately the optical constants of a substrate. Following the measurement error analysis that was prescribed in earlier papers for a single angle of incidence and fixed wavelength measurements, the results for dual angle of incidence are also presented. Using the Elliptically Polarized Analysis (EPA) method, involving the differences of the measurable optical constants of the substrate, it is possible to find a well-defined pair of incident angles to perform the measurement. Without a measurement error analysis, there would be no way of knowing what the absolute measurement uncertainty is or which angles of incidence could provide optimum measurement conditions. As in the case of single angle of incidence measurement where we were able to select an optimum angle of incidence to assure the highest measurement accuracy, the dual angle of incidence measurement can provide the optimum angle of incidence. It was found that in the case of single angle of incidence ellipsometry the principal angle of incidence can sharply define the optimum angle for measuring bare substrates and very thin films on a substrate. Likewise, for the dual angle of incidence measurement, there can also be two sharply defined angles for certain sample surfaces at different incident angles. The method of calculating the ellipsometric measurement of the real part of the refractive index of a silicon substrate at the wavelength of 632.8 nm is described. A silicon dioxide film thickness between 125 and 150 nm and the two angles of incidence, 68 and 72 deg, optimized the measurement.</td>
</tr>
</tbody>
</table>

**Keywords:** Calibrating, Power transmission lines, Measurement, Ion counters, Ion density, Ion detection, HVDC systems.

The characterization of a parallel plate apparatus which has produced a unipolar ion density that is suitable for calibrating aspirator-type ion counters operating in the ground plane is described. The influence of a dc electric field, air motion, Colburn repulsion and diffusion on the transport of ions into the ion counter are examined to determine their effects on instrument calibration and measurements in the vicinity of high voltage dc transmission lines. An ion density which is known with an uncertainty of less than + 0.9% is used to check the performance of an ion counter with and without a duct at its entrance. The results of laboratory measurements of ion density under a monopolar ion counter line, which complement the studies with the parallel-plate apparatus, are also described.

**Keywords:** Test facilities, Reverberation, Electromagnetic fields, Design, Evaluation, and Use of a Reverberation Chamber for Performing Electromagnetic Susceptibility/Vulnerability Measurements.

The report presents the results of work at the National Bureau of Standards, Boulder, Colorado, to carefully evaluate, document, develop (when necessary), and standardize methods for testing radiated susceptibility/vulnerability measurements using a reverberation chamber. The report describes the reverberation chamber, its design theory, operation, evaluation, functional use, and operation for performing immunity measurements. It includes an estimate of measurement uncertainty and a method for comparing radiated susceptibility/vulnerability measurements using an anechoic chamber measurement. Finally, it discusses the limitations and advantages of this measurement technique and suggestions for potential users in determining the applicability of the technique to their electromagnetic compatibility (EMC) measurement needs.
ELECTROTECHNOLOGY

General


Keywords: "Josephson junctions, *Standards, Superconductivity, Antennas, Silicon, Voltage standards. Josephson voltage standards have long been limited by their low 1-10 mV output level. A new method for operating 1000 or more Josephson junctions in series has produced a practical standard at the one volt level. The junction array is in the form of a microstrip which is fine-line coupled to a waveguide at one end and is terminated at the other end. The whole circuit is fabricated on a 6 by 12 mm silicon substrate. With applied radiation at 72 GHz, the junction array produces up to 8000 quantized levels at the voltages nh/V(2e). (In the United States 2e/h has an assigned value of 483593.420 GHz/V(NBS)). Any voltage from 0.1 to 1.2 volts can be obtained by selecting the level, n, and fine tuning the frequency, 1. The high output voltage eliminates the need for a voltage divider and greatly reduces errors due to thermal voltages. When fully evaluated, Josephson voltage standards are expected to have a precision of a few parts in a billion.

600.850 PB86-229366 Not available NTIS National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div. Practical Josephson Voltage Standard at 1 V

Keywords: "Standards, *Josephson junctions, Superconductivity, Resonators, Antennas. A seven-year study of 1484 pairs of Josephson junctions biased by microwave at 72 GHz, is demonstrated to provide stable quantized voltages at the 1 V level. The niobium/lead-ally junctions used in the array are not affected by thermal cycling.

600.851 PB86-229374 Not available NTIS National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div. Sensitive, High Frequency, Electromagnetic Field Probe Using a Semiconductor Laser in a Small Loop Antenna

Keywords: "Electromagnetic fields, Microwave, Semiconductor lasers, Loop antennas, Avalanche diodes, Photodiodes, *Probes(Electromagnetic). Laser applications, Optical fibers. Using a loop antenna in series with a semiconductor laser, an optically coupled electromagnetic field probe has demonstrated sensitivities better than 3 microV/m (m(0.003 V/m)). The probes outside dimensions are equal to 5.7 x 5.7 x 1.3 cm. It can be used to measure fields with frequencies as high as 2 GHz. The dynamic range is estimated to exceed orders of magnitude for incident microwave powers.

600.852 PB86-231164 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Temperature and Pressure Div. Intrinsic and Extrinsic Noise Sources in an RF Bias-Teed SQUID (Resistive-SQUID)

Keywords: "Noise measuring devices, Josephson junctions, Cryogenic, *Noise thermometers, SQUID devices. The authors have modelled the influence of external circuit noise on the performance of a resistive-SQUID noise thermometer. The predictions of the model are compared with experimental results that evidences that one can reduce their influence to such an extent that noise thermometry free of systematic errors may be conducted to the 0.1% level from 1 mK to 500 mK.

Final rept., M. T. Ma, and G. H. Koepke. 1986, 2p Pub. in Proceedings of the IEEE (Institute of Electrical and Electronics Engineers) 74, n.11 p110-111 Jan 86.

Keywords: "Electromagnetic radiation, *Electromagnetic interference, Measurement, TEM cells. A summary of a new method for determining the radiation characteristics of leakage from electronic equipment for the unintentional radiators of interference is presented. The theoretical background and specific measurement procedures for the method using a vector transverse electromagnetic cell are outlined. First, the theory and measurements have been verified in referenced work by the results of a simulated theoretical experiment using a spherical dipole radiator. Mathematical analysis of the uncertainties in the final, extracted results when the experimental data are degraded by the background noise and measurement imperfections is also available.


Keywords: "Electric current, *Electrical measurement, Fiber optics, *Electric pulses. Recent progress in the design of fiber sensors for pulsed electric currents is reviewed. Several of the most useful sensor configurations are described and compared. Models are used to predict the transfer function of these sensors, their sensitivity to non-ideal fiber properties, particularly linear birefringence, and methods for overcoming these problems. Other recent research is examined to suggest the prospect for sensors with improved sensitivity and stability.


Keywords: "Frequency standards, Cesium. Optical pumping, Laser pumping. The authors report on their project to study and demonstrate the potential performance achievable in cesium beam frequency standards in which laser driven optical pumping is used for the atomic state selection and state detection in place of the conventional magnetic state selection. The beam tubes used have been derived from commercial devices. In the first unit the only functional change was a simple replacement of state selection magnets with optics. In a second unit, the magnetic shields and c-field have been extended to include the regions of optical pumping.

600.856 PB86-236869 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div. Beam Reversal Experiment on NBS-6 (National Bureau of Standards) Primary Cs Standard Including Interference Evaluation

Keywords: "Frequency standards, Cesium. An improvement in the evaluation of the Cs beam primary frequency standard NBS-6 is being attempted through a revatification of Roberting, since recently published theory. Time of flight distribution measurements and frequency measurements at various C-field values have been performed in both beam directions. This allows the authors to model Rabi pulling and hence more clearly study other systematic effects.

600.857 PB86-238706 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div. Recirculating Oven for Atom Beam Frequency Standards

Keywords: "Frequency standards, Atomic beams, Ovens. The paper describes a simple recirculating oven which produces an atomic beam which can be better collimated than that from a conventional oven with equivalent collimation ratio. The oven is spall proof and requires no cooling. The oven is constructed for operation under suitable conditions the total beam flux can be significantly less than for conventional cesium ovens. This translates into a more efficient use of the cesium charge and less contamination of the beam tube.

600.858 PB86-239290 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div. Nonlinearity, Measurement Capabilities and Limitations at Millimeter Wave Frequencies

Keywords: "Measurement, Millimeter waves, Extremely high frequencies, Standards, Reprints, National Bureau of Standards.

The National Bureau of Standards (NBS) establishes national artificf standards and provides a metrology base for U.S. industry and technology. In the millimeter wave frequency spectrum, NBS has not established all of the required metrology to meet the needs of industry or government for this technology. It is the intent of the paper to describe the technical demands of responding to the challenges of millimeter wave technology.

600.859 PB86-240777 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div. Fluorescent Light Shift In Optically Pumped Cesium Standards

Keywords: "Frequency standards, Cesium, Optical pumping. The authors have calculated the light shift in an optically pumped cesium beam frequency standard caused by fluorescence co-propagating with the
ELECTROTECHNOLOGY

General

Test of the Quantum Hall Effect as a Resistance Standard
Final rept.

Keywords: *Standards, *Electrical resistance, *Electrical measurement, Hall effect, Reprints.

The paper demonstrates that the quantum Hall effect can be used to monitor a laboratory unit of resistance. A 6.452 ohm resistor in a room temperature Hall device was calibrated relative to two quantum Hall device voltmeters with a 0.017 ppm (1 sigma) uncertainty for each one hour measurement period. The accuracy was achieved by correcting for a measurement system offset error and for the temperature dependences of each quantum Hall device. Harmonic six-port signal resistor networks were then used to calibrate the 6.4532 ohms resistor in terms of the five ohm resistor which comprised the NBS ohm. The total 1 sigma accuracy for the transfer between the quantum Hall devices and the one ohm resistors was 0.047 ppm.

600.868
PB87-108576
Not available NTIS National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Estimation of True Power Ratios in Six-Port Network Analyzers Using Diode Detectors.
Final rept.


A model for detector nonlinearity is included in the determination of six-port parameters without using additional standards. A computer simulation was performed assuming that the true power into each six-port detector is related to the power observed by the detector. Simultaneous estimation of the six-port and detector parameters is accomplished through a nonlinear least squares algorithm. Results of the simulation compare Gamma computed from corrected power readings and Gamma calculated from observed power readings.

600.869
PB87-110060
Not available NTIS National Bureau of Standards (N), Gaithersburg, MD. Electrosystems Div.

Discussion of ‘Four-Terminal Impedance Current Transformer Bridge with Resistive Ratio Arm’ by Franco Castelli.
Final rept.


The advantages and disadvantages of a measurement technique for low value 4-terminal impedances is discussed. The method uses current transformer scaling and mixed ratio arms.

600.870
PB87-110128
Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Electromagnetic Fields Div.


The material's shielding capability is generally measured in terms of insertion loss: the field reduction between a transmitter and a receiver achieved by introducing the shield. Ambiguities arise when one attempts to interpret specific measurement results. Insertion loss data depend not only on the shield materi-
The wave of three NBS, and their international System of Units (SI) values as possible and would be used by every national standards laboratory which employs the Josephson and quantum Hall effects to define and maintain their national or legal units of voltage and resistance. Based on current knowledge, this would lead to an increase in the U.S. Legal Volt of about nine parts-per-million (ppm) on the NBS 0.0125 in the orthogonal magnetic field component at the measurement point. This magnetic field meter is nearly isotropic over its dynamic range. The electric circuitry of the meter obtains the total magnitude of all field polarizations for all xg signals in the entire frequency band. The sensor is isotropic and is well suited for measuring the near field of an emitter, including regions of multiple reflections and standing waves. The meter can be used to monitor either the plane wave fields in the far zone of a transmitter, or the complicated fields very close to an leakage source. The report describes the design, performance and operating instructions for the MFM-10.

A broadband magnetic field meter has been developed at the National Bureau of Standards (NBS) for a frequency range of 300 kHz to 100 MHz. The isotropic antenna unit consists of three mutually orthogonal loops, each 10 cm in diameter. The magnetic field probe described in the paper has a measurement range of 0.1 to 30 A/m. The readout of the meter is in terms of the Hermitian or total magnitude of the magnetic field strength which is equal to the root-sum-square value of the three orthogonal magnetic field components at the measurement point. The magnetic field meter is nearly isotropic over its dynamic range. The electric circuitry of the meter obtains the total magnitude of all field polarizations for all xg signals in the entire frequency band. The sensor is isotropic and is well suited for measuring the near field of an emitter, including regions of multiple reflections and standing waves. The meter can be used to monitor either the plane wave fields in the far zone of a transmitter, or the complicated fields very close to an leakage source. The report describes the design, performance and operating instructions for the MFM-10.
ENERGY

Batteries & Components

600,880
PATENT 4576882 Not available NTIS Department of the Navy, Washington, DC.
Polyethylene Imine-Metal Salt Solid Electrolyte.
Patent
Supersedes AD-D01 078.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.
Keywords: *Patents, *Solid electrolytes, *Electric batteries, Imines, Metals, Electrolytes, Polyamides, Salts, Polyethylene.
The invention is a solid polymer electrolyte having a) a matrix of poly(ethylene imine) having the formula (-CH2CH2-NH)-, and b) a metal salt which is Li, LiClO4, Na, NaBr, K, CsSO4, AgNO3, CuCl2, CoCl2, or MgClO4, wherein the salt is dissolved in and distributed throughout the poly(ethylene imine) matrix and from more than zero to 0.1 mole of salt is used per mole of monomer repeat unit, (-CH2CH2-NH)-.

Electric Power Transmission

600,881
PB86-231156 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Electroystems Div.
Discussion of 'A Fast Response Impulse Voltage Measuring System for Testing of Gas Insulated Substations Equipment'.
Final rept.
R. H. McClure. 1986, 1p Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Delivery PWRD-1, n3 p47 Jul 86.
Keywords: *Electrical measurement, High voltage, Substations, Frequency response, Step response, Reprints.
The discussion is a contribution of a technical paper presented at the winter meeting of the Power Engineering Society, IEEE. It questions some of the authors assumptions, and references other applications of the measurement method described.

600,882
PB87-131884 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Electroystems Div.
Calibration of Test Systems for Measuring Power Losses of Transformers.
Final rept.
S. P. Mehta, and O. Petersons. 1986, 9p See also PB86-130202.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Delivery PWRD-1, n4 p215-223 Oct 86.
Keywords: *Power transformers, *Power loss, Electrical measurement, Power factor, Calibrating, Reprints, Test methods.
Two years of development work by ASEA Electric, under the auspices of the Industrial Research Associate Program of the National Bureau of Standards has resulted in a verifiable method of determining overall accuracy of test systems used in the measurement of transformer losses. The technical achievement is important to the industry because of the present trend towards lower power factors which makes loss measurements exceedingly difficult with desirable test system accuracy that is traceable. The technical details of the work are presented in NBS Technical Note 1204 (over 100 page document).

Energy Policies, Regulations & Studies

600,883
PB86-163458 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Mathematical Analysis Div.
Final rept.
The article discusses briefly recent trends in computer software used in the building design process, and examines a new computer program for evaluating the life-cycle costs of alternative building designs and systems against this general perspective. The use of the Building Life-Cycle Cost (BLCC) computer program is illustrated in a case example, and its advances and limitations are noted. The point is made that though the move is towards expert systems, at this stage, expert knowledge on the part of the user continues to be required.

600,884
PB86-199957 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Building Equipment Div.
Measurement of Temperature, Humidity, and Fluid Flow.
Final rept.
Keywords: *Temperature measuring instruments, *Measuring instruments, Humidity, Fluid flow, Temperature, Calibrating, Maintenance, Reprints.
Laboratory and field experience, and surveys, have clearly indicated that computerized laboratory and field tests and HVAC installations enhanced with Energy Management and Control Systems (EMCS) often experience problems related to the accuracy and reliability of the system instrumentation. The paper is being presented to call attention to only a few of the many neglected characteristics of instrumentation used in EMCS that have been found in the field to be the basic cause of problems in EMCS in new and existing installations. The characteristics of some of the available temperature, moisture, and flow monitoring instrumentation pertaining to EMCS application will be presented followed by typical problems encountered in interfacing various monitoring and control instrumentation with computer controlled systems.

Fuel Conversion Processes

600,885

Evaluation of the Performance of Materials and Components Used in the CO sub 2 Acceptor Process at the Gasification Pilot Plant.
Final rept.
Contract AC01-76ET10253.
Keywords: *Carbon Dioxide Acceptor Process, *Coal Gasification Plants, Alloys, Experimental Data, Flow-sheets, Lignite, Materials, Performance, Pilot Plants, Recommendations, Refractories, South Dakota, ERDA/010404, ERDA/360100, ERDA/360200.
This report addresses the performance of materials and components used in the operation of the Conoco Lignite Gasification Pilot Plant, located in Rapid City, South Dakota. Describing this performance over the five and one-half years of plant operation were acquired primarily from the plant operating records. Run reports, lists of shutdown work performed between runs, inspection reports and monthly reports to project sponsors were read and operating events were identified, classified and abstracted. In addition, other documents, generated over the life of the plant, were analyzed; these include the plant construction report, operating reports, annual reports and other memoranda. Several visits to the plant were made and discussions of some of the unique features of this plant were held on several occasions with Conoco and Steam-Roger personnel. Performance histories and assessments of this performance have been given for all materials and components for which there was sufficient information contained in these plant records. Performance is summarized under each major component or class of components in the body of the report. A plan for sampling selected materials of construction, both metals and refractories, for laboratory analysis was submitted to plant management and project sponsors and resulted in a laboratory analysis limited to the refractory lining of the gasifier vessel. A report of the findings of this laboratory evaluation is not made in this appendix to this report. Conclusions and recommendations for future efforts in developing performance information are given. 6 refs., 29 figs., 5 tabs. (ERAA citation 10/05895).

600,886
PB86-195609 Not available NTIS National Bureau of Standards (NMLS), Gaithersburg, MD. Chemical Kinetics Div.
Free Radicals in Coal Conversion.
Final rept.
Keywords: *Coal, *Free radicals, Pyrolysis, Kinetics, Reprints.
It is generally accepted that free radicals are the key reactive intermediates in thermal coal chemistry. This view is supported by the general observation that free radical reactions control pyrolysis chemistry of most organic substances. General kinetic features of coal liquefaction have also been used to support this view. A detailed consideration of the chemical structure of coal and its reaction products also strongly suggests that free-radical reactions control coal chemistry. The aromatic and hydroaromatic units found in coal tars and liquids and presumed to be dominant structures in coal itself are known to be very reactive toward free radicals. Moreover, resonance stabilized radicals derived from these structures are formed and react readily at coal decomposition temperatures. Methyl and hydroxyl substitutes serve to increase the overall free-radical reactivity of the molecules to which they are attached.

600,887
PB87-104220 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Thermophysics Div.
Viscosities and Densities of Selected Organic Compounds and Mixtures of Interest in Coal Liquefaction Studies.
Final rept.
Pub. in International Jnl. of Thermophysics 7, n3 p500-608 1986.

600,887
**ENERGY**

**Fuel Conversion Processes**

Keywords: "Viscosity, *Density(Mass/volume), Ther- mochemical properties, Organic compounds, Xylene, Thio- phylene, Quinoline, Cresols, Reprints, *Coal liquefac- tion, Naphthalene/methyl, Tetrahydronaphthalene, Coal liquids."

Experimental measurements are presented for the density and viscosity of selected organic compounds and mixtures at ambient pressure (0.003 M Pa) and temperatures of 298, 318, 338, and 358 K. The compounds studied were decalin, 1-methyl-naphthalene, tetrahydrofluoran, thiophene, quino- line 2.6-tudine, and m-cresol. Measurements were also made on three mixtures of the compounds decalin, 1-methyl-naphthalene, tetrahydronaphthalene, and m- cresol. The experimental results are compared with predictions made using a modified corresponding state procedure called TRAPP. The density predictions for the individual compounds and mixtures are good in all cases. For the viscosity, however, the predictions are in reasonable agreement with experiment only for nonassociating compounds and mixtures at reduced densities less than 3. These results suggest that TRAPP is a fairly useful as a screening tool to distinguish between nonassociating and highly associating mixtures. Such a test would be extremely useful when dealing with mixtures of unknown composition, such as coal liquids.

**Fuels**


Keywords: "Thermophysical properties, *Gas industry, Gases, Liquids, Fuels, Technology, Natural gas, Lique- fied natural gas, Coal, Heavy oils, Bituminous sands, Thermodynamic properties, Chemical feedstocks, Synthetic fuels."

To provide the gas and related industries with a data base and procedures to predict the thermophysical properties of gases and liquids.


Keywords: "Flammable liquids, *Burning rate, Jet engine fuels, Predictions, Flame propagation, *Pool fires."

Data for predicting the burning rate and heat output of large pool fires (Diameter greater or equal to 0.2 m) are compiled and evaluated. Attention is also focused on areas where further research is most needed in order to improve predictability.


Keywords: "Liquefied natural gas, Chemical proper- ties, Reviews, Physical properties, Technology, Measure- ment instrumentation, Tables/Data."

Results of National Bureau of Standards (NBS) research programs concerning Liquefied Natural Gas (LNG) are presented and reviewed. In addition to previously reported information on LNG materials and fluids property data in graphic format, these more recent programs provide information on combustion and properties of the LNG components and mixtures for molecular weights of methane through the hexanes, real gas mixture densities, both measured and calculat- ed as a function of temperature, pressure, and composition. The physical properties correlations, tabulations, and equations of state. The metrology of custody transfer is presented in context of previ- ous work on instrumentation, ship and tank storage and loading flowmeters. The measurement processes are examined for accuracy and precision. Propagation of error is presented with sample calcula- tions for the various custody transfer situa- tions such as ship tank unloading, pipeline flowme- tering, shore tank storage and vaporization and gas flow measurements.


Keywords: "Laboratory equipment, *Atmosphere control, Coal, Recirculating system, Reprints, *Controlled atmosphere chamber, Glove box."

The recent availability of premium coal samples makes it desirable to have the capability for working with these materials, in one's own laboratory, in an atmos- phere which can be controlled. A controlled-atmosphere chamber, large enough to allow for processing samples yet small enough to fit easily in an ordinary laboratory, has been designed and fabricated. The overall cost of the controlled-atmosphere chamber was competitive with commercially available systems. The major advantages of the specific system include: convenient size and reversible design for use in a limited work space, incorporation of a full vacuum an- tichamber that minimizes loss of the working chamber purified atmosphere, and a recirculating system with a bypass valve arrangement allowing separate or com- bined operation of oxygen and moisture removal sys- tems. The design features were combined to create a unique apparatus capable of both the specific use for which it was intended and general controlled-atmos- phere chamber applications. Complete modular- design would allow the chambers to be purchased from commercial vendors; however, it still would have been necessary to custom fabricate both the antichamber and recirculation system to meet the require- ments of the anticipated experimental work.


Keywords: "Coal, Aggregates, Density functions, Density(Mass/volume), Thermodynamic properties, Gels. Reprints."

Coal is a sedimentary, organic *rock* which is almost never in a state of thermal equilibrium. Because of its importance, the thermal properties of this ill-character- ized substance are of great interest. Recent work has shown that coal has many of the characteristics of a gel-like substance. The present work has made this observation the basis for a model study of the thermal properties of a gel system, using the equation-of-motion method to determine the equations of state for the system and, thereby, its heat capacity. The model has one of the essential features of a model of coal, namely, a porous structure. With a hard gel-like material as our lattice as the basis for our gel, we have calculated the frequency spectrum for several particle densities.

600.893 PB86-208493 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Thermodynamics Div. Physical Properties of Pure Components of Natural Gas.


Keywords: "Natural gas, Physical properties, Combustion. Reprints."

The principal physical properties of components of natural gas that are of importance to the gas industry are those related to heating value and to volume. New recommendations for the heating values and molar volumes of components of natural gas and for their molar properties are reported. These are based on a re-assessment of the available experimental data.


Keywords: "Liquefied natural gas, *Density(Mass/ volume), Densimeters, Standard reference materials, Numerical solution."

Work has been carried out over the past ten years at the National Bureau of Standards to provide alternate methods for the accurate determination of the density of liquefied natural gas (LNG) that would serve as a basis for equitable custody transfer. A magnetic sus- pension densimeter was used to obtain density data for LNG components and their mixtures with a total un- certainty in density of less than 0.1%. These data were used to optimize and test mathematical models for LNG density calculations. Four mathematical models for the calculation of LNG densities have been opti- mized, tested, and compared.


Keywords: "Liquefied natural gas, Density(Mass/ volume), Measurement, Instruments, Data."

The LNG Measurement Manual will provide measure- ment engineers and others with a source of critically
evaluated basic physical property data, a description of recent relevant measurement research and detailed examples of several means of standardizing the quantity and quality of liquefied natural gas (LNG) as a commercial commodity at the custody transfer point of sale. The thermodynamics of the manual are edited condensations of published research on properties and measurement processes.


Keywords: Carbon dioxide, Equations of state, Mathematical models, Thermophysical properties, Reprints, Enhanced oil recovery.

Enhanced oil recovery using carbon dioxide and associated carbon dioxide pipeline and gas processing interests have generated a great demand for accurate thermophysical property data for systems containing CO2. In an attempt to meet these demands, an experimental measurement and model development program has been undertaken at the National Bureau of Standards (NBS) to determine the properties of pure carbon dioxide and CO2 rich mixtures. The entire fluid range of conditions has been studied in the work but special attention has been paid to single phase properties such as densities and enthalpies in the near but supercritical region. In the report, a new equation of state for pure carbon dioxide and an accurate equation of state model for CO2 rich mixtures will be discussed.


Keywords: Viscosity, Gases, Density (Mass/Volume), Temperature, Reprints, Compressed gases.

Recent measurements of the dynamic shear viscosity of compressed and liquefied hydrocarbon gases are compared with a global extended corresponding states model. At densities above less than 2.5 rho sub cr, the measurements and model generally differ by less than 7%. At higher densities, however, the differences are substantial and some of the differences increase with increasing density. Our data for liquid isobutane are satisfactorily correlated by using the Hildebrand equation. A good correlation was found between the fluidity (viscosity) of the liquids examined and their mean molecular radius of gyration.


Keywords: Gas flow, Orifice meters, Flowmeters, Laboratories, Flow measurement, Experimental data, Mass flow, Pipes, Comparisons, Data bases, European economic community.

Recent developments in the multi-year gas flow measurement include new experimental volumetric meter coefficient data, an archival orifice meter data base, an interlaboratory comparison with flow facilities in the European Economic Community (EEC), and tests on five flow conditioners. The current status of these tasks is described and some examples are presented that may be useful in future revisions of the orifice flow measurement standard.


Keywords: Sulfur, Chlorine, Separation, Calorimetry, Calorific value, Reprints, "Refused derived fuels, Municipal solid wastes.

The combustible fraction was separated from a municipal solid waste (MSW) sample from New Castle County, Delaware at the Bureau of Mines (Bureau) pilot resource recovery plant in College Park, Maryland. The combustible fraction was collected at seven points after various stages of processing through air classifiers and trommels. The calorific value, moisture, ash, sulfur and chlorine contents were measured by NBS and Bureau laboratories and the results analyzed to determine if these properties were characteristic of or altered by a type of processing that the refuse-derived fuel (RDF) had undergone. The NBS analysis concluded that some of the RDF properties are characteristic of or altered by the type of processing that the RDF undergoes. Air classifiers were very effective in separating the light components of RDF (i.e., paper and plastic films) from the heavier components of RDF. A trommel in the RDF solution scheme moves some of the undesirable characteristics of RDF, namely, the non-combustible, sulfur and chlorine containing components of RDF.


Keywords: Natural gas, Moisture content, Hydrogen sulfide, Concentration (Composition), Compressibility, Handbooks, Measuring instruments.

A Natural Gas Handbook has been prepared to help Air Force BCE personnel better understand the principles of metering and some natural gas on energy content basis. The various aspects of natural gas such as heating value, moisture content, and hydrogen sulfide content are discussed. The characteristics of the various types of meters currently used for flow measurements are given. The correct procedures for calculating the utility rates by using the necessity for correlation equations, are presented. The responsibility of the gas utility to periodically check the gas meter and instrument accuracy is discussed. A discussion of a situation that should appear on the gas utility bill is given, and the various methods of selling natural gas are discussed.


Keywords: Heating equipment, Time lag, Delay circuits, Residential buildings, Reprints, Stack Damper. Computer procedures were developed for modeling stack dampers with delayed operation between burners shut-off and damper closure. Correction factors for the time delay have been obtained and a quantitative theoretical rationale is used to evaluate the effect of the time delay on the seasonal efficiency of fossil fuel-fired residential heating equipment. Finally, an implementation of a time-delaying damper was installed and this rational into the existing DoE's furnace/boiler seasonal efficiency test and evaluation procedure.


Keywords: Fire protection, Radiant heat, Stoves, Chimneys, Ceiling (Architecture), Walls, Building codes, Reprints, Radiant heat transfer. An evaluation was made of the effects of radiant heat transfer from hot stove and chimney pipes to unprotected and protected room walls and ceilings. Pipe surface temperatures were 350 degrees C (662 degrees F) for the unprotected operation and 400-450 C (752-842 degrees F) to simulate overfire conditions. Recommendations for model building code specifications for wall and ceiling protection are provided.

ENERGY  Heating & Cooling Systems


Six test buildings were extensively instrumented for measuring heating loads and indoor comfort. These test buildings were exposed to a winter heating season and an intermediate heating season. During the winter season, when some space heating was supplied each hour of test, measured heating loads were predicted with a steady-state heat transfer model which did not include the effect of thermal mass. The indoor comfort was not affected by wall mass. During the intermediate heating season, when the indoor temperatures floated above the thermostat set temperatures during winter days, a significant thermal mass effect was observed. Heavyweight buildings were observed to conserve less heating energy than comparable lightweight buildings having equivalent wall thermal resistance. The effect was greatest when wall mass was positioned inside as opposed to outside wall insulation. Wall mass was observed to reduce considerably overheating during warm days, and thereby produce more comfortable indoor conditions.

600.907
PB86-217104
PC A03/MF A01
Sponsored by Department of Energy, Washington, DC., and Civil Engineering Lab. (Navy), Port Hueneme, CA.


Software is an important component of building energy management and control systems (EMCS). The National Bureau of Standards developed and documented eight public domain EMCS supervisory control algorithms. The testing and validation of these eight algorithms are described in the report. The algorithms tested cover dry bulb and enthalpy economizer cycles, optimum and scheduled start/stop, duty cycling, demand limiting, outside air supply air reset, and demand supply air reset.

600.908
PB86-247871
PC A03/MF A01
Prepared in cooperation with Maryland Univ., College Park. Dept. of Mechanical Engineering.

Keywords: *Evaporative cooling, *Evaporation, Surfaces, Thermal conductivity, Sprinkler systems, Sprayers, *Water droplet.

A model is presented that predicts major features of the evaporation of water droplets deposited on a hot non-porous solid surface. In the temperature range of interest, nucleate boiling heat transfer is fully suppressed, hence the model is only concerned with the evaporative process. In the model, the solid material is assumed to be a high thermal conductivity, diffusivity, so that the surface temperature under the water droplet can be considered uniform. The temperature of the portion of a larger solid surface covered by the liquid is calculated from the classic solution for contact temperature between two semi-infinite bodies.

600.909
PB87-108619
Not available NTIS


The general principle of a simplified energy analysis procedure suitable for use in a small engineering office with a desk-top or pocket calculator is developed for building energy conservation standards application. The procedure is based upon ASHRAE cooling load factor techniques for the load calculation, and standard meteorologic heat balances for the HVAC system analysis and seasonal efficiency of equipment performance (which is found in the REAP methodology). The methodology is illustrated for an office building with a VAV air distribution system connected to a centrifugal chiller and hot water boiler.

Two classes of hydrated inorganic salts have been studied to assess their potential as materials for passive solar energy storage. These classes of salt are typified by ettringite, a trisulfated salt, and Friedel’s salt, a monosulfated salt, both of which are typically found in Portland cement and concrete. These trisulfated salts were studied to assess their potential for latent heat storage, utilizing a low-temperature dehydrogenation reaction. Both classes were studied to assess their potential for sensible heat storage. Preliminary experiments indicate the dehydration of the trisulfated salts is reversible, though additional tests are required. The thermal data demonstrate that the trisulfated salts have potential as latent heat storage materials and both classes of salts have potential as sensible heat storage materials. Furthermore, it is noted that the materials may be contained in conventional Portland cement concrete, making them particularly attractive for thermal energy storage.

Solar Energy

600.913
PB86-199965
Not available NTIS


The National Bureau of Standards Passive Solar Test Building, constructed under the sponsorship of the U.S. Department of Energy, has been operational since October 1981. The building has been constructed for the purpose of acquiring class A performance monitoring data for various passive systems under different experimental conditions. The report briefly describes the test building, instrumentation and data acquisition system, continuous air infiltration monitoring system and experimental work conducted in fiscal year 1983. The report contains representative data, and briefly describes the research activities planned for the future.

600.914
PB86-201282
PC A03/MF A01

L. Strubbe, and P. Brown. Apr 86, 71p NBSIR-86/3325

Keywords: *Energy storage, Solar energy, Inorganic salts, Dehydration, Specific heat, Passive systems, Sensible heat storage.

Two classes of hydrated inorganic salts have been studied to assess their potential as materials for passive solar energy storage. The materials are part of the quaternary system CaO-Al2O3-SiO2-H2O and related chemical systems, and the two classes are typified by ettringite, a trisulfated salt, and Friedel’s salt, a monosulfated salt. The trisulfated salts were studied for their possible application in latent heat storage, utilizing a low-temperature dehydrogenation reaction, and both classes were studied for their application in sensible heat storage. The materials have been synthesized, characterized by several analytical techniques, and thermal properties measured. The results demonstrate that the high latent heats of the trisulfated salts vary somewhat with chemical composition, with the temperature of the onset of dehydration ranging from 100°C for ettringite to 200°C for Friedel’s salt, and enthalpy changes on dehyrating from 80 to 250 cal/g for the trisulfated phases 0.23 and 0.28 cal/g for the monosulfated phases.

Sponsored by Department of Energy, Washington, DC.

PB87-108650 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.


G. T. Sav, R. T. Ruegg, and J. W. Powell. Jun 81, 8p
Contract DOE-EG-77-C01-0402
Sponsored by Department of Energy, Washington, DC.

PB87-109476 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.


W. L. Warnick, and J. E. HILL. Feb 80, 6p

PB87-118089 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.


J. E. Braun, and A. H. Fanney. 1983, 6p
Sponsored by Department of Energy, Washington, DC.

PB90-125381 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.

The design and performance of thermosiphon systems for a variety of conditions.

PB92-116874 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.


A. H. Fanney, and C. P. Terlizzi. 1985, 14p
Sponsored by Department of Energy, Washington, DC.

PB87-206364 PC A03/MF A01 National Bureau of Standards, Gaithersburg, MD.

600.928 
PB86-206338 
(Order as PB86-206338, PC A04/MF A01) National Bureau of Standards, Gaithersburg, MD. Interlaboratory Test of pH Measurements in Rainwater, W. F. Koch, G. Marinenko, and R. C. Paule. 23 Oct 85, 10p. Included in Jnl. of Research of the National Bureau of Standards, v91 n1 p17-22 Jan-Feb 86.

Keywords: *pH*, *Acidity*, *Rain, Electrodes, Measurement, Reliability, Trends*, *Rainwater*, *Acid rain*. An interlaboratory test of pH measurements in rainwater has been conducted. Various types of electrodes and pH measurement devices were used in the test. The results of the exercise verify that there are significant differences in the pH values of low ion strength solutions reported by various laboratories.

600.928 
PB86-206414 

Keywords: *Acidity*, *Rain, pH, Chemical analysis, Statistical analysis, Standard reference material, Rainwater*. The paper describes the development of Standard Reference Material, SRM 2694, "Simulated Rainwater", intended to aid in the analysis of acidic rainfall. Details of the formulation and preparation of the two levels of solutions (2694-I and 2694-II) are given. The 10 analytical techniques used to measure the 12 components in the solutions are described in brief.

600.929 
PB86-210585 

Keywords: *Smoke, Air pollution control*, *Air pollution, Smoke control*, *Veterans administration hospitals*. The Veterans Administration (VA) has sponsored a project at the Center for Fire Research of the National Bureau of Standards to study smoke control in VA hospitals. The system approaches methods of acceptance testing. The report presents general background information that is believed to be of interest to those involved with design, construction, and acceptance testing of smoke control systems. The performance requirements of smoke control systems for VA hospitals are discussed. The results of field tests at five VA hospitals is presented and discussed. Based on the information gained from the field tests and the background information, different approaches to smoke control are discussed. The report also contains a list of acceptability criteria.

600.930 
PB86-247483 

Keywords: *Acidity, Rain, pH, Chemical analysis, Statistical analysis, Standard reference material, Rainwater*. The report describes the development, preparation, analysis, and certification of Standard Reference Material, SRM 2694, Simulated Rainwater, intended to aid in the analysis of acidic rainfall. Details of the formulation and preparation of the two levels of solutions (2694-I and 2694-II) are given, as well as those of the precursor to the SRM, namely Research Material, RM 8409, Simulated Rainwater. The analytical techniques used to measure the twelve components in the solutions are described in detail. The data used in the statistical evaluation of the results are summarized and the recommended values for pH, specific conductance, acidity, fluoride, chloride, nitrate, sulfate, sodium, potassium, ammonium, calcium, and magnesium are tabulated. The recommended values for SRM 2694 are given, as well as those of the precursor to the SRM, namely Research Material, RM 8409, Simulated Rainwater. The analytical techniques used to measure the twelve components in the solutions are described in detail.
noise control is not necessary to utilize the methodologi- 

Radiation Pollution & Control

600,934
PB86-139301 Not available NTIS
National Bureau of Standards (NLML), Gaithersburg, MD. Inorganic Analytical Research Div.

Determination of Iodine-129 at Natural Levels by 
Thermal Neutron Activation Analysis

Final rep.
G. J. Lutz, H. L. Rook, and R. M. Lindstrom. 1984, 1p

Keywords: *Radioactive contaminants, *Radioactivation 
analysis, Reprints, *Iodine 129, *Activation analy-

Solid Wastes Pollution & Control

600,535
AD-A139 213/3 PC A06/MF A01
National Bureau of Standards (NLML), Washington, DC.
Chemical Kinetics Div.

Combustion Technology for Incinerating Wastes 
from Air Force Industrial Processes.

Final rep. Jun 81-Jun 83
W. M. Shal, and W. Tsang. Feb 84, 121p AFESC/ 
ESL-TR-83-14
Contract MIPR-N-8146


Air Force bases, particularly Air Logistics Centers, gen-
erate significant amounts of process wastes from a va-

The National Bureau of Standards/ Gaithersburg, MD.

Biological Mediation of Marine Metal Cycles: The Case of Methyl Iodide.

Final rep.
F. E. Brinkman, G. J. Olson, and J. S. Thayer. 1985, 12p
Pub. in Marine Estuarine Geochemistry, p227-238 1985.

Keywords: *Water pollution, Sulphur organic com-

Exocellular biogenic metabolites solubilize and methyl-
ate heavy metals and may be important in global metal 
cycling. The authors found that methyl iodide, ubiqui-
tous in marine environments, though its biogeochemical 
poorly understood, solubilizes bulk metals and refrac-
tory binary and ternary metal sulfides, possibly repre-

600,939
PB87-131421 Not available NTIS
National Bureau of Standards (NLML), Gaithersburg, MD. Molecular Spectroscopy Div.

Resistance to Standards Development.

Final rep.
W. H. Kirchhoff, 1984, 3p
Pub. in ASTM (American Society for Testing and Mate-

Keywords: *Standards, Resistance, Reprints, *Envi-

In the recent years, the American Society for Testing 
and Materials, ASTM, has experienced rapid growth 
in standards writing activities related to environmental 
assessment. The growth has brought into the mem-

Health Care

600,940
PB87-117929 Not available NTIS

Assessing the Costs of Fire Protection in Health Care Facilities.

Final rep.
R. E. Chapman, 1985, 11p
Pub. in Fire Safety Jnl. 9, n6 p221-231 Jul 85.

Keywords: *Fire protection, *Health facilities, *Cost estimates, Reprints.

The identification of cost-effective levels of fire safety 
in health care facilities is a major concern to hospital 
admirators, fire safety engineers, and public policy-
makers. Rising construction and operating costs cou-
pied with more stringent building codes and continuing 
advances in medical and building technology have com-

Industrial & Mechanical Engineering

600,941
PB86-193059 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.

Environmental Engineering

600,941
PB86-193059 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.

Environmental Engineering
Industrial Safety Engineering


Keywords: *Fire safety, Artificial intelligence, Computer programs, Fire hazards.*

The Fire Research (CFR) has a long-term project to develop expert systems as a technology transfer tool. This is an educational aspect of the project to develop a computer program which will make an expert estimate of the fire safety of a building based on CFR's deterministic physical models, technical data, and the expert judgement of its staff. 600.946


Keywords: *Fire design theory, Buoyancy, Conv., Fire, Enclosures, Reprints, Fire studies.*

The paper studies the significance of a wall effect that has been observed during the propagation of enclosure fires. Relative to the two-layer phenomenon which tends to develop during such fires, the effect has been observed to be more pronounced in the upper layer gases than a relatively cool uncontaminated lower layer. It is conjectured that these observed upper layer buoyant flows involve the development of thermals because of the relatively cool temperatures of the upper wall whose surfaces are in contact with the hot layer. The results of the analysis indicate the importance of taking the wall effect into account in two-layer zonal analyses of enclosure fire phenomena. 600.949


Keywords: *Models, Test models, Fire, Fire smoke, Smoke, Enclosures, Fire models, Compartment fires.*

Salt water modeling is used to study fire-induced flows in multicompartments structures. Scaling laws relating salt water flows and hot gas flows are developed. Results from the scaled-scale salt water simulations of fire-induced flows in a single-story multroom structure are shown to be in good agreement with available full-scale data. The model has been tested in a 1/20 scale model of a U.S. Navy ship to demonstrate the feasibility of using the technique to study hot gas flows in compartmented structures too complex to study economically by other means. 600.950

PB86-193817 PC A03/MF A01 National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research. Fire research Public: Buoyancy, Enclosures, Fire models. *Fire Research Publications, 1985* is a supplement to previous editions: Earlier editions, i.e., 1968-1979, are also available in the National Technical Information Service (NTIS). Only publications prepared by members of the Center for Fire Research (CFR), by other National Bureau of Standards (NBS) personnel for CFR, or by external laboratories under contract or grant from the CFR are cited. 600.951

PB86-20582PC A04/MF A01 National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research. Missing some headings. Please verify if the text is correct.
Keywords: "Fire detection systems, *Buildings, Fire damage, Fire protection, Fire resistance, Data, Computer programs, Computer applications."

The report presents a methodology for evaluating heat detection systems installed in buildings. Previous work for use primarily in designing new thermal fire detection systems was used as a starting point. The previous work was enhanced and supplemented to make it more useful for evaluating existing systems. The resulting equations were programmed into a user interactive computer program. The program is available in both BASIC and FORTRAN and will run on mainframes as well as personal computers. In addition, a modified version of the FORTRAN program was used to develop an extensive set of tables listing detector activation times for given building geometries, detector characteristics, and fire growth rates. These tables should be useful for quick evaluation of alternative heat detector installations. Finally, practical examples are included to illustrate the use of the tables and computer programs.

PB86-210002 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD, Center for Fire Research. Use of Fire Statistics in Assessing the Fire Risk of Products.
Keywords: "Statistical analysis, *Curves, Fire tests, Fire hazards, "Fire protection.""

In assessing the fire risk of one or more specific products, fire incidence statistics provide an important base line measure of the extent of fire losses, and of the principal causative factors, including sources of ignition and the effects of occupancy and fire protective measures. Normalizing the incidence data in terms of the exposure time, the available exposed area of the product, and the number of persons at risk may permit more meaningful comparisons to be made. Analysis of the likelihood of fire propagation from ignition to an ultimate injury or loss provides insights into the fire resistance factors important in laboratory evaluation of a product.

Keywords: "Construction, *Nets, Safety engineering, Requirements, Regulations, Tests, Test methods, models, Guidelines, Failing bodies, "Occupational safety and health."

Current construction-site safety net regulations set limits on the maximum horizontal projection of perimeter nets and the maximum vertical distance between an elevated working surface and the net below. These limitations were arbitrarily established as no actual or simulated fall data existed. The adequacy of these requirements in ensuring construction worker safety has been questioned. To provide a test program was carried out to determine the adequacy of existing regulations. Simulated fall tests were conducted using anthropomorphic dummies to represent falling workers. Results are presented to show the trajectory of the falling body and the maximum horizontal distance in the final landing position. An analytical model was developed to simulate a falling worker. The model can be used to predict trajectories for a given set of initial conditions including worker height and weight, departure horizontal velocity, and fall height. Guidelines are presented for revising existing regulations pertaining to the dimensional requirements for perimeter nets.

Keywords: "Fire safety, *Fire protection, *Evacuating(Traansportation), Building codes, Fire detection systems."

Fire safety requirements are being developed for buildings housing disabled people including the mentally retarded. Some disabled people can escape a building rapidly without assistance while others need someone to assist them. A test program was carried out to build the building when the disabled residents require assistance to evacuate. A procedure has been developed to evaluate the difficulties of evacuating residences housing disabled people. The measure is used to determine the fire safety protection features needed to be built into the building, the greater the evacuation difficulty, the more fire protection features are required.

Keywords: "*Fire investigation, Fire reporting, Fire studies."

Progress made on several fronts in the area of fire investigation in the U.S. in recent years is discussed. Improvements in both the quantity and quality of U.S. Fire Investigations is referenced, including fire reporting, post fire interviews and special studies.

Keywords: "*Fire detection systems, *Buildings, Fire damage, Fire protection, Fire resistance, Sprinkler systems, Fire safety, Fire alarm systems."

The report presents a methodology for evaluating heat detection systems installed in buildings. Previous work for use primarily in designing new thermal fire detection systems was used as a starting point. The previous work was enhanced and supplemented to make it more useful for evaluating existing systems.

Keywords: Fire tests, Combustion products, Smoke, *Fire studies, Compartment fires, Fire investigations, Room fires.

A user-oriented computer program which carries out the required simulations and provides estimates for the ASET has been developed. Describes the program and its use. For fire growth in a particular fuel assemblage, a single program run can be used to evaluate the ASET from contours (which are assumed to contain the fuel assembly) of different heights and under a variety of different detection and hazard criteria.

Keywords: Fire tests, "Burning rate, Fire safety, Combustion, Fire resistance, Reprints, *Fire studies, "Pillow."

Burning rates have been determined for four common pillow types and one of newer design, intended to be especially fire resistant. One replicate test was run and showed satisfactory reproducibility. The order of performance, best to worst, was: fiberglass covered with fiberglass cover; feathers; fiberglass (ordinary construction); polyurethane foam; latex foam.

INDUSTRIAL & MECHANICAL ENGINEERING

Industrial Safety Engineering

Keywords: *Protective clothing, Fire resistant textiles, Fire protection, Clothing, Reprints, Fire fighters.

Principles of protection afforded by clothing in fire situations are reviewed briefly. Several examples of measurements of heat protective properties are given. Materials considered are single layers of fabrics appropriate for work uniforms, the same type of fabric combined with four popular underwear fabrics, and typical fire fighters' turnout coats assemblies, consisting of a shell fabric, vapor barrier, and thermal barrier.

300.966
Keywords: *Fire protection, Fire tests, Housing, Research management, Reprints.

The CFR research program is designed to provide powerful new capabilities for reducing fire losses and the costs of fire protection. It is based on an analysis of our own capabilities and a complex array of factors in the environment external to the Center for Fire Research. It represents a significant departure from the more conservative course of incremental improvement in those traditional practices for fire protection which have no basis in scientific fact. The course raises a number of issues. Four have been evoked out: the need for a viable community of private and public sector researchers; departure from dependence on traditional practices; the need for new institutional mechanisms; and a directed assault on the toughest area of fire loss, in particular, existing residential occupancies. This paper discusses the most expedient of the four possibilities. The easiest course for us to follow. However, it is the one the Congress assigned us nearly a decade ago. Experience today affirms it remains the right one.

300.967
Keywords: *Extinguishing, Evaporative cooling, Aluminum, Dips(Liquids), Fire safety, Reprints.

The thermal behavior of a hot surface subjected to a cold liquid droplet management and evaporation was investigated using a heated aluminum block, and deionized and degassed water. Evaporation times and droplet radii on the aluminum surface were measured. A thermal conduction model for the cooling of the aluminum was coded to determine radial and in-depth transient temperatures in the area of the evaporating droplet.

300.968
Pub. in American Society for Testing and Materials Standardization News 14, p938-40 Sep 86.
Keywords: *Fire safety, *Mathematical models, Combustion, Heat transfer, Fluid flow, Reprints.

Recent rapid advances in the development of fire modeling techniques and recognition of their potential uses in fire safety have suggested a role for ASTM. The mathematical representation of the fire growth process and its effect on materials and people according to the appropriate mass and energy relationships of combustion, heat transfer, and fluid flow is fire modeling. The following examines the history and current role in fire modeling.

300.969
Keywords: *Calorimeters, *Fire detectors, Heat measurement, Ignition tests, Reprints, Toxic gas production.

The rate of heat release is probably the single most important measure of fire hazard. For fire testing purposes, the scale required even for bench-scale tests is large enough to have precluded affordable, yet competent calorimeters, having small, well-characterized errors. The application of the oxygen consumption principle has now permitted a new generation of heat release measurement apparatuses to be developed for fire testing purposes. The Cone Calorimeter was also seen as a suitable combustor to be used in making other fire hazard measurements. Thus, techniques of ignition, smoke obscuration, soot production, and the generation of toxic gas species. The prototype of flame spread behavior may be simultaneously obtained.

300.970
Keywords: *Extinguishing, *Evaporative cooling, Aluminum, Dips(Liquids), Fire safety, Computerized simulation, Metal plates.

The thermal behavior of a hot aluminum surface subjected to cold water droplet impingement is investigated. Evaporation phenomena of a single droplet of pure water is studied for initial surface temperature ranging from 75 to 100 deg C (implying full suppression of nucleate boiling). The effect of droplet release height, initial surface temperature and, droplet volume on the geometrical configuration of the droplet is investigated. A computer model is developed to predict the cooking effect (volume of influence) induced by a single droplet in contact with the hot surface, using finite difference techniques. A model to predict the evaporation of a single droplet dispersed on a hot non-porous solid surface is derived. The water-vapor molar fraction in the air at the exposed surface of the water droplets is calculated by the coupled heat and mass transfer energy balance. Spatial and temporal integration of the overall droplet energy equation is used to predict the droplet evaporation time and the instantaneous evaporation rate. Model predictions agree well with experiments. The model is used to quantify spatial and temporal heat fluxes distribution at the exposed surface of the water droplet. The volume of influence is found to correlate linearly with the evaporation time. This funding is particular important in light of the modeling of multi-droplets cooling effect.

Laboratory & Test Facilities

300.971
Keywords: *Photometry, Luminance, Brightness, Color, Reprints.
The principle of time-resolved magnetic dispersion of ions can be used to improve the abundance sensitivity for elemental ratio measurement with laser ionization. A pulsed laser tuned to a discrete electronic transition of an element efficiently and selectively produces a pulsed ion beam. The pulsed ion beam is focused through a magnetic sector and, thus, mass filtering due to time-of-flight dispersion and magnetic dispersion is combined. The time-resolved magnetic dispersion is demonstrated using rhenium. The origin of scattered ions which cause loss of abundance sensitivity is displayed in the magnetic field-time plane. Increased abundance sensitivity is demonstrated using tantalum.

Machine Representation of Standards

Machine Representation of Standards

No abstract available.

PB87-112298

Keywords: *Measurement, *Semiconductor devices, Bibliographies, Metrology, Gallium arsenides, Insulation, Interfaces, Integrated circuits, Packaging, National Bureau of Standards, Listings

The bibliography contains reports of work performed at the National Bureau of Standards in the field of Semiconductor Measurement Technology in the period from 1962 through December 1985.

PB87-113593
NBS National Bureau of Standards (NBS), Gaithersburg, MD. Center for Mg. Engineering. Pulsed Laser Caliper for Noncontact Dimensional Measurement


Keywords: *Dimensional measurement, Optical equipment, *Reprints, *Laser applications, Noncontact measurement

A new optical device for making caliperlike noncontact dimensional measurements on macroscopic objects is described. The device called a pulsed laser caliper, consists of a picosecond pulse laser, an ultrafast detector, various optical components, and a time-interval counter or high-speed sampling oscilloscope. Basically, a dimensional measurement is made by determining the time-of-flight difference between a reference laser pulse and another pulse which reflects off both sides of an object. Accuracy and limitations of the device are discussed briefly. Experimental results using a mode-locked argon laser and a sampling oscilloscope for pulse timing gave an accuracy of 0.0075 cm in dimensional measurements of five gauge blocks with lengths from 1.9 to 10.2 cm.

PB87-116091
NBS National Bureau of Standards (NBS), Gaithersburg, MD. Automated Production Technology Div. Force Calibration at the National Bureau of Standards

Final rep., R. A. Mitchell. Aug 86, 30p NBS/TN-1227 also available from Sup't of Docs as SN003-003-02755-3

Keywords: *Loads(Forces), *Calibrating, Measurement, National Bureau of Standards

Force calibration and force measurement services available at the National Bureau of Standards (NBS) are described. Direct deadweight calibration of force sensors are performed in both compression and tension up to 1 million lbf (4.4 MN). Comparison calibrations relative to force sensor transfer standards are performed in compression up to 12 million lbf (53 MN). In order to perform force calibrations, the following tests are performed to further characterize force sensors: temperature sensitivity, pressure sensitivity, creep, and eccentric load sensitivity.

PB87-118154
NBS National Bureau of Standards (NBS), Gaithersburg, MD. Electricity Div. Economy Representation of Standards

No available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Center for Building Technology.

The bibliography contains reports of work performed at the National Bureau of Standards in the field of Semiconductor Measurement Technology in the period from 1962 through December 1985.
INDUSTRIAL & MECHANICAL ENGINEERING

Labaratory & Test Facilities

High-Accuracy Automated Resistance Bridge for Measuring Quantum Hall Devices.
Keywords: *Resistance bridges, Hall effect, Measurment, Accuracy, Semiconductor devices, Comparison, Electrical resistance, Reprints.

An automated resistance bridge has been constructed specifically to measure the Hall resistance of semiconductor devices which exhibit the quantum Hall effect. The bridge is used to perform a one-to-one comparison of the Hall resistance to a reference resistor of similar value. A measurement accuracy of 0.01 ppm or better is expected.

600.583
Keywords: *Voltage measuring instruments, Calibrating, Accuracy, Voltmeters, Standards, Direct current, Reprints.

An automated measuring system has been developed for calibrating arbitrary-voltage references in the range one to ten volts, with an inherent measurement accuracy of 0.2 to 0.02 ppm (3 sigma). The paper discusses the design and uncertainty analysis of the system and presents data obtained on an available Zener voltage reference.

600.584
Keywords: *Metrology, *Optical measuring instruments, Calibrating, Machine tools, Reprints.

The authors describe techniques used to measure straightness errors of precision machines. These measurements employ a dimensionally stable mechanical reference surface which is sampled with a laser interferometer - hence the term optical straightedge. The figure error of the reference surface and the straightness error motion of a coordinate measuring machine carriage in a horizontal plane are each measured with an estimated accuracy of 0.5 microns (13 nm) over 40 inches (1m) of travel. When measuring straightness error in a vertical plane, the optical straightedge is deformed by gravitational forces. The authors use a computational algorithm, based upon simple beam theory, to correct straightness data for this distortion.

600.525

Reports by the several standing and annual committees of the Conference comprise the major portion of the publication. Included also are papers presented by Conference officials and others. Major issues discussed at the Conference included the National Type Evaluation Program, the National Training Program, compliance test methods for products subject to moisture loss, an electronic bulletin board, new methods of sale, electromagnetic interference on weights and measures devices.

600.596
Keywords: *Pressure measurement, Comparison, Reprints, High pressure.

An international intercomparison in the pressure range 20 - 100 MPa has been organized under the auspices of the International Bureau of Weights and Measures. Given here is a brief outline of the results of the first three phases in which the national standards laboratories of France, Italy, the United Kingdoms, the United States of America and West Germany participated. These results show good agreement when considered in conjunction with the estimates of the uncertainty of measurement.

600.597
Keywords: *Standards, *Humidity, Moisture meters, Accuracy, Hygrometers, Chemical analysis.

The paper summarizes the activities in humidity standards at the National Bureau of Standards (NBS). Included in the discussion will be brief descriptions of the standard hygrometer, saturation vapor pressure formulation, enhancement factors, humidity generators, secondary standards, and humidity fixed points using saturated salt solutions.

Manufacturing Processes & Materials Handling

600.906
Keywords: *Dimensional measurement, *Line width, Metal oxide transistors, Optical microscopes.

A monochromatic, waveguide model is presented which can predict the optical microscopic images of thick-layer objects including multiplier structures with sloping, curved, and undercut edges, granular structures, such as polysilicon, and asymmetric objects. The model is used to illustrate the power of line selection on the optical image. Qualitive agreement with experimental line profiles is demonstrated. Application of the model to study the effects of variations in layer thickness and edge geometry on linewidth measurements made at different stages of manufacturing an MOS device is discussed.

Electrodeposition of Nickel-Chromium Alloys.
Keywords: *Electrodeposition, Nickel alloys, Chromium alloys, Protective coatings, Wear resistance.

A process has been developed to electrodeposit nickel-chromium alloys with excellent mechanical properties. The composition of this coating can be varied from 1% to about 60% (wt) chromium by varying the deposition parameters over coatings greater than 100 micrometers have been made. Dynamic wear performance of the 20% chromium alloys is shown to be superior to electrodeposited nickel. The corrosion performance was characterized by the Potentiodynamic method. The alloy is a composition modulated material with layers rich in chromium adjacent to layers poor in chromium. The existence of layers is consistent with diffusional phenomena occurring in a two component system. These layers are thought to play a role in the corrosion performance of the coating.

Nondestructive Testing

600.990
Keywords: *Directories, *Laboratories, Test facilities, Accreditation.

The 1985-86 NVLAP Directory of Accredited Laboratories provides information on the activities of the National Bureau of Standards in administering the National Voluntary Laboratory Accreditation Program (NVLAP) during calendar year 1985. The status of current programs is briefly described and a summary of laboratory participation is provided. Indexes cross reference the laboratories by name, NVLAP Lab Code, test method, accreditation program, and geographical location and cross reference NVLAP code numbers with test method designations. The scope of accreditation of each laboratory, testing the test methods for which it is accredited, is provided along with a tabulation of test methods and the laboratories accredited for those test methods.

600.991
Keywords: *Anechoic chambers, Measurement, *Reverberation chambers, "Electromagnetic susceptibility.

The paper compares measurement results obtained using a 2.7 m x 3.1 m x 4.6 m reverberation chamber and a 4.9 m x 6.7 m x 8.5 m anechoic chamber to determine the EM susceptibility of equipment under test (EUT). The frequency range was 200 MHz - 18 GHz. The correlation factor between the two techniques appears to be directly proportional to the gain of the EUT. Four sample EUTS included in the study were a one centimeter dipole probe, a ridged horn antenna, a small rectangular TEM transmission cell with an aperture and a modified 7.0 m (27.5m) diameter folded in aircraft rocket.
600.992
Weld Flaw Sizing Using Back-Scattered and Forward-Scattered Low Frequency Ultrasound.
Final rep., R. E. Schramm, and T. A. Siewert. Nov 85, 8p Sponsore by Ames Lab. 1A.

Keywords: Ultrasonic tests, Weld defects, Transducer.

Electromagnetic-acoustic transducers (EMATs) generating low frequency ultrasound can detect and size planar flaws in welds. The back-scattered signal carries information on the through-depth flaw size. Measurements on slits in 16-mm thick steel plates indicated a sensitivity to flaw depth sizes as small as 0.5 mm. In accordance with theory, the signal saturated at about 2.5 mm. This is a very important size range for many fracture mechanics considerations, but it is desirable to extend the range to still larger flaw sizes. The report describes the simultaneous use of the forward and back-scattered signals to extend the range. Processing the signals from two receiver transducers on either side of the flaw demonstrated a sizing ability for artificial flaws up to 11-mm deep. The technique has also been successfully applied to two welded plates, each containing intentional flaws such as inadequate joint penetration and incomplete fusion. The weld flaw sizes predicted by the EMAT signals and those determined by destructive metallography agree within 1 mm.

600.992
PB86-161369 PC A09/MF A01 National Bureau of Standards, Gaithersburg, MD.

Keywords: Temperature measurement, Thermometry, Thermometers.

The manuscript develops the concept of thermometry, including historical experiments and thermodynamics, the Kelvin thermodynamic temperature scale, international practical temperature scales: the thermodynamic methods used to realize the Kelvin scale; and modern types of thermometers. Nearly 400 bibliographic references are included.

600.994

Keywords: Nondestructive tests, Standards, Composite materials, Process control, Interfaces.

A review of the Nondestructive Evaluation Program at NBS, for fiscal year 1985, is presented in the annual report.

600.995

Keywords: Metrology. Organizations, Recommendations, Standards, International relations, "Legal metrology."

The International Organization of Legal Metrology (OML) was founded in 1955 to promote intergovernmental cooperation in the field of legal metrology. The United States joined this organization in 1972 and the National Bureau of Standards was assigned the responsibility for managing the U.S. involvement in cooperation with the Department of State. The paper describes the functions of the International Conference of Legal Metrology, the International Committee of Legal Metrology, and the International Bureau of Legal Metrology. The organizational procedures for the development and approval of International Recommendations through the Plenary Session and the Report of the General Assembly are discussed. The U.S. participation and involvement in the technical programs of OML is discussed as well as the importance of both public and private sector participation in terms of the future exportation of U.S. manufactured products.

600.999

Keywords: Calibrating, National Bureau of Standards. Describe the status of efforts at NBS related to domestic and international recognition of U.S. calibration facilities.

600.997

Keywords: Nondestructive tests. Mossbauer effect, Materials tests, Reprints.

The Mossbauer effect, a nuclear-physic technique involving the emission and absorption of gamma rays without recoil, is also known as nuclear gamma-ray resonance or nuclear resonance-fluorescence. It provides information on the local atomic environment which, in turn, relates to the properties of the materials. Mossbauer studies have been applied to a wide variety of problems, including catalysis, corrosion, magnetism, atomic structure, chemical kinetics, diffusion and biology. Many nuclear isotopes can be used for Mossbauer studies, but the most common is 57 Fe. For the reasons why Mossbauer studies in ferrous metallurgy is an important application area for the Mossbauer technique.

600.999

Keywords: Nondestructive tests, Failure, Pressure vessels, Ultrasonic tests, Radiography, Inspection, Reprints.

The role of NDE in failure analysis is discussed. Some applications of the State-of-the-Art are described.

600.999

Keywords: Nondestructive tests, Electromagnetic tests, Microwaves, Scattering, Reprints.

The electromagnetic equations relevant to microwave nondestructive evaluation are given in this review of the NDE techniques and measurements in the time and frequency domain are discussed with respect to real measurement situations.

601.000

Keywords: Texture, Nondestructive tests, Materials tests, Anisotropy, Orientation, Diffraction, Reprints.

Texture is the term applied to the presence of a preferred crystallographic orientation of the crystallites (grains) in a polycrystalline material. Fibers become textured during growth or processing. Mechanical operations such as drawing, rolling or swaging induce texture. All such texturing introduces anisotropy in the mechanical properties of the aggregate which affects the response of the material during further forming, fabrication or in-service operations.

601.001

Keywords: Nondestructive tests, Materials tests, Residual stress, X-ray diffraction, Ultrasonic tests, Barkhausen effect, Neutron diffraction, Determination of stress, Reprints.

Following a brief description of the nature and the significance of residual stresses in materials, the physical bases of nondestructive methods for measuring residual stresses are presented. Principal emphases are on the conventional x-ray diffraction method and on the ultrasonic method. An approach based on Barkhausen noise analysis is briefly described. Recent research on the measurement of internal stresses by neutron diffraction and by high-energy x-ray diffraction is noted.

601.002

Keywords: Nondestructive tests, Optical tests, Surface properties, Reprints.

The review deals with optical techniques for evaluating the surface flaws and surface roughness of solids, in short, the quality of solid surfaces. The wide variety of optical NDE techniques have been grouped into four classes: imaging, scattering, diffraction, and profilometry. An illustrative example of each class is discussed and opto-acoustic NDE methods are briefly reviewed.

601.003

Keywords: Nondestructive tests, Magnetic tests, Magnetic fields, Magnetic properties, Reprints.

Magnetic methods of nondestructive evaluation utilize the relationship between magnetic properties and changes in susceptibility, magnetic permeability, magnetic induction, magnetic flux density, magnetic field strength, magnetic force, magnetic moment, and magnetization when an object is exposed to a magnetic field. Some methods are relatively inexpensive test methods. Uses include measurement of important metallurgical properties, determination of material properties, and measurement of coating thickness. This article will briefly review the properties of leakage fields and methods of their de-
Industrial & Mechanical Engineering

Nondestructive Testing

tion and the origin and measurement of magnetic properties.

601,004
PB87-104426
AC03/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD.
Center for Building Technology.
Investigation of the Use of Nondestructive Methods for Inspection of Seams of Single-Ply Roofing Membranes, W. J. Rossiter, Sep 86, 36p (NBSIR-86/3455)
Sponsored by Civil Engineering Lab.(Navy), Port Hueneme, CA.

Keywords: Roofing, Detection, Ultrasonic tests, Seams(Joints), Nondestructive tests, Inspection, Infrared thermography.

Investigations were conducted regarding the use of the ultrasonic pulse echo technique, ultrasonic time-of-flight diffraction (TOFD), and the ultrasonic pulse echo technique with the ultrasonic pulse echo method using a wheel transducer can be used as a field technique for assisting in the quality assessment of seams.

601,005
PB87-115432
Not available NTIS National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Mapping of Eddy Current Probe Fields.

Keywords: Eddy current tests, Magnetic fields, Electrical measurement, Nondestructive tests, Mapping, Probes, Eddy currents.

The magnetic fields produced by four different eddy current probe were mapped in the near field with very small (0.43 mm) dia inductive magnetic field sensors. The four eddy current probes included two nominally identical, absolute, air core probes, an absolute ferrite core probe, a reflection probe with an air core excitation coil and two counterclockwise ferrite core pickup coils. Measured fields for the air core probes are compared with values calculated from the theory of Bond and Deeds. All measurements were performed at 10 kHz; for the ferrite core probe the field intensity was also measured from 1 kHz to 100 kHz using conventional methods.

601,006
PB87-118766
Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Final rept., N. N. Hsu, and D. G. Etten, 1982, 8p.

Keywords: Signal processing, Reprints, Acoustic emission testing.

The paper addresses the problem of determining the AE source time-function from the detected AE signal with a sensor located a short distance away from the source. The solution to the problem is in the form of an inverse filter (deconvolution filter) such that the explicit waveform of the source can be obtained by passing the detected AE signal through such a filter. In other words, by removing the effects of the reverberations of the structure and the particular characteristics of the sensor, the filter recovers the AE source signature which characterizes the source mechanism alone.

601,007
PB87-122206
Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Center for MgF Engineering.
Acoustic Emission Chip-Form Monitor for Single-Point Turning.

Keywords: AE sensors, AE source characteristics, AE source signatures, AE source mechanism.

A perturbation method is described for the investigation of the propagation of Rayleigh waves on the surface of a homogeneous anisotropic initially deformed material plate. The authors derive the Rayleigh wave phase velocity as a function of the propagation direction, the elastic constants and the initial stresses. The linearity of our formulas suggests that Rayleigh waves can be conveniently used as an experimental technique for the solution of the inverse problem of determining the elastic constants and/or the initial stresses in the material. The perturbation formalism is quite general and can be applied whenever other small effects, like slight temperature changes or external magnetic fields, affect the Rayleigh wave propagation velocity.

Production Planning & Process Controls

601,011
AD-P003 180/7
Pub. in Proceedings IPAD II, Advances in Distributed Data Bases Management for CAD/CAM, National Symposium held in Denver, CO on 17-19 Apr 84, AD-A140 614, p211-227.

Keywords: Manufacturing, Automation, Research facilities, Data management, Data bases, Distributed data processing, Systems analysis, Computer architecture, Interfaces, Networks, Research management, Technology transfer, Computer aided design, Component reports, National Bureau of Standards (NBS), Distributed data dictionaries, CAM (Computer Aided Manufacturing).

The NBS(National Bureau of Standards) AMRF(Automated Manufacturing Research Facility) exemplified an approach to integrating a set of heterogeneous distributed databases. While the 1983 implementation is primitive, it provides real-time control protocols with access to conventional databases, rapidly changing memory-resident data, and large binary files. It demonstrates the feasibility of front-end existing data management systems with a data administration system implementing a common user interface, constructing process-dependent logical views of the data, and providing networked data access. The major shortcoming of the current implementation is the absence of a common data dictionary, and the major task of the near future is the development and automation of a distributed data dictionary system.

601,012
PB86-201738
Not available NTIS National Bureau of Standards, Gaithersburg, MD. Manufacturing Research Facility.
Acoustic Emission for In-Process Monitoring and Microstructure Control.

Keywords: Process control, Metal finishing, Quality control, Microstructure, Cracking/Flaking, Phase transformations, Plastic properties, Acoustic emissions, Acoustic emission testing.

Acoustic emissions are the elastic waves emitted by sudden localized changes of stress by, for example, the formation of cracks, plasticity, and phase transfor-
mations. It is beginning to be considered a potential in-process monitoring technique for quality and productivity improvements in a sensor for closed loop feed-back control systems. Applications of the technique are held back because of its complicated nature and because the signals are controlled rather subtly by microstructure. In the review the authors describe the theoretical framework that has begun to emerge and which now provides a physical understanding of acoustic emission. The authors then reconsider the results of laboratory studies and recent applications to assess, in the light of this understanding, the contribution acoustic emission methods might make toward in-process monitoring and microstructure control during metals processing.

Quality Control & Reliability

601,013
PB86-209205 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.


Keywords: "Quality assurance," Data processing, Accuracy, Quality control, Data.

The quality of data must be known and established before it can be used logically in any application. Data quality may be judged on the basis of its quantitative accuracy and on the confidence that can be placed in the qualitative identification of the parameters measured. It requires its production in a quality assurance program that permits the assignment of its statistically supported limits of uncertainty. The essential features of such a program, consisting of quality control and quality assurance techniques, are discussed in the paper.

Tooling, Machinery, & Tools

601,014
PB87-118741 Not available NTIS National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.


Keywords: "Centrifugal pumps," Cryogenics, Liquid helium, Superfluidity, Reprints.

The paper summarizes and correlates the liquid helium pump data obtained previously in two separate test programs. In normal helium the second set of data shows a large performance improvement over the first set as a result of changes in measurement methods and in the pump itself. Peak pump efficiencies of 46% were measured. The pump appeared to perform approximately the same in He I as in He II; however, the He II data are not adequate for system design or analyses. Therefore, a new pump program is planned to test the improved version of the pump in an apparatus designed specifically for He II.


Keywords: Epoxy, Epoxy cements, Temperature effects, Temperature gradients, Thermometers, Airfoils, Calibration, Cryogenics, Surface temperature, Temperature measurement.

The stability upon thermal cycling and handling of ten small, epoxy-encapsulated silicon diode thermometers at six temperatures in the range from liquid nitrogen temperatures to about 60 C. The thermal tempera-
tures of measurement were -196, -78, 0, 20, 40, and 60 C, as measured on the International Practical Tempera-
ture Scale of 1968. Diodes were to be thermal-
cyced 15 to 20 times. Since NASA anticipates that the uncertainty in their temperature measurements will be at least about 1 C, the results of the study will provide guidance on the uncertainties in the measured values when the devices are used.


Keywords: "Pressure gages, Shear stress, Pizzloelec-
tricity, Measuring," "Polyvinylidene fluoride polymers."

The construction, calibration and use of a polyvinyl-
diene fluoride (PVDF) pressure gage is described. The polymeric material, PVDF is in the form of 12 microm-
eter films with active areas 1 cm in diameter. The gage consists of two films whose active regions are laminated together face-to-face and subsequently laminated between protective layers of polycarbonate or another suitable polymeric material. Temperature compensation, provided by both active and passive tech-
niques, is described. The response of the PVDF gage to shear stresses is found to be significant but small compared to the response to an equivalent hydrostatic pressure.

601,019
PB86-162039 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.


Keywords: "Welded joints, Pipeline, Welds, defects, Crack propagation, Fracture (Mechanics)."

The significance of porosity, slag and arc burns on pipeline integrity is evaluated by assessing the probability of survival of the contributing flaw to crack initiation and to ac-
celerated crack growth during low cycle fatigue. It is found that such flaws are essentially innocuous in low cycle fatigue. The flaw size is determined by the geometric discontinuity created by the weld reinforce-
ment. It is shown that the maximum through-wall depth of the weld or porosity is limited to the depth of the weld pass in which it occurs. This provides an upper limit to flaw depth that greatly simplifies assessment flaw significance by fracture mechanics principles, should it be desired to do so. Suggestions are offered for ap-
proaches to treating the presence of blunt flaws during field inspections of pipelines.

601,020
PB86-164555 Not available NTIS National Bureau of Standards (NBL), Gaithersburg, MD. Physical Analysis Div.


Keywords: "Calibrating," "Automatic test equipment."

A model for estimating the benefits of improved ATE calibration is presented and illustrated. The benefits arise in terms of reduced probabilities of the two types of errors possible in every test situation: Con-
sumer's Loss (CL) and Producer's Loss (PL). CL is the error of an accepted bad unit under test (UUT) and PL is the probability of rejecting a good UUT. The model expresses both probabilities, CL and PL, as explicit functions of measurement bias (systematic error), represented by the mean of measurement error, and of measurement imprecision, represented by the standard deviation of measurement error. The model can directly translate any changes in bias and/or pre-
cision resulting from a calibration improvement into equivalent changes in the probabilities, CL and PL. When applied to a case study, the economic value of the improve-
ment, in terms of dollars saved per UUT tested, can be established from these probabilities.

601,021
PB86-171139 Not available NTIS National Bureau of Standards (NBL), Gaithersburg, MD. Semiconductor Electronics Div.

General

601,015
N86-291557/6 PC A05/MF A01 National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.

601,018
PB86-160579 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Poly-
mers Div.
General


Keywords: Dimensional measurement, Magnetic tapes, Calibrating. Line width.

Accurate calibration of micrometer and submicrometer optical line width filaments requires that the calibration standard match the properties of the line to be measured. The NBS photomask linewidth standard has been designed for high-magnification measurement by the integrated circuit community and are not directly suitable for use in other applications. A method of calibrating systems for measuring the width of ferrite gaps in magnetic tape heads has been developed that involves a two-step calibration using the NBS antireflecting-chromium photomask as the primary reference standard. This primary standard is used in transmitted green light to calibrate the linewidths on a secondary black-chromium photomask.

601.025
PB86-177714 PC A05/MF A01 National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.


Keywords: *Thermometers, Calibrating.

The document describes the means by which a state calibration laboratory can establish a calibration service based on liquid-in-glass thermometers. Discussed are: ice-point baths, controlled-temperature baths, thermometer inspection, calibration techniques, and control chart procedures.

601.023
PB86-188497 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.


Keywords: *Heat pumps, Distillation, Refrigerants, Thermodynamics, Reprints, Thermodynamic diagrams.

Various thermodynamic diagrams that are well known in absorption heat pump design and distillation techniques are introduced in the paper for non-azeotropic halogenated hydrocarbon mixtures. As an example, a typical compressor heat pump cycle for refrigerant mixtures is displayed and the cycle itself discussed using these diagrams. It is shown that virtually all the necessary thermodynamic design information can be obtained from the enthalpy-composition diagram. It offers the possibility to determine the amount of heat, pressures, temperatures and compositions involved by simple geometric constructions even when the refrigerant cycle varies in certain components. Furthermore, it is shown by an example that thermodynamic diagrams provide a basic understanding of the influence of refrigerant properties on the heat pump cycle.

601.024
PB86-192002 PC A09/MF A01 National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.


Keywords: *Time standards, *Frequency standards, Accuracy, Time signals, Time dissemination, Time broadcast service.

The study examines options for delivery of accurate time and frequency information to industrial users. The study is sponsored by the Bonnivee Power Administration (BPA) who finds a need for accurate timing to the one microsecond level. Prospective existing and future dissemination methods (Loran-C, GOES, USRDSS, GPS, etc.) are discussed in detail. The study produces a system architecture and preliminary design for a BPA calculation using the widely available U.S. fixed satellite service (FSS) in which customers shall assume full costs of its operation through subscriber fees. The study concludes that a fully implemented system can be built for the cost of $15 million. The market study concludes that the greatest satisfaction is drawn from the 10,000 small industrial users.

601.025
PB86-192127 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.


Keywords: *Heat pumps, Solar energy, Efficiency, Temperature control, Reprints.

In operating a series solar heat pump system, a common practice is to use direct solar heating instead of the heat pump whenever the temperature of the solar-heated water exceeds a certain value called the switch-over temperature. The switch-over temperature setting has a significant effect on the system’s energy consumption. It is shown in the analytical study that the ideal switch-over temperature increases with the building load, but that it has a maximum value determined completely by the characteristics of the water-to-air heat pump. If based on its controller, a solar heat pump system is to have a fixed switch-over temperature independent of the building load, then the temperature should not exceed the ideal switch-over temperature corresponding to the building design load if the energy consumption of the system is to be minimized.

601.026

Keywords: *Metric system, *Units of measurement, Charts.

The chart presents a popularized yet technically accurate guide to SI base units, supplementary units, multiples and prefixes, and common conversions. The intended audience is (mainly) school children and the general public.

601.027

Keywords: *Metric system, *Units of measurement, Charts.

The chart presents a popularized yet technically accurate guide to SI base units, supplementary units, multiples and prefixes, and common conversions. The intended audience is (mainly) school children and the general public.

601.028
PB86-193109 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.


Keywords: *Laboratories, Test facilities, Standards, Measurement, Meetings, Reprints, *Accreditation.

A description is given of the organization and activity of the International Laboratory Accreditation Conference. Included is a listing of representation from the United States, international organizations, and other nations.

601.029
PB86-193604 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.


Keywords: *Melting points, *Silver, Temperature measuring instruments, Gold, Reprints, *Thermometers, Optical fibers.

Measurements were made at the gold and silver freezing points to demonstrate the accuracy of the new optical fiber thermometer (OFT). It is shown that the output signal from the OFT is related to the radiance from a blackbody source in a simple manner, and that the temperature interval between the gold and silver freezing points, as determined with the OFT, is close to other recent results.

601.030
PB86-195971 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Test Measurements and Standards Division.


Keywords: Laboratory equipment, Reprints, *Optical cells.

The construction of low-cost optical cells using the thin-walled sapphire tubing, which are used for observing phase separation in fluid mixtures, are described.

601.031

Keywords: *Measurement, Evaluation, Statistical analysis, Quality control.

The paper was published originally as a chapter in the book entitled "Quality Assurance Practices for Health and Safety Laboratories." It is for that reason that the examples used as illustrations are taken from health-related fields of research. However, the statistical concepts and methods presented here are entirely general and therefore also applicable to measurements originating in physics, chemistry, engineering, and other technical disciplines. The reader should have no difficulty in applying the material of this paper to the systems of measurement in his particular field of activity.

601.032
PB86-197365 Not available NTIS National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Divs.
Temperature Distribution in the Diamond Anvil Pressure Cell at High Temperature.

Rugh, J. 1 Jan 84; 5p.

Keywords: *Load cells, Diamonds, Temperature distribution, Thermal diffusion, Heating equipment, Reprints, Finite difference methods.*

The temperature distribution in a diamond anvil pressure cell is investigated theoretically for a realistic model cell having a cylindrical external heater. For a heater diameter of 1000 absolute millimeters above the ambient temperature, it is found, at steady state, that the region of the sample chamber is, for all practical purposes, a temperature plateau of about 11 degrees below the temperature of the heater. When the heater temperature is subsequently incremented instantaneously by ten degrees, a new steady state is reached in about 30 seconds.

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Plackett-Burman designs are used in ruggedged tests. These designs involve the simultaneous change of levels of a number of variables. The designs allow the ruggedness test user to determine the effect of the separated variables on the measurement process.

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The rates of heat loss from two underground insulated pipes installed in a shallow trench were calculated using an infrared thermography program based on the application of the finite element method to solution of two-dimensional steady heat conduction problems. To evaluate the results of pipe heat loss under a specified ground temperature condition are summarized for a range of pipe insulation thickness, different sizes of shallow trench, and various trench and ground temperatures. Methods of determining the minimum life-cycle heat loss and the corresponding economic insulation thicknesses for shallow trench heat distribution systems are presented. Life-cycle cost analysis was performed for two insulated pipes in a concrete trench to determine the cost of construction, annual energy cost, associated with pipe heat loss, and yearly operating and maintenance costs.

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Keywords: *Pipes(Tubes), *Heat loss, Thermal insulation, Heat transfer, Life cycles, Service life,* Heat pipes.*

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Temperature Distribution in the Diamond Anvil Pressure Cell at High Temperature.
Not abstract available.

Not available NTIS National Bureau of Standards, Gaithersburg, MD. Office of the Director.

Measurement Accuracy - RF to Optical. Final rept., E. Ambler, Jan 86, 2p
Sponsored by Institute of Electrical and Electronics Engineers, Inc., Washington, DC.
Pub. in Proceedings of Institute of Electrical and Electronics Engineers 74, n1 p73-Jan 86.

Keywords: *Metrology, Measurement, Calibrating, Microwaves, Optical communication.

Various developments in microwave and optical metrology that have been stimulated by the needs of satellite and optical fiber telecommunication are discussed. A few recent examples of the symbiosis of science, technology, and metrology in the microwave and optical fields are noted. Meeting the challenge of providing calibration support to the new automated measurement systems is seen to require a high degree of cooperation among government, industry, and the universities.


Keywords: *Measuring instruments; X rays, Gamma rays, Electrons, Neutrons, Radiocmetry, Reprints.

Gauges employing penetrating radiation such as x- or gamma-rays, electrons, or neutrons, are discussed. Such a gauge consists of a radiation source and a radiation sensor which detects the fraction of source radiation transmitted by the examined material, or in some applications detects secondary radiation such as scattered from the fluorescent photons resulting from interactions of the source-radiation with atoms of the material. Some examples of currently-used radiation gauges are mentioned.


Keywords: *Standards, Nondestructive tests, Ultrasonic testing, Reprints, Reference blocks.

The article describes the functions of ultrasonic reference artifacts as a tool for setting up ultrasonic test sensitively, as an aid in interpreting signals and as a tool for classification of test parts. The design considerations of reference blocks relating to material, outer geometry, and reflector geometry are described. The most commercial reference blocks, the IWW Block and the ASTM E-127 Block, are described. References for additional information are listed.

Supersedes PB82-154584. Also available from Supt. of Docs as SN003-003-02739-1. Prepared in cooperation with National Physical Lab., Teddington (England).

Keywords: *Metric system, Units of measurement, Primary standards, Translations, Foreign technology, International system of units.

The booklet is the United States edition of the English translation of the fifth edition of "Le Systeme International d'Unites (SI)," the definitive publication in the French language issued in 1985 by the International Bureau of Weights and Measures (BIPM). This U.S. edition, which conforms in substance with the British edition that follows the French text in the original document, is the result of a joint effort by the National Bureau of Standards (NBS) of the United States and the National Physical Laboratory (NPL) in the United Kingdom.

Supersedes PB85-15162. Also available from Supt. of Docs as SN003-003-02749-9. Color illustrations reproduced in black and white.

Keywords: *Calibrating, *Measurement, Standards, Services, National Bureau of Standards.

The NBS Calibration Service Users Guide provides detailed descriptions of the currently available NBS calibration services, special technical services, and measurement assurance programs. The document is a revised edition of NBS Special Publication 250. It describes the NBS services available as of the second quarter of 1986 and reflects a number of important changes since the 1982 edition was published. A detailed cross-reference index that links the new NBS test numbers to those previously identified to the document is a cross-reference index that links the new NBS test numbers to those previously identified to the services. Also needed is a large number of NBS technical details (including addresses and telephone numbers) which may be contacted for further information concerning services or measurement problems. Future editions will be published periodically as NBS services change. The document also presents a detailed description of a number of Measurement Assurance Program (MAP) services.

Sponsored by Aberdeen Proving Ground, MD.

Keywords: *Rope, Nylon fibers, Tensile properties, Breaking load, Elongation.

Pleated. nylon ropes of two sizes and approximately the same length were tensioned to rupture in a universal test machine. Several of the ropes were tested at room temperature. The others were subjected to specified high and low temperatures before testing. Deflection measurements of all the specimens were recorded while testing in progress. The results were used to evaluate the breaking strength, ultimate elongation, and shape-deflection properties, and to develop criteria for possible application in the recovery of mined ropes.

Contract NASA-A-14746-SC

Keywords: *Refrigerators, Cryogenics, Reprints, *Pulse tube refrigerators.

The paper compares the three types with each other and with common refrigerators such as Joule-Thomson and Stirling refrigerators. An apparatus is described which can measure the intrinsic behavior of the different types from temperatures of about 30 K to 300 K. Overall cycle efficiency as well as sources of loss such as radiation, thermal and regenerator inefficiency are discussed and the advantages of various phase shifting techniques to increase refrigeration capacity are compared.


Keywords: *Welded joints, Pipelines, Nondestructive tests, Inspection.

A review of fitness-for-service assessment of pipeline girth welds is presented. The U.S., British, Japanese, and Canadian approaches are summarized and compared in internal terms of allowable flaw sizes. Included is an in-depth discussion of nondestructive inspection of girth welds, using electromagnetic-acoustic transducers (EMATs). The report covers a nondestructive test method for testing long, straight pipelines using laboratory tests of transient stress wave propagation in plates and in plates containing flaws are presented. The test method involves introducing transient stress waves into a test object by mechanical point impact and monitoring reflections of the waves from internal defects and external boundaries using a point receiver.


Keywords: *Pipelines, *Corrosion, *Anaerobic bacteria, Reprints, Microbial corrosion, Desulfotobacterium, Electrochemical noise, Sulfitolytic bacteria.

Anaerobic (bacterial) corrosion is an important cause of failures of underground structures, such as pipelines. Pipeline failures could be prevented by better methods for determining the presence and location of areas of bacterial corrosion existed. A technique was developed which monitors detection and recording of rapid potential fluctuations (noise) produced in a corroding metal. It is believed that the noise is mainly caused by the breaking of protective films on the metal surface. Anaerobic bacterial corrosion also produces a type of noise, probably due to the breaking of iron sulfide films. Negative evidence indicates that detection and production of the noise on pipelines may offer promise in locating areas of microbial corrosion as well as other types of corrosion. Differences in the type of noise signal could enable differentiation between biological and nonbiological corrosion.

PC04/MF A01 National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Also available from Supt. of Docs as SN003-003-02771-5. Sponsored by National Aeronautics and Space Administration, Moffett Field, CA. Ames Research Center.

Keywords: *Refrigerators, Cryogenic, *Cryocoolers, Regenerative cooling.

Pulse-tube thermacoustic refrigerators have the potential for high reliability since they require only one moving part—an oscillating piston or diaphragm—at room temperature. If a tube is closed at one end and connected to a pressure wave generator at the open end, and if the phase angle between mass flow and pressure is shifted from 90 deg, then refrigeration occurs at the open end. The shift in phase angle can be realized by thermal relaxation between the gas and the tube walls or by an orifice at the closed end. A low temperature of 60 K using helium gas in a one stage orifice pulse tube has been achieved at NBS. The report describes the first measurements of the efficiency, refrigeration power, and refrigeration power per unit mass flow for three pulse-tube refrigerators. Three tube sizes, differing in length and diameter, were studied over a frequency range of 3 to 11.5 Hz. Cooling efficiencies as high as 90% of the Carnot efficiency were obtained when compressor and regenerative losses are neglected.

LIBRARY & INFORMATION SCIENCES

Information Systems

601,054
Supersedes PB85-152312.
Source tape is in the EBCDIC or ASCII character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions.

Keywords: *Data file, *Coding, *United States, Urban areas, Rural areas, Municipalities, Communities, States(United States), Magnetic tapes, *Federal information processing standards, *Geocoding, Standard metropolitan statistical areas, Counties, ZIP codes.

The eighth update of the Federal Information Processing Standard (FIPS) 55 data file provides a two-character State code and five-character numeric place code to uniquely identify each listed entity. Areas of the United States covered are the fifty states, the District of Columbia, and all outlying territories with significant self-administration. An exhaustive list is carried of incorporated places, census designated places (CDPs), primary county divisions (such as townships, New England towns, and census county divisions), recognized Indian reservations and Alaska Native villages, and counties. The listing also includes unincorporated places, military bases, National parks, airports, and ground transportation points.

601,055
PB88-212092 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.


The proliferation of small and medium sized computers has made it possible to decentralize the data processing work load into a number of smaller distributed systems. With this decentralization, there is an increasing need to translate data and application programs from one computer processing environment to another. To serve this need there has been a welcome progress in the specification of national and international standards for data definition, data manipulation, and data interchange. The paper discusses standard specifications for database languages recently completed by technical committees X3H2 of the American National Standards Institute and for computer interface forms recently adopted by the International Organization for Standardization. It shows by example how a complete database application can be transported or shared in a standard manner among different computer processing environments.

601,058


The report documents the initial phases of the MIST database, which is a demonstration project jointly supported by the Department of Energy and the National Bureau of Standards. The purpose of the project is to present information for Science and Technology (MIST) is to demonstrate the power and utility of computer access to materials property data. The initial goals include: to exercise the concept of a computer network of materials databases and to build a demonstration of such a system in a way so as to be suitable for use as the core of operational systems in the future. Phases I and II are described in detail. In addition, a discussion is given of the expected usage of the databases.

Marketing & User Services

601,059

Keywords: *Information centers, Organizations, Microcomputers, Access, Systems engineering, Services, *Mainframe computers, *User needs, End use.

The paper summarizes the motivation for and issues associated with organizing to support and user access to computing resources. A combination of information center functions to provide access to large mainframes and support to end users in their access to microcomputers is included. Various issues are identified and discussed that will help organizations develop supporting organizational structures for end user computing.

Operations & Planning

601,060

Keywords: *Meetings, Costs, Planning, Tools, Standards, *Data administration.

The Special Publication constitutes the proceedings of a two-day workshop on Data Administration held at the National Bureau of Standards, Gaithersburg, Maryland, on March 27-28, 1985. The workshop was sponsored by the National Bureau of Standards under the auspices of the Federal Data Management Users Group (FEDMUG). The purpose of the workshop was to provide a forum for Federal, State, and local government Program Managers, Information Resource Managers, Data Processing Managers, and Data Administrators to hear nationally prominent speakers and to discuss and share data administration ideas and experiences.

601,061
PB86-247552 PC A04/MF A01 National Bureau of Standards, Gaithersburg, MD. Information Resources and Services Div.

Keywords: "Information centers, Libraries, Handbooks, Services, Resources, National Bureau of Standards, Federal libraries. The directory describes the information resources and services of the National Bureau of Standards Research Information Center.

Reference Materials

601,062 PB86-191871 PC A08/MF A01 Toth (R.B.) Associates, McLean, VA.
Federal Government Certification Programs for Products and Services.
Final rep.
R. B. Toth, Apr 86, 150p NBS/SP-714

Keywords: "Directories, National Government, Services, Regulations, Standards, Inspection, Industries, Data bases, Certification, Commodities."

The directory presents information on 61 U.S. Government certification programs for products and services. Entries describe the scope and nature of each certification program, testing and inspection practices, standards used, methods of certification and enforcement, reciprocal recognition or acceptance of certification, and other relevant details. The directory is part of an ongoing NBS effort to establish and maintain a comprehensive database on standards, regulations, certification programs and related information. The material has been compiled to meet the needs of government agencies, industry, and the public for information on U.S. Government certification programs in accordance with the requirements of the U.S. Trade Agreements Act of 1979.

National Standard Reference Data System of the United States.
Final rep.
D. R. Lide, 1984, 4p
Pub. in Computer Physics Communications 33, n-3 p207-210 Aug-Sep 84.

Keywords: "Standards, Physics, Information centers, United States, Evaluation, Reprints, Standard reference data."

The operation of the National Standard Reference Data Program is described. A list of data centers of interest to the physics community is given.

601,064 PB86-201290 PC A02/MF A01 National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering Center for Electronics and Electrical Engineering Technical Publication Announcements Covering Center Programs, July to September 1985 with 1986 CEEE Events Calendar.
E. J. Walters, Apr 86, 22p NBSIR-86/3366

Keywords: "Bibliographies, Electronics, Electrical engineering, National Bureau of Standards."

This is the sixth issue of a quarterly publication providing information on the technical work of the National Bureau of Standards Center for Electronics and Electrical Engineering. The issue of the CEEE Technical Publication Announcements covers the third quarter of calendar year 1985.

601,065 PB86-315142 PC A03/MF A01 National Bureau of Standards, Gaithersburg, MD. Public Information Div.
May 86, 34p NBS/SP-680/5
See also PB86-129707. Library of Congress catalog card no. 86-600534.

Keywords: "Research projects, Surface roughness, Polymers, Standards, Commerce, International trade, Algae, Diets, Drain magnetic fields, image processing, Flare stars, US NBS."

Contents: Research update; a perspective on the future of NBS, Surface roughness monitor for advanced manufacturing developed; Artificial vision device performs high-speed processing of images; Taking the "guesswork" out of making polymer blends; Standards and global trade--a government perspective; Counterfeit chlorophyll, antifungal algae-the perfect energy device;

Burgers, fries, pizza pies--all part of massive study of worldwide diets; JILA astronomers first to detect magnetic fields on a flare star; New publications; Conference calendar.

601,066 PB86-232000 PC A03/MF A01 National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electromagnetism Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, October-December 1985 with 1986 CEEE Events Calendar, E. J. Walters, Jun 86, 36p NBSIR-86/3344/2
See also PB85-191393.

Keywords: "Electronics, Electrical engineering, Bibliographies, National Bureau of Standards."

This is the thirteenth issue of a quarterly publication providing information on the technical work of the National Bureau of Standards Center for Electronics and Electrical Engineering. The issue of the CEEE Technical Progress Bulletin covers the fourth quarter of calendar year 1985. Abstracts are provided by technical area for both published papers and papers approved by NBS for publication.

601,067 PB86-237260 PC A03/MF A01 National Bureau of Standards, Gaithersburg, MD. Public Information Div.
NBS (National Bureau of Standards) Research Reports, February 1985, S. Shaffer, Feb 85, 36p NBS/SP-680/2
See also PB85-127421. Library of Congress catalog card no. 84-601166.

Keywords: "Research projects, Technology assessments, Computer networks, Earthquakes, Radiation, Metal industry, Alloys, National Bureau of Standards."

This report covers the following topics: Research update; NBS and steel producers join in high-risk research; Metals-processing technology for the future; Diagrams for designing alloys; Radiation: Keeping the gene under control; Tools and technology for the building industry; New facility used to simulate earthquake forces; Welcome to the new computer age: The era of networks; NBS perspective on open systems interconnection; NBS adds credibility to energy-related inventions; New publications, and Conference calendar.

601,068 PB86-247616 PC A07/MF A01 National Bureau of Standards, Gaithersburg, MD. Information Resources and Services Div.
Data Bases Available at the National Bureau of Standards Research Information Center (Fifth Edition), D. Cunningham, Jul 86, 135p NBSIR-86/3428
See also 3rd edition, PB83-155986.

Keywords: "Information systems, Directories, Information centers, Indexes, (Documentation), Bibliographic data bases, Data bases, National Bureau of Standards."

An alphabetical listing of data bases available online at the National Bureau of Standards (NBS) Research Information Center is listed by either acronym or full title of the data base. Other additional information includes description of the data base, period of coverage, producers (corresponding hard copy), principal sources and vendors. A general subject index and a cross reference index to the data bases are also supplied.

601,069 PB87-106720 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
C. Eisenhart, 1985, 6p

Keywords: "Periodicals, Research, National Bureau of Standards."

The founding of the Bureau, its primary mission and expanded scope through subsequent legislation. History of its Journal of Research, with particular attention to papers published from 1947 to 1985 that contain material on probability theory, statistical theory and methodology, or applications thereof to potential interest to statisticians and teachers of statistics.

CODATA Role in International and Interdisciplinary Cooperation.
Final rep.
D. R. Lide, 1984, 2p
Pub. in Computer Physics Communications 33, n-3 p205-206 Aug-Sep 84.

Keywords: "Scientific societies, Experimental data, Data processing, Standards, Distributing, Reprints, Scientific data, Interdisciplinary cooperation, International cooperation, Data compilation, Disseminating, References (Standards)."

International cooperation in the compilation of scientific data is briefly reviewed. The organization and administrative structure of CODATA are described. Several types of CODATA activities are summarized.

General

601,071 PB88-231487 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Information Resources and Services Div.

Keywords: "Librarians, Technical information specialists, Education, Standards, Reprints, Federal libraries, Federal government."

The report is a chapter in a book edited by Herbert White. The chapter reviews the development and applications of educational standards for librarians and technical information specialists in the federal government since 1966. Some conspicuous developmental and application failures are discussed as well, and a possible hedge against future disasters is suggested.

601,072 PB87-140004 PC A04/MF A01 National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Cost Comparison of Selected Alternatives for Preserving Historic Pension Files.
Final rep.
R. E. Schofer, Jul 86, 59p NBSIR-86/3335
Sponsored by National Archives and Records Administration, Washington, DC.

Keywords: "Records management, Cost estimates, Systems analysis, Archives, Labor estimates, Microfilm, Preservation, Services, Historic pension files."
The report describes the results of a cost study of three selected alternatives for preserving the historic Alcove files. The three alternatives evaluated comprise three levels of technology: Hand retrieval of original paper documents; Hand retrieval of microfiche copies of the original documents; and Automated retrieval of microfiche copies. Results indicate that the microfiche alternatives substantially reduce storage space requirements and the labor cost of providing reference service. The automated-retrieval-alternative reduction in labor cost is very substantial. However, the extremely low cost of producing the microfiche more than cancels out the savings in both space and operating costs, except under very high reference usage. Notwithstanding the above, the report concludes that these alternatives are an attractive alternative. At current usage rates, each file is requested, on the average, every 65 years. At these rates, preservation experts do not expect the documents to deteriorate from reference usage.

Computer Aided Design (CAD)


PB87-107363 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.

Keywords: "Surveys, Flexible manufacturing systems, Computer aided manufacturing"

The report presents descriptive data on three hundred manufacturing facilities that are using computer integrated manufacturing (CIM) techniques to machine component parts for commercial, industrial, and military use. Of these, 247 are flexible manufacturing systems (FMS). Key descriptive statistics were gathered for each system. The data is organized by records by country, by industry, and geographic location. Each record is made up of 24 fields that describe the product, the facility, and the operational parameters, and is providing a reference to the source(s) of information.


MANUFACTURING TECHNOLOGY
Computer Aided Manufacturing (CAM)

al Bureau of Standards, Gaithersburg, Maryland. January 21, 1986. It was prepared by the Center for Manufacturing Engineering (with funds obtained from the Army Manufacturing Technology Program) and the Center for Applied Mathematics. It was designed to bring together those who design and test optimization procedures for solving planning, scheduling, and routing problems, who must use these procedures in a real-time manufacturing environment.

601.061
PB87-120292 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.


A real-time compensation scheme for geometric and thermally-induced errors of a computerized numerical control (CNC) machine tool is described. The compensation system predicts these errors using a combination of data taken from various sensors on the machine tool and previously established relationships (transfer functions). The system translates these errors into servos commands and injects them into the control loop of the machine tool controller and the system is the workhorse of the system. The system is implemented in PLM, a high level programming language, is modular, flexible and easily maintainable.

601.062
PB87-131850 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Finite Element Analysis of Flexible Fixturing System. Final rep.


A computer system has been developed for the analysis and design of the fixtures. The software can lead the designer to the optimal design of the fixture system which can be included in the computer aided fixture system. The fixture system is modeled as a linear elastic solid fixture system. The machining forces are simulated by specifying applied forces acting on parts of the surface of the workpart. The fixturing system consists of a number of fixture elements, each in contact with the workpart having specified location and area of contact. The interface at contact, Coulomb's law of friction is employed. The boundary conditions at the interface of contact are treated exactly. The computer software program is composed of a finite element program. The program is currently available on the system which has been underisofted and deformed workpart and within lines removed. Three sample problems have been solved and the numerical results are presented in the paper.

601.063
PB87-134706 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Cell Layout Program for the AMRF (Automated Manufacturing Research Facility). Final rep.


The paper describes the Cell Control System developed for the Automated Manufacturing Research Facility using hierarchical task-decomposition and real-time sensory-interactive control techniques developed at NBS. The primary functions of the cell are to manage and coordinate the machine at all workstations and interface to the existing operator command system, database management system, network communications system, and information display system. In addition, the data structures developed for command/feedback interfaces between control modules and PRODOS development to perform inventory and job status updates, and the mailgram structures developed to transmit information over the current network, are outlined.

Engineering Materials

601.066
PB87-128807 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Computation Division.
Compressive Properties of Silica Aerogel at 295, 76, and 20 K. Final rep.


Specimens of silica aerogel were tested in compression at 295, 76, and 20 K in a helium gas environment. The properties reported include young's modulus, the proportional limit, and yield strength. Compressive stress-versus-strain curves at these temperatures are also given. A test apparatus was developed specifically to determine the compressive properties of low strength materials. To measure specimen strain a concentric, overlapping cylinder, capillarity extensometer was developed. This fractionless device has the capability to conduct variable temperature tests at any temperature from 1.6 to 26 K. Results from the compression tests indicate that at low temperatures the material is not only stronger, but tougher. During 295 K compression tests, the samples fractured and, in some cases, crumbled. After 76- or 20 K compression tests, the specimens remained intact.

Joining

601.087
PB86-163797 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Gas and Particulate Science Div.


Positive and negative ion spectra of micrometer-size particles of nickel metal and four nickel compounds are examined to determine the nickel speciation by LAMMA. The four nickel compounds include nickel oxide, nickel sulfate hexahydrate, nickel sulfide, and nickel hydroxide. The positive and negative ion "fingerprints" spectra distinguish nickel metal, nickel oxide, and nickel sulfate hexahydrate from nickel sulfide and nickel subsulfide. The positive and negative ion spectra of nickel sulfide and nickel subsulfide are qualitatively identical. The difficulty in differentiating the nickel sulfide and nickel subsulfide spectra using positive atomic ion intensity ratios as a reflector of compound stoichiometry is related to variations in laser power deposition and possible inhomogeneity in sample composition.

601.088
Fusion Line Shape Versus Toughness in HY-80 GMA (Gas Metal Arc) Welds, T. A. Siewert, R. E. Trevisan, and P. T. Futscher. Apr 86, 48p. NBSIR-86-3043
Sponsored by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.
Keywords: "Arc seam welds, Welded joints, Toughness, Gas metal arc welding, Steel HY-80.

The report describes the effect of the electrode weave procedure on both the fusion line shape and toughness of reduced-gas metal arc (GMA) welds. To study the variation in toughness, four GMA welds were produced in 25-mm-thick HY-80 plate using MIL 1005-1 electrode and following the weld procedure listed in the electrode specification, MIL-E-23765/2C. These four welds were used to compare stinger beads with various weave procedures using both manually controlled and adaptively controlled welds.

601,089
PB87-119137 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.
Final report
R. E. Schramm, and T. A. Siewert. 1986. 3p
Sponsored by Naval Sea Systems Command, Washington, D.C.
Pub. in Materials Evaluation 44, n0 p1136-1138 Aug 86.
Keywords: "Welded joints, Ultrasonic tests, Nondestructive tests, Ultrasonic frequencies, Reprints, "Flaws."

The paper describes a procedure for the production of various uniform two-dimensional flaws for NDE calibration and their evaluation by both an electromagnetic acoustic transducer system and metallographic sectioning.

601,090
Final report
D. T. Read. 1986. 8p
Sponsored by Department of Transportation, Washington, D.C.
Keywords: "Standards, "Fracture tests, "Pipelines, Toughness, Stress analysis, Mechanical properties, Weld defects, Inspection, Nondestructive tests. Qual. assurance. "Flaw detection."

Fitness-for-purpose standards for weld inspection and flaw repair criteria offer means for rational, quantitative balance among the three critical parameters governing fracture safety, material toughness, flaw size, and applied stress. The results of fitness-for-purpose analysis can be expressed as curves dividing all possible flaws into two categories, those that must be repaired and those that may safely be left un repaired. Such flaw tolerance curves are obtained by calculations using elastic-plastic fracture mechanics analysis. Required input for such calculations includes material strength and toughness characterization and accurate values for imposed stress.

Linewidth measurement errors are introduced when an anti-reflective (AR) chromium photomask standard such as the NBS SRM 474/475 is used to calibrate an optical linewidth measurement system for subsequent measurements on another material such as bright chromium. The optical properties of the materials and the magnitude of these errors varies from system to system and depends upon resolution, choice of edge-categorical, shape, reflectance, and edge geometry. These errors are greatest when measurements are made in reflected light due to the greater sensitivity to the mismatch in optical parameters of the materials between the calibration standard (AR-chromium) and the material to be measured (bright chromium). The report, therefore, recommends use of transmitted light for linewidth measurements on photomasks and as close a match as possible between the material parameters of the calibration standard and those of the part being measured in order to ensure a realistic assessment of the accuracy and precision of subsequent measurements.

601,092
H. T. Yoiksen, and R. M. Dickerson. 85, 72p. NBSIR-86/3341
Prepared in cooperation with California Univ., Santa Barbara. Sponsored by Industrial Research Inst., New York, and Office of Science and Technology Policy, Washington, DC.
Keywords: "Material handling. "Detectors, Automata, Ceramics, Composite materials, Metals, Polymers, Optical materials."

This is the proceedings of the workshop 'A National Forum on the Future of Automation in Materials Processing in U.S. Industry - The Role of Sensors'. This is the first of two workshops to be sponsored by the Industrial Research Institute. While the Office of Science and Technology Policy, Committee on Materials Working Group on Automation of Materials Processing. The second workshop will address other two key components required for automated material processing, process models and artificial intelligence coupled with computer integration of the system. The objective of these workshops is to identify and assess important issues affecting the competitive position of U.S. industries relative to automation and production processes for basic and advanced materials and to develop approaches for improved capability through cooperative R&D and associated efforts.

601,093
PB86-229945 Not available NTIS National Bureau of Standards (NLS), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
Final report
Pub. in Jnl. of the Electrochemical Society 130, n0 p319-c193.
Keywords: "Lithography, Electron beams, Line width, Measurement, Reprints."

An electrical test structure and test method is described for estimating the magnitude of proximity effects in electron-beam lithography. The test structure consists of van der Pauw cross resistor for measuring sheet resistance, Wheatstone bridge resistor for measuring electrical linewidth, and a second bridge resistor simulating a close line-space environment for measuring electrical linewidth where proximity effects from nearby patterns may be encountered. These test structures were delineated in a metal layer on a silicon wafer, using electron beam exposure and wet chemical etching. Electrical measurements are compared to optical measurements. The technique provides an alternative to traditional measurement techniques, which may be effective in a dense circuit environment and can be used to estimate parameters for the double Gaussian model used in proximity correction algorithms.

601,097
PB87-113501 Not available NTIS National Bureau of Standards (NLS), Gaithersburg, MD. Center for Mig. Engineering. SEM-BSE (Scanning Electron Microscope Based) System for Calibration of Line Width SRMs (Standard Reference Materials) for the IC (Integrated Circuit) Industry.

Final report
D. Nyyssonen, and M. T. Postnik. 1985. 7p

601,098
PB86-181684 PC A02/MF A01 National Bureau of Standards (NLS), Boulder, CO. Electromagnetic Fields Div.
Keywords: "Anechoic chambers, "Control charts, Electromagnetic fields, Standards, "Statistical control."

The microwave anechoic chamber is a National Bureau of Standards laboratory facility in which standard electromagnetic fields are generated. The chamber is used for special measurements and electromagnetic compatibility tests to be conducted on antennas and other devices. The paper is concerned with methodology for assuring that the standard field pattern generated in the chamber are repeatable. Procedures are proposed for developing a data base from measurements taken by placing NIST2 Version 5.1. These procedures generate the fields, in certain relevant reference configurations. Methodology is presented for developing statistical control chart both the location and the scale parameters of these data over time.

601,099
For system on diskette, see PB86-182490. Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Keywords: "Computer programs, Wafers, Computer systems programs, STAT2 computer program, Automatic test equipment."

The document describes the changes which have been made in the STAT2 computer program since its documentation in NBS Special Publication 400-75, Semiconductor Measurement Technology: A FORTRAN Program for Analysis of Data from Microwav e Electronic Test Structures, and NBS Internal Report B3-2779, Release Notes for STAT2 Version 75.1. It is assumed that the reader has these documents, and no attempt is made to review STAT2 features or operation. The changes extend the functionality and versatility of the program. More specifically, the new features added in version 1.7 include data base exten sion, an input data format suitable for test sites not in a periodic array, an outlier exclusion algorithm suitable for small numbers of sites, common site exclusions for related failures, a vector of partial response results, a line chart, extended macro command file capability, and other changes. Following the description of the changes is an annotated listing of new error messages. The document and the two previous publications cited constitute the documentation of version 1.7 of STAT2.
Robotics/Robots

601,100

Keywords: *Robots,* Real-time operations, Computer programming, Control equipment, Reprints, Computer applications, Computer program verification.

The benefits of developing a real-time control system (RCS) using FORTH is discussed. FORTH software development is achieved through the use of small, verifiably correct modules. The FORTH programming environment is flexible, complete, open, and easily extensible. A real-time robot control system requires much software integration, fine-tuning, hardware interfacing, and robot error handling. RCS was developed using and extending FORTH because FORTH best handled the broad and diverse programming needs of a robot control system. With FORTH as a base system, RCS provides a robot programming environment geared to reducing software development requirements and allowing the user to control the robot system.


Keywords: *Robots,* Control equipment, Real time operations, Interactive systems.

The National Bureau of Standards, Industrial Systems Division has designed the Real-Time Control System with high level goals are decomposed through a succession of levels, each producing strings of simpler commands to the next lower level. The bottom level generates the drive signals to the robot, gripper, and other actuators. Each control level is a separate process with a limited scope of responsibility, independent of the details at other levels, thus providing a foundation for future modular, plug compatible hardware and software for robotics and other real-time sensory interactive control applications.

601,104

Keywords: *Robots,* Control equipment, Automation, Reprints, *Computer aided manufacturing.*
Estimation of the Dynamic Parameters of a Robot Joint Drive System.  

Keywords: "Joint(Junctions), *Robots, Systems analysis, Dynamics, Drives, Random processes, Accelerometers, Frequency response, Estimating, Parameters, Data analysis."

A system identification technique has been developed for estimating the dynamic parameters of an industrial robot joint drive system. Category of experimental citation was injected through the power amplifier of the joint drive system being analyzed. The motion of the robot link was monitored by a pair of accelerometers. The frequency response of two portions of the joint drive system was determined for two different loads.

601.107 


There are many different aspects of safety to consider when utilizing a robot in an industrial application. In general, however, these can be categorized into the areas of personnel safety and equipment safety. The paper address these areas of concern and presents one approach of providing equipment safety through the use of an auxiliary computer to monitor operations in the work area. Such a computer system can be used to check robot operations during programming, automatic cycling, and debugging and repair to prevent unwanted conditions from occurring. The basic concept design and implementation of such an auxiliary computer on a robot operating in a machining workstation are described here.

MATERIALS SCIENCES

Adhesives & Seals

601.110 

Keywords: "Adhesives, Polymers, Stress analysis, Epox compounds, Viscoelasticity, Reprints."

The desire to use adhesives and composites in structural applications has led to a need for a failure prediction capability for the polymers used in such systems. The authors of this study considered rising load experiments at different cross-head speeds and temperatures for neat and adhesive bond specimens. The results demonstrate that the data can be fit to empirical models that provide estimates of mode-1 fracture behavior. Current studies are now examining more complex loading histories and composite specimens.

Ceramics, Refractories, & Glass

601.111 

Keywords: "Refractory materials, *Synthesis(Chemistry), *Borides, *Carbides, *Patents, PAT-CL423-S034."

Refractory borides or carbides are prepared by contacting an alkali-metal reducible metal chloride or silicon tetrachloride with boron trichloride or carbon tetrachloride in an inert solvent in the presence of an alkali metal, the metal chloride or silicon tetrachloride and the boron trichloride or carbon tetrachloride being present in an amount about stoichiometrically equivalent to the boride or carbide to be prepared and the alkali metal being present in an amount about stoichiometrically equivalent to the amount of chloride in the metal chloride or silicon tetrachloride and the boron trichloride or carbon tetrachloride, until all chlorine present has reacted with the alkali metal to form alkali metal chloride.

601.112 

Keywords: "Barium titanates, *Dielectrics, *Patents, Roasting, Precipitation(Chemistry), Ferroelectric materials, Precursors, PAT-CL423 S066."

A process for producing any desired Ba/Ti mixture to be formulated as an amorphous solid which crystallized at very low temperatures to yield a desired phase or phases is disclosed. The process yields products free of undesirable impurities, and allows maximum proportion of certain phases in the barium-titanate system, having exceptional high frequency dielectric properties, that were previously unattainable through solid-state high temperature production techniques.

601.113 

Keywords: "Ceramics, *Meetings, Industries, Marketing, Technology, Research and development."

Advanced ceramics are a new generation of high performance materials, widely believed to hold promise of multi-billion dollar markets. The U.S. competitive position, however, has been eroded in recent years with the prognosis for the future equally dim. To address this problem, the Department of Commerce held an industrially oriented conference, July 10-11, 1985, at which time the ceramic industry assessed critical competitive issues from both a technological and business viewpoint and developed approaches for improved U.S. market posture. The conference considered electronic and structural advanced ceramic markets, with focus on cooperative mechanisms for industrial R&D. A consensus was reached on the most critical areas for research and on the need for inter- and intra-industry collaboration. Assistance from DOC was requested to facilitate the implementation of cooperative research ventures. The report constitutes the Proceedings of the Conference and includes the paper presented and summary of the workshop sessions.

601.114 

Keywords: "Ceramics, *Cracking(Fracturing), Mechanical properties, Aluminum oxide, Barium titanates, Glass, Microstructure, *Foreign technology."

MANUFACTURING TECHNOLOGY

Robots/Robots

601.114

119
A systematic study of the inert-strength characteristics of ceramics as a function of crack size relative to grain size has been made using controlled indentation flaws. The focus of the test program is on alumina, with barium titanate and glass-ceramics providing support data for metalization and inelastic trends. Observations indicate that grain size progressively diminishes the indentation load, the strengths first show a steady increase, but subsequently tend to a plateau. These results suggest that the contact size begins to approach the characteristic grain size. A simple extension of conventional indentation fracture mechanics theory (inorporating size effects) is developed to describe this scale transition. The basis of the analysis is the postulated existence of a 'microstructural driving force' governing the crack initiation at the pyknolite radial crack, in direct analogy to the indentation driving force. This description provides closed-form solutions to these size effects. It is shown that the equations are consistent with data in terms of an apparent R-curve function. Only two quantities are required to specify the function: one relating to the macroscopic toughness determined from large-scale crack specimens and the other to a microstructure-associated stress intensity factor. These quantities are advocated as useful reliability parameters. It is found that the second quantity can vary widely from material to material, even within a given class, to the extent that materials which show superior strength characteristics at large indentation loads may be dramatically weaker at very low loads. The implications are that, at least in aluminas, the key to such weakening effects is to be found in the grain-boundary structures. The study emphasizes the need for caution in interpreting macroscopic-crack data unconditionally into the microstructural-law region, and for more fundamental investigations into the underlying physical processes actually responsible for the microscopic driving forces.

This is demonstrated graphically by reducing such data sets onto universal fatigue diagrams.
advances in the study of the interaction processes in glasses is presented. Attention is focussed on ideally ‘sharp’ indenters, in which the contact deformation contains both reversible and irreversible components. The relative amounts of these two components are determined by the ratio of hardness to elastic modulus, and are directly measurable from the depth recovery of the impression. At high loading rates the plastic work rate may be sufficient to cause local surface ‘melting’.

The nature of contact-induced surface damage in brittle materials, and the fracture mechanics principles used to describe the damage, are surveyed. The importance of understanding the role of the plastic deformation processes which precede fracture is emphasized. Strength and erosive wear properties are intimately connected to the fractographic damage mechanics.

Advanced techniques have been developed enabling both shear and longitudinal ultrasonic waves to be dried-out, using minimal pressure, into green and sintered ceramic materials. The measurement of these techniques permitted the velocity measurements to be made at megahertz frequencies, from which the elastic wave velocities could be used in independent density measurements. Velocity differences between samples were observed to be sufficiently distinct to enable the intermediate sintered states to be identified in the near dense states.

Original techniques have been developed enabling both shear and longitudinal ultrasonic waves to be dried-out, using minimal pressure, into green and sintered ceramic materials. The measurement of these techniques permitted the velocity measurements to be made at megahertz frequencies, from which the elastic wave velocities could be used in independent density measurements. Velocity differences between samples were observed to be sufficiently distinct to enable the intermediate sintered states to be identified in the near dense states.

Region II is shown to be transport rate controlled, while above Region I, a recently proposed electrostatic model is shown to fit the data for soda-lime-silica glasses. These experimental variables such as pH and temperature on the slope and portion of crack growth curves are discussed.

The pressure-temperature phase diagram of zirconia (ZrO2) is determined under equilibrum conditions in a diamond anvil high pressure cell (DAC) equipped for heating, by optical microscopy and x-ray diffraction techniques. At room temperature zirconia transforms from the monoclinic (M) phase to a tetragonal (T) phase which is related to the well-known high temperature tetragonal structure (stable above 1170°C at one atmosphere. The transition to the high pressure T' form is accompanied by a volume change of -0.3%. The transition pressure is controlled by the orthohombic (PcC2b) structure. The volume change at the transition is -6.7%. With increasing temperature the T' form transforms to the high temperature tetragonal form (T). The M+T' and T+T' phase boundaries were determined under hydrostatic conditions using single crystal samples. For increasing P and T, the M+T' triple point was located at T = 596 + or - 18 deg C and P = 2.26 + or - 0.28 GPa, while for decreasing P and T, the triple point is at T = 535 + or - 25 deg C and P = 1.7 + or - 0.28 GPa.

Recent advances have been made in the understanding of sintering of ceramics. The primary advances have been in the modelling of grain boundary and surface processes and in the development of the measurement of the effect of low levels of impurities and dopants on the energies and properties of interfaces. These results indicate that the grain boundary is strongly affected by crystalline anisotropy, multiple transport mechanisms, complex geometries and impurity effects. In particular the effect of variable concentrations of impurities at the trace level have been found to mask the effects of changing most other system parameters in ceramics with low intrin-
solutions. Experiments are described which can be used to isolate specific parameters or processes involved in sintering, such as the surface energy, boundary diffusion angle. Specific examples of impurity effects in MgO and alpha-Al2O3 are presented.

601,132

Subcritical Crack Growth in Ceramics.


Keywords: *Ceramics, *Crack propagation, Fractures(Materials), Reprints.

The fracture of ceramic materials is often preceded by a subcritical crack growth which originates from flaws or cracks contained in the surfaces of these materials. Subcritical crack growth is usually the result of a stress-enhanced reaction between the ceramic and water in the air, and has been observed in a wide variety of ceramic materials; glasses, porcelain, oxides, silicate minerals and titanates. Because subcritical crack growth precedes catastrophic fracture, the strength of ceramic materials is often found to be time dependent: delayed fracture occurs when ceramics are subjected to a load, and strength of ceramics is observed to depend on loading rate. The effect of subcritical crack growth on the strength of ceramics can be understood by using the science of fracture mechanics, which provides methods for quantifying crack growth. Fracture mechanics also provides a logical framework for predicting the lifetime of structural ceramics that are subjected to either static or dynamic loads.

601,133

Surfaces and Interfaces: Effects on Mechanical Properties of Ceramics and Glasses.


Keywords: *Ceramics, *Glass, Interfaces, Surface properties, Microstructure, Fracture properties, Creep properties, Reprints.

The mechanical behavior of ceramic materials at both low and elevated temperatures is influenced by the presence of surfaces and interfaces. At low temperatures where the materials are brittle, mechanical perfection of surfaces determines the strength of ceramic materials. At elevated temperatures, where atoms move and react freely, factors such as creep and surface reactivity play a role in determining mechanical behavior. In the article, low temperature mechanical behavior of ceramic materials is discussed in terms of the microstructure of surfaces and the effect of machining, polishing and processing on the microstructure. High temperature mechanical behavior is discussed in terms of surface reactivity and grain boundary mobility and the importance of these processes to fracture, creep, and creep fracture.

601,134
PB86-241718 Not available NTIS National Bureau of Standards, Gaithersburg, MD. polymer Div.

Fracture Toughness Testing of Brittle Materials.


Keywords: *Brittleness, Toughness, Fracture properties, Tests, Reprints, Fracture toughness.

No abstract available.

601,135
PB87-104915 Not available NTIS National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Problems with Cryogenic Operation of Piezoelectric Bending Elements.


Keywords: Ceramics, Cryogenics, Bending, Reprints. *Lead titanate zirconates, Bimorphs, Micropositioners.

Piezoelectric bimorphs constructed from lead titanate-zirconate (PZT) ceramic bonded to a brass sheet have been tested at cryogenic temperatures to determine their suitability for use in a low-temperature micropositioner. Experimental data are presented on bimorph sensitivity (displacement per volt) as a function of the number of temperature cycles. Results indicate that bimorphs of this type cannot be calibrated because of irreversible changes in the bending characteristics that occur while cycling from room temperature to 4 K.

601,136
PB87-105029 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.

Chargetrapping of Microcracks in Yttrium Chromate (III) Using Small-Angle Neutron Scattering and Elasticity Measurements.


Keywords: *Ceramics, *Cracks, Neutron scattering, Elastic properties, Polycrystals, Reprints, *Yttrium chromates.

The mean crack radius, crack opening displacement, number density, and volume fraction have been estimated for a population of microcracks in polycrystalline YCrO3 using small angle neutron scattering in tandem with elasticity measurements.

601,137
PB87-106501 Not available NTIS National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.

Complex Permittivity of Beryllium-Oxide between 100-K and 300-K at 9.3 GHz.


Keywords: *Beryllium oxides, Ceramics, Dielectric properties, Reprints.

9.3 gigahertz measurement results of the relative dielectric constant and loss tangent of ceramic beryllium oxide at 99, 145, 223, and 300 kelvins are reported.

601,138

Monocrystal Elastic Constants of NbC.


Keywords: *Niobium carbides, Elastic properties, Reprints.

Using ultrasonic methods at ambient temperatures, for niobium carbide the authors determined the monocrystalline elastic stiffnesses: C sub 11, C sub 12 and C sub 44. A Voigt model analysis indicated that the authors calculated the quasi-isotropic (polycrystalline) elastic constants and the elastic Debye characteristic temperature. Their results derived from a blackman diagram suggest that ionic forces contribute significantly to the elastic constants and to interatomic bonding. This conclusion applies not only to NbC but also to other MX carbides with an NaCl-type crystal structure.

601,139
PB87-118931 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Ceramics Div.

Electrical Resistivity and Microwave Transmission of Hexagonal Boron-Nitride.


Keywords: *Boron nitrides, Electrical resistivity, Semiconductor, High temperature research, Energy gap, Wave propagation, Microwaves, Reprints.

The dc conductivity of hexagonal boron-nitride (BN) and NC-containing composites was measured as a function of temperature up to 2400 deg C. The results confirm that at high temperatures BN is an intrinsic semiconductor with an energy gap of 6.2 plus or minus 0.4 ev at T = 0 K. Extrapolated values for the resistivity of BN in the range 2600 to 3000 deg C are used to analyze the absorption, reflectivity, and transmissivity of a BN window when subjected to microwave radiations are shown to affect slopes and positions of the soda-lime-creep crack-growth curves, either through changes in the properties of the Si-O bond or through changes in the elastic properties of the bridging network. Sodium ion exchange and silica dissolution are also shown to be important, particularly at low crack velocities.

601,141
PB87-119749 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Ceramics Div.

Comparison of the Liquid-Nitrogen Strength and the High-Stressing-Rate Strength of Soda-Lime Glass.


Keywords: *Alkali glass, *Fatigue(Materials), Ceramics, Crack propagation, Fracture strength, Reprints, *Liquid nitrogen strength, Soda lime glass.

Indentation strength testing is used to compare two methods of avoiding slow crack growth: a high-stress-rate test under ambient conditions vs testing under liquid nitrogen. The liquid-nitrogen strength of soda-lime glass found to be 9% greater than the high-stress-rate strength. This is consistent with previous measurements of an increase in K(sub c) of 9.3% at liquid-nitrogen temperature. The implication of this finding regarding time-to-failure calculations is discussed.

601,142
PB87-122651 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Predictive Phase Equilibrium Model for Multicomponent Oxide Mixtures, Part 2: Oxides of Sodium, Potassium, Calcium, Magnesium, Aluminum, and Silicon.


Keywords: *Ceramics, Thermodynamics, Sodium oxides, Potassium oxides, Calcium oxides, Magnesium oxides, Aluminum oxides, Silicon oxides, Mathematical models, Reprints,* Phase equilibrium.

A new modeling approach, described in Part I of this series, for thermodynamic predictions of multicomponent, multiphase high temperature ceramic systems has been extended to include the binary to ternary oxide mixtures of Na, K, Ca, Mg, Al, and Si. The model, which attributes negative deviations from ideal solution behavior to the formation of complex liquids and solids, is demonstrated for systems important in high temperature materials and energy technology, including coal slags, glasses, and minerals. Good agreement between the model predictions and experimental vapor pressure data is found. Predictions and comparisons with experiments concerning melting and phase composition are also given.

601.143
PB87-135208 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.

Local Atomic Structure in Transition Metal/Metalloid Glasses: Ni-P.


Keywords: *Glass, Atomic structure, Chemical bonds, Density(Mass/volume), Nuclear magnetic resonance, Reprints,* Amorphous metals, *Nickel phosphorus alloys, Fine structure.*

Details of the local atomic structure and some aspects of the chemical bonding have been explored in alloys representative of the important class of metallic glasses formed from transition-metals and metalloids. A large number of binary Ni-P alloys were formed as glasses over a wide composition range by many different preparation processes. NMR experiments revealed that two distinct types of glasses were formed. A representative type of each class of glass was examined by EXAFS, revealing differences in structure and bonding.

601.144
PB87-136628 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Ceramics Div.

Static Fatigue Limit at Elevated Temperature.

Grant DE-A105-80ER02079
Sponsored by Department of Energy, Washington, DC.

Keywords: *Ceramics, *Crack(Propagation), Crack(Fracturing), Fatigue(Materials), Construction materials, Crack initiation tests, Grain boundaries, Reprints,* Static fatigue limit.

The static fatigue limit, defined as the stress level below which prolonged service life is expected, is derived from irreversible thermodynamics and found to be sensitive to kinetics. Existing theories of crack growth based on distinct mechanisms are summarized and discussed to give various values of the predicted static fatigue limit. Data for the static fatigue limit measured from alpha-SiC bend bar specimens tested at 1200 C are compared with those theoretical predictions. The results suggest that, for structural ceramics crept at elevated temperatures, diffusive crack growth along the grain boundaries, and not the static fatigue process and provides the fundamental level for the static fatigue limit.

601.149
PB87-136636 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Ceramics Div.

Real-Time Ultrasonic Nondestructive Evaluation of Green State Ceramic Powders during Compaction.

Final rep., M. P. Blessing and G. V. Blessing, 1986, 14p

Keywords: *Nondestructive tests, *Ceramics, Compacting, Ultrasonic methods.*  

A real-time ultrasonic technique for the nondestructive evaluation of ceramic powders during compaction has been demonstrated. Initial results indicate that this technique can be used in the absence of harmful agents in a spray-dried alumina powder. The proposed sensor could be employed by industry to spot flawed parts prior to removing them from the die, and to provide in-line criteria for control of compaction parameters.

601.148
PB86-160983 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.


Final rep., M. E. McKnight, and J. W. Martin, 1984, 8p
Sponsored by Federal Highway Administration, Washington, DC.

Keywords: *Organic coatings, *Corrosion, Blistering, Degradation, Evaluation, Nondestructive testing, *Infrared thermography.*

A nondestructive procedure using infrared thermography for detecting air and water filled blisters and localized corrosion at the coating/substrate interface is described. Deteriorated areas are observed in real time as varying gray levels on the cathode ray tube of an infrared thermographic camera or after digitization of the signal on a TV monitor. Digitization of the analog signal permits (1) image enhancement through signal averaging techniques, (2) association of gray levels with degraded areas, (3) quantitative analysis of the patch area, location, and type of degradation, (4) computerized storage of the digitized signal for dynamic analysis of the degraded coating and (5) graphic display of thermographic images.

601.147
PB86-165206 PC A03/MF A01 National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.


M. E. McKnight, T. Nguyen, and J. W. Martin. Feb 86, 33p NBSIR-86/3253
Sponsored by Civil Engineering Lab. (Navy), Port Hueneme, CA.

Keywords: *Degradation, *Coatings, Protective coatings, Tests.*

Non-electrode methods used to characterize early degradation in coating systems were reviewed and critiqued with respect to their ability to provide predictive in-service performance data. The methods reviewed were classified into those that measure chemical changes, coating/substrate interfacial changes, and adhesion and mechanical properties. Although many methods are used to characterize coating system degradation, very limited research has been done to relate early property to in-service performance. It was concluded that because of the complexity of the degradation of coating systems, a combination of methods will be needed to fully describe the condition to the extent that service-life prediction of coating systems can be based on these measurements.

601.150
PB86-192432 Not available NTIS National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.


Final rep., J. J. Retter, 1984, 6p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Coatings Technology 56, n74 p55-60 1984.

Keywords: *Acrylic coating, Chelating inhibitors, Anodization, Reprints,* *Cathodic dolamination, Ellipsometry.*

Qualitative ellipsometry has been used to study the effects of chelating inhibitors on the cathodic delamination of an acrylic coating from an iron surface. Chelating effects, such as 2-hydroxyquinoline and 2,5-di-mercapto 1,3,4 thiodiazole, when dispersed in the coating, were observed to delay the onset of delamination. A similar beneficial effect was noted with a-two
layer system employing a zinc chromate primer. However, when applied by an anodic pretreatment procedure, these chalking inhibitors were relatively ineffec- tive. A coating was found to be an ineffective inhibitor, whereas 4-methylcatechol exhibited impressive inhibition when applied in the two-step anodization pretreat- ment process.


Keywords: X-ray spectroscopy, Films, Metals, Surface properties.

Two sample-and-detector chambers for the study of passive films on metals using x-ray absorption spec- troscopy are described. Results have been obtained using a high intensity rotating anode x-ray generator and using the Cornell High Energy Synchrotron Source (CHESS).


Keywords: Abrasion resistant coatings, Protective coating, Titanium, Plasma spraying, Arc spraying, Chromium carbide, Tungsten carbide, Hard Facing. Wear.

The plasma transferred arc process (PTA) has been traditionally used to deposit wear resistant coatings on iron base alloy substrates, but has not been employed to coat light weight alloys due to processing problems. In the current study, use of the PTA process to deposit TiC, WC, and Cr2C2 on titanium substrates has been explored. The resistance of these coatings to dry abrasive wear has been measured and com- pared to that of TiC. The results show that in terms of resistance of these coatings is discussed in terms of the carbide particle size and the microstructure of the deposit. A comparison is made between the coatings prepared by the present process and coatings prepared by a laser surface melting and carbide particle injection process.


Keywords: Reaction kinetics, Drying oils, Varnishes, Polymerization, Curing, Coatings, Thermal analysis, Links, Reprints, Differential scanning calorimetry, Latigo inks.

The differential scanning calorimeter (DSC) is ideal for measuring the cure of the drying oils and varnishes in currency ink since it measures these oxidative cata- lyzed polymerization reactions with great sensitivity. However, the cure reaction takes place mainly at the oxygen-ink interface and deep curve depends on the permeation of oxygen through a highly crosslinked system which complicates the kinetics and makes it difficult to measure to total heat and degree of cure. Special fused silica cells of constant surface area and constant mass have been constructed to circumvent these complications. Temperature jump techniques have been used for the first time with the DSC. Equations are developed for direct cur- rent fitting of rate-time data and tables are given of time ratios for determining kinetic parameters. Examples of these techniques are applied to the cure of inks and their drying oil components.


Keywords: Aluminum coatings, Electrodeposited coatings, Metals, Surfaces.

A review of the current technology used to electrode- posit metallic coatings on aluminum is presented. For many years the zincate process seemed to dominate the surface and this trend seems to be continuing with the adoption of coatings containing zinc, copper, iron, and nickel. Problems in alloy stability continue with the zincate process and there are even more severe in anodic process- es. Even so, some alloys can be coated using a phospho- ric acid anodizing process as a pretreatment to plating.


Keywords: Surface chemistry, Polymeric films, Sub- strates, Surface physics, Silane, Chemical vapor deposition, Surface reactions.

Slow discharge deposition of hydrogenated amor- phous silicon films involves; (A) the electron collisions which produce the reactive species, (B) the gas reac- tions these species undergo while diffracting or drifting to the surfaces, and (C) the surface reactions involved in film growth and gas processing. The author will first describe results of his deposition studies involving these interactions, then of the surface reactions, and finally the author will offer some conceptions regarding the reasons for the surface reactions and bombardments upon film properties.


Keywords: Composite materials, Polymers, Re- search, Measurement, Plastics processing, Reprints. The application and growth of polymer composites are hindered by problems associated with fabrication and performance prediction capabilities. A major source of these problems is the lack of basic knowledge con- cerning the relationships among processing, and prop- erties. Research at the National Bureau of Standards is helping to address the need by developing test methods and by using these methods to generate scien- tific data on model materials. The program involves efforts in three areas. First, processing is being studied by developing measurements to monitor cure and by simultaneously applying these tests to study model systems. Second, measurement methods for the analy- sis of molecular structure, morphology, and defect content in composite materials are being investigated. Finally, performance properties are being measured and correlated in order to establish relationships between material properties and mechanical properties. The authors concluded that the current knowledge of the fundamental physics and chemistry of polymer processing is still inadequate and that many questions need to be answered before effective application of composites can be made.


Keywords: Particulate composites, Composite mate- rials, Wave propagation, Plane waves, Elastic prop- erties, Reprints, Aluminum matrix composites, Silicon carbide reinforced composites.

Plane-wave propagation in a SiC-particle-reinforced aluminum-alloy composite was studied. Considering the composite to possess orthotropic symmetry (nine independent elastic constants), by a pulse-echo method, nine independent ultrasonic velocities were measured. Using ensemble-average, scattered-plane-waves methods, the composite was modeled as SiC particles repre- sented as prolate spheroids distributed randomly, both in position and in orientation. Wave speeds of plane waves that are propagated parallel and normal to the in-plane anisotropy of the lamellar composite were measured. The wave speeds were used to determine the effective elastic constants that result from averaging the measured wave speeds over the particle distribution. The effective elastic constants were determined for a wide range of SiC volume fractions, and the results were compared to published data on the effective elastic constants of other particle-reinforced materials. The authors concluded that the current knowledge of the fundamental physics and chemistry of polymer processing is still inadequate and that many questions need to be answered before effective application of composites can be made.

Silicon carbide and 6061 aluminum alloy possess very different thermal-expansion coefficients: 3.3 and 22.5x10^-6/ K, respectively. Thus, one expects large internal strains and stresses in these composites because the two constituents form interfacial bonds at high temperatures and are cooled to ambient tempera- ture. Composite materials. One expects a hydrostatic tensile stress in the aluminum matrix and a hydrostatic compressive stress in the silicon-carbide particles. Of course, this is a simplification. Using Cu ka alpha radiation, the authors studied three surfaces of a plate specimen. For two phases, the authors determined the unit-cell dimensions for two situations: unmix and mixed in the final composite.

Composite Materials


Keywords: Residual stress, Particulate composites, Composite materials, Strains, Reprints, Aluminum matrix composites, Silicon carbide reinforced composites.

The authors describe experiments on the anisotropic elastic constants and internal friction of rein- forced composites. Reinforcement types include fiber, plate, and fabric. Studied materials include boron-aluminum, glass-epoxy, boron-epoxy, graphite-epoxy, and aramid-epoxy. The authors made measurements with a Marx three-component oscillator at kilohertz frequen- cies. In all cases, elastic constant direction dependence is evidenced. The authors concluded that the current knowledge of the fundamental physics and chemistry of polymer processing is still inadequate and that many questions need to be answered before effective application of composites can be made.
Young Modulus and Internal Friction of a Fiber-Reinforced Composite.

Final rep., H. L. Ledbetter, M. Lei, and M. W. Austin, 1986, 5p
Sponsored by Department of Energy, Washington, DC.
Office of Naval Research, NTIS PB87-116708.

Keywords: Fiber composites, Modulus of elasticity, Internal friction, Fiber-reinforced plastics, Reprints, epoxy matrix composites.

By a kilohertz-frequency resonance method the authors determined the Young modulus and internal friction of a uniaxially fiber-reinforced composite. The composite comprised glass fibers in an epoxy-resin matrix. The authors studied three fiber contents: 0.41, and 49 vol %. The Young modulus fit a linear rule of mixture. The internal friction fit a classical free-damped-oscillator model where one assumes a linear rule of mixture for three quantities: mass, force constant, and mechanical-resistance constant.

A review is presented of the open literature concerning fire tests for fiber-reinforced composites which may be considered for use in U.S. Navy shipboard structures and installations. Results obtained for thermoplastic resins, thermoset resins, and composite structures are summarized from standard test methods. The methods include tests for limiting oxygen index, smoke production, flame spread, fire endurance, and also from measurements of polymer properties, including differential scanning calorimetry and thermogravimetric analysis. Typical criteria used by various investigators for ranking materials are discussed, and the material rankings based on test results are given. Data from non-standard tests designed to measure fire performance are also discussed. A detailed review of data and results of tests for selected references is given. Finally, recommendations are made for test design, testing, and for the future direction of the U.S. Navy's fire evaluation program for composites and related materials intended for shipboard use.


Final rep., D. L. Hunston, 1984, 5p
Contract NASA-L-31154B
Sponsored by National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.

Keywords: Fracture(Materials), Composite materials, Crack propagation, Adhesion, Thermoplastic resins, Delamination, Reprints, Interlaminar fracture.

The data analyzed in the paper show a definite correlation between resin model fracture energy and composite interlaminar fracture energy as measured by the double cantilever beam specimen. With brittle polymers, the resin toughness is fully transferred to the composite while with tougher polymers the resin toughness is only partially transferred presumably because the toughness of the resin is converted to deformation work in the polymer. Not surprisingly, resin toughness is not the only factor that is important in interlaminar fracture.

Factors that tend to increase the interlaminar toughness are fiber nesting and bridging and fiber breakage and pull-out during crack growth. Factors that tend to lower the interlaminar fracture energy are resin porosity and weak fiber-matrix bonding.
Corrosion & Corrosion Inhibition

501,170
PB86-193828 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Use of Load-Pulsing Technique to Determine Stress-Corrosion Crack Velocity.
Final rept., P. W. Slattery, J. Smit, and E. N. Pugh. 1984, 1p
Keys: *Stress corrosion, Crackling/Fracturing*, Admiralty metal, Reprints.
The load-pulsing technique has been used to determine a velocity of transgranular stress-corrosion cracks in Admiralty Metal tested in a 15N aqueous ammonical solution. In this technique, small load pulses are periodically superimposed onto an otherwise constant tensile load during crack propagation, producing markings on the fracture surfaces which delineate the positions of the crack front.

501,171
PB86-238094 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Corrosion of Zinc. Final rept., J. Kruger. 1986, 1p
Keys: "Corrosion, *Zinc, Reprints."
No abstract available.

501,172
PB86-238102 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Corrosion of Tin. Final rept., J. Kruger. 1986, 1p
Keys: "Corrosion, *Tin, Reprints."
No abstract available.

501,173
PB86-238110 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Corrosion of Magnesium. Final rept., J. Kruger. 1986, 2p
No abstract available.

501,174
PB86-238128 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Corrosion of Lead. Final rept., J. Kruger. 1986, 1p
Keys: "Corrosion, *Lead(Metal), Reprints."
No abstract available.

501,175
PB86-238169 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Pub. in Proceedings of International Congress on Metallic Corrosion (9th), (Toronto, Canada), June 3-7, 1984, p144-152.
Keys: "Brasses, *Stress corrosion, Ammonia, Electrochemistry."
The chemistry and electrochemistry of the brass-ammonia system have been reviewed and updated. It has been concluded that the cupric ammonium complex whose presence is necessary for the occurrence of cracking under open-circuit conditions in conventional oxygenated solutions simply provides a cathodic reaction, permitting cracking either by the film-rupture model or by a mechanism involving dezincification. It is shown that cracking can also occur in deoxygenated solutions in the absence of significant concentration of the cupric ions provided that cuprous complexes are present, and it is suggested that the role of the cuprous complex is again to provide a cathodic reaction, in the case allowing dezincification to occur. These findings are consistent with the recognition that stress-corrosion failures of brass are not specific to ammonia.

501,176
PB86-238177 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
No abstract available.

501,177
PB86-238185 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Keys: *Brasses, Stress corrosion, Ammonia, Reprints, Copper alloy 30Zn.
Tensile tests on Cu-30Zn brass were carried out in aqueous ammonia solutions containing Cu+ ions and equilibrated with respect to copper so that no detectable dissolution of the specimens occurred. The specimens failed by transgranular stress corrosion cracking (SCC). Similar tests in deoxygenated aqueous ammonia did not show any brittle fracture. The results show that anodic dissolution of copper is not required for SCC to occur. The significance of these results in terms of various proposed mechanisms for SCC is discussed. Periodic Cu+ depletion at the crack tip is a possible cause for the experimentally observed discontinuous crack advance.

501,178
PB86-238334 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Keys: *Underground corrosion, Reprints.
No abstract available.

501,179
PB86-238375 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Keys: *Corrosion, Reviews, Reprints.
No abstract available.

501,180
Keys: *Corrosion, Reprints.
No abstract available.

501,181
Keys: *Stress corrosion, Reprints.
No abstract available.

501,182
Keys: *Corrosion, Degradation, Economic analysis, Reprints.
No abstract available.
Corrosion & Corrosion Inhibition

The fundamentals of fracture are presented with an emphasis on atomic models and delocalization interactions with cracks. The general fundamental principles are presented with some discussion of application to the hydrogen problem.

601,189
PB88-196623
Not available NTIS National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Application of Pulse-Echo Ultrasonics to Locate the Solid/Liquid Interface During Solidification and Melting of Steel and Other Metals.
Final rept.
Pub. in Appl. Phys. 56, n1 p140-1416, 1 Dec 85.
Keywords: *Steels, Ultrasonic tests, Solidification, Melting, Metallography, Interfaces, Reprints.
The velocity of sound and the density have values that are sufficiently different for liquid as compared to solid phases of metals and alloys to permit the use of pulse-echo ultrasonic techniques to locate the solid/liquid interface during solidification and melting. Experimental results presented herein illustrate observation of the melting and freezing of pure iron, 304 stainless steel, and tin, using Bragg-dynane furnaces with unidirectional and bi-directional heat flow, at frequencies from 1 to 5 MHz. For both iron and steel, rapid grain growth in the solid phase at high temperatures can strongly attenuate the sound waves and can also produce backscattered waves which obscure the identification of the solid/liquid echo. Additionally, in alloys the presence of a "mushy zone" rather than a sharp interface further reduces the reflected signal. These signal/noise problems were successfully overcome by the use of a transducer with spatial scanning technique with computer signal averaging that permits the interface to be located even in concentrated alloys.

Iron & Iron Alloys

601,187
AD-A160 831/4
PC A04/IF A01
National Bureau of Standards (IMSPE), Gaithersburg, MD. Fracture and Deformation Div.
Effect of Heat Treatment on Mechanical Properties and Microstructure of Four Different Heats of ASTM A710 Steel.
Keywords: *Heat treatment, *Low alloy steels, Age hardening, Electrons, Metallurgy, Fracture(Mechanics), Heat, Steel, Microstructure, Fine grained materials, Grain size, Mechanical properties, Fractography, Tensile properties, Test and evaluation, Thermomechanics, High strength alloys, Chemical properties.
A710 is an high strength low alloy steel whose strength is a result of both a fine grained microstructure and a dispersion of copper precipitates. For these reasons, the tensile and impact properties of an A710 plate depend as much on the thermo-mechanical history of each plate as on the chemistry of each heat. Since plates shipped from steel suppliers are frequently heat treated under different conditions, it is difficult to attribute property differences to chemistry variations rather than to heat treatment variations or vice versa. Heat to heat property differences must be determined for a specific, known heat treatment. This report describes the variability in the mechanical properties of four plates (representing four heats of steel) that have been delivered, and carefully controlled, heat treatments at the National Bureau of Standards. The sensitivity of these properties, within each heat of steel is also reported here. Optical and electron metallographic techniques were used to determine as-received and heat treated microstructures. Scanning electron fractography was used to ascertain the fracture mechanism in the tensile and impact tests. This report contains two appendices in which splitting fracture and microchemistry observations in A710 are discussed.

601,186
PB88-214074
Not available NTIS National Bureau of Standards (IMSPE), Gaithersburg, MD. Fire Measurement and Research Div.
Apparel Flammability: Accident Simulations and Bench-Scale Tests.
Pub. in Textile Research Jnl. 56, n5 p287-303 May 86.
Keywords: *Clothing, *Fire resistant textiles, Flammability, Ignition, Burning rate, Flammability testing, Apparel fabrics, Reprints.

601,191
PB88-196813
Not available NTIS National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
White-Beam Synchrotron Topography of Metals and Alloys.
Final rept.
W. J. Boettinger, H. E. Burdette, and M. Kuryama. 1984, 11p
Keywords: *Topography, *Microstructure, Iron alloys, Aluminum alloys, Containing, Recrystallization(Metallurgy), Grain growth, Synchrotron radiation, X ray diffraction, Reprints.
Some applications of white beam synchrotron topography, obtained at the Cornell High Energy Synchrotron Source (CHESS), to the microstructural characterization of metals and alloys will be described. The general quality of the x-ray topographs is shown with examples from Fe-24wt%Al samples. Topographs have also been obtained from 100 μm diameter Sn powder samples. These powder samples were prepared by the Per-zeck droplet-emulsion technique for obtaining large undercooling of liquid metal prior to solidification. Most of the powders are single crystals as determined from the topographs, but a small fraction are composed of two or three crystal grains. Multiphase alloy powders have also been examined. In situ recrystallization and subsequent grain coarsening of Al has been recorded on video tape using white beam synchrotron topography. The evolution of the size of a number of crystal grains during heat treatment is determined. Simultaneous coarsening and recrystallization of a sample is seen to occur.

601,190
PB88-21746
Not available NTIS National Bureau of Standards (IMSPE), Gaithersburg, MD. Fire Measurement and Research Div.
Ostwald Ripening of Rapidly Solidified Solid-Liquid Mixtures.
Final rept.
P. W. Voorhees, and M. E. Glicksman. 1983, 15p
Sponsored by Metallurgical Society of AIME, Warren, PA, and American Society for Metals, Metals Park, OH.
MATERIALS SCIENCES

Iron & Iron Alloys

Metallurgical, and Petroleum Engineers, Inc.) Chemis-
try and Physics of Rapidly Solidified Materials, St.

Keywords: *Curing, Metallurgy, Mixtures, Solidification,
Curvature, Morphology, Temperature measurement,
*Foreign technology, *Rapid solidification.

A new theory of Ostwald ripening in two-phase mix-
tures has been developed which explicitly accounts for the
diffusion-induced coarsening between the dispersed
coarsening second phase. The theory predicts the morpho-
ylogy of coarsening solid/liquid mixtures in terms of
infinite rate distributions of interfacial curvature. The
theory also predicts a dependence of the sur-
curate conditions on the volume fraction solidified.
Experiments were per-
factor of the solute-induced transformation can-
not be repeated. Evidence is provided that the solute-
induced reaction (DGM) process also occurs during con-
tinental grain growth.

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Experiments were per-
factor of the solute-induced transformation can-
not be repeated. Evidence is provided that the solute-
induced reaction (DGM) process also occurs during con-
tinental grain growth.

601.192
PB87-118543 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture
and Deformation Div.
Cryogenic Diffusion for Superconducting Magnets
Developments in Japan.
Final rept., H. Ohmori, 1985, 21p
Sponsored by Department of Energy, Washington, DC.
Office of Fusion Energy.
Pub. in ONRFE (Office of Naval Research Liaison

Keywords: *Steels, Cryogenics, Superconducting
magnets, Stainless steels, Reprints.
The Japan Atomic Energy Research Institute initiated
a program in 1982 to develop cryogenic steels for use
in superconducting magnets planned for the Fusion Experimen-
Tional Reactor. The target properties for
the cryogenic steels are a yield strength of 1200 MPa
at 4 K and a fracture toughness of 200 MPa m 1/2 at 4 K.

601.196
PB87-118592 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Polymers Div.
Mechanical and Swelling Behaviour of Well Char-
acterized Polybutadiene Networks.
Final rept., G. B. McKenna, and J. A. Hinkley, 1986, 9p
Pub. in Polymer 27, p1068-1076 Sep 86.

Keywords: *Polybutadiene, Synthetic elastomers,
Swelling, Elastomers, Reprints.
Endrinning of hydroxy-terminated polybutadiene
with the appropriate isocyanate has been used to prepare well
characterized networks. Two networks have been studied with molecular weights of the polymers
being 6100 and 2400 g/mole by g.p.c. Cylindrical
specimens were prepared and the derivatives of the
stored energy function with respect to the stretch in-
variants were determined by torque and normal force
measurements in torsion. From these data the Valan-
s-Lander function, which is a special form of the
Land-Landel function, has been fitted to that determined
from the experiments. The contributions, Delta A sub ph
and Delta A sub cub to the stored energy Dickon
the phantom network and from the junction con-
strants respectively do not agree with predictions from
the topologies of the networks. In spite of this, the
function of w prime (lambda) for the junction constraint model
and the excellent ‘ curve fit’ at the data. Comparison is
also made with equilibrium swelling.

601.197
PB87-119111 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fracture and Deformation Div.
Strength-Toughness Relationship for Austenitic
Stainless Steel Welds at 4 K.
Sponsored by Department of Energy, Washington, DC.
Office of Fusion Energy.
Pub. in Cryogenics 26, p392-395 Jul 86.

Keywords: *Austenitic steels, Welded joints, Mechanical
properties, Fractures(Materials), Toughness, Cryo-
genics, Reprints, Low temperature.
Cryogenic mechanical property data compiled at the
National Bureau of Standards, USA, have been used to
analyse the relationship between yield strength and
 fracture toughness for austenitic stainless steel welds at 4 K.
The study demonstrates that there is an inverse
curve correlation between yield strength and fracture
toughness for the stainless steel welds at 4 K, and that
the welds have significantly lower toughness than
base materials of comparable strength.

Fatigue Crack Initiation from Notches in Austenitic Stainless Steels.
Final rept., R. L. Tobler, and O. S. Shu, 1986, 6p
Sponsored by Department of Energy, Washington, DC.
Office of Fusion Energy.
Pub. in Cryogenics 26, p396-401 Jul 86.

Keywords: *Austenitic stainless steels, *Cracking(Fracturing), *Fatigue(Materials), Austenitic
steels, Cryogenics, Notch sensitivity, Mechanical prop-
erties, Reprints, Steel AISI 316, Steel AISI 304L.
Fatigue crack initiation from notches in austenitic stainless steels has been studied using compact
specimens of two common cryogenic alloys: AISI 316 and AISI 304L. The procedure is based on a
fracture mechanics technique whereby delta K roth(sub -1/2), a parameter proportional to the change in maximum
elastic stress at the notch root, is correlated with the
cycles to initiate a 0.254 mm crack. The effects of
different environmental variables including notch radius,
stress level, specimen size and test temperature (255, 76, and 4 K) are presented, and the fatigue crack
initiation resistances of the AISI 316 and 304L austenitic steels are compared with martensitic and ferritic/pear-
litic steel data at room temperature.
keywords: *brittle fracturing, crack propagation, adhesion, reprints.

A new conception of brittle fracture processes is presented. It is proposed that the crack-tip structure is im-
mutably sharp at the atomic level, such that the attend-
gant growth laws are uniquely determined by the stress in-
side the 'vector of 'fracture mechanics' origin. Threshold features in the measured v(K) function for
the crack growth in interactive environments, previously
put forward as evidence for fundamental changes in
fracture behavior, have been shown to be of type blunting,
consistent with a negative K contribution from interfa-
cial adhesive forces. These adhesive forces should be
determinable from the crack velocity characteristics.

Lubricants & Hydraulic Fluids

Materials Degradation & Fouling

MATERIALS SCIENCES
Iron & Iron Alloys

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MATERIALS SCIENCES

Materials Degradation & Fouling

Thin compact tension specimens with varying crack size-to-ligament ratios in a simple experimental procedure have been established that both measures are equivalent, at least under the plane stress conditions, and that they both represent the fraction of energy which is transmitted through the plastic deformation field into the crack tip region. The ratio "essential work of fracture/total work of fracture" has been suggested as a quantitative measure of the energy transmission process. Certain predictions are made concerning variations of the energy transmission factor during the stable phase of ductile fracture propagation.

Miscellaneous Materials


Keywords: Refrigerants, Equations of state, Computer programs, Thermodynamic properties.

The note describes the application of the Carnahan-Starling-DeSantis equation of state to halogenated hydrocarbons and their mixtures. A complete and consistent set of thermodynamic functions is derived from the p-V-T equation of state and the perfect (ideal) gas heat capacities. A thorough discussion of reference states is included for both pure materials and their mixtures. Although this model exhibits a critical point, it does not quantitatively represent properties in the critical region. Despite this limitation, this model can represent both liquid and gaseous mixtures away from their own critical points even at conditions near to and above the critical points of their components.

Nonferrous Metals & Alloys

601.213 DE85000592 PC A02/MF A01 National Bureau of Standards (IMS), Gaithersburg, MD. Metallograv-D. Patterns in the Occurrence of the Brittile Topologically Close-Pack-Phases: Al. L. H. Bennett, and R. E. Watson. 1984, 12p BNL-35275. CONF-840417-4


Portions are illegible in microfiche products.

Keywords: "Heat Resisting Alloys, Aluminum Alloys, D States, Design, Embrittlement, Phase Studies, Transion Element Alloys, ERDA/360102.

Precipitation of sigma and structurally related phases can weaken or embritter superalloys and stainless steels. These phases, known generically as topologically close-packed (TCP) structures, exist in many transition-metal alloys. Methods of predicting their appearances include examination of phase diagrams and the use of d-band electron-vacancy concentrations for the transition elements. The use of an effective site occupancy of the d-vacancy sites for the transition elements is reviewed. An effective d-electron vacancy value between that of Rh and Ru is assigned to the important nontransition element Al. (ERA citation 10:000871)


Keywords: Alloys, Transition metals, Phases, Chemical bonds, Reprints, Laves phases, Sigma phase.

The occurrence or non-occurrence of topologically close-packed (top) phases is discussed in terms of phase diagrams (V-Nb system) and stoichiometry. The ranges of stoichiometries over which top phases occur are shown to be related to the relative sizes of the alloy constituents. It is necessary to consider the laves structures as distinct from the other top phases. The non-laves top phases having a range of Al-Dp site volume ratios. Some suggestions are given of alloy systems in which top phases have not been reported but are expected, and vice versa.


Keywords: Transition metals, Alkaline earth metals, Alloys, Reprints, Laves phases.

A simple cellular model estimate of the site volume changes attending alloying of transition metals with each other, with alkali and alkaline earth metals is made. Application is made to AB2 (MgCu2 and MgZn2) Laves phases as well as the related AlB5 CaCu5 and AlB12 structures. Size factors and electron factors are considered as measures controlling the occurrence of Laves phases.


Keywords: "Metalloid alloys, Crystal structure, Transion metals, Reprints.

Easy glass formation usually occurs near eutectic, where the glass forming temperature is close to the melting point. However, as Anderson observed (1), other factors also exist. Citing relevant systems such as SiO2 and GeO2, he noted that glass formation is favored when the crystal structure(s) of the compounds are complicated. The purpose of the present communication is to seek transition metal rich-metalloid compounds have complicated structures and what implications this might have for glass formation.


Keywords: "Aluminum alloys, Manganese containing alloys, Precipitation(Chemistry), Microstructure, Reprints, Rapid solidification.

Precipitation at 450°C was studied in melt-spun ribbons containing up to 15 wt. % Mn in solid solution in Al. The as-cast alloy showed high degree of precipitation-free at compositions up to 5 wt. % Mn, but in more concentrated alloys a cellular microstructure was present. Upon annealing, four precipitate phases are observed, some of them being found preferentially on cell boundaries and others being found within the cells. AlMn, G and G double prime phase can coexist for long times at 450 C, but the G phase appears to be slightly more stable. A less stable T phase was detected in Al-5 wt. % Mn foil's following short annealing periods. The supersaturation of the Al matrix can persist for many hours in alloys containing up to 3 wt. % Mn, but is essentially gone after 1 hour in alloys with 5 wt. % Mn or more.


Keywords: "Zirconium oxides, Ceramics, "Aluminum oxides, Mechanical properties, X ray diffraction, Reprints.

The authors are undertaking a systematic study of the structural and bulk properties of zirconia and alumina-based materials as functions of pressure and temperature. This paper describes the experimental approach that is being taken and discusses some of the results obtained for ZrO2 with 8 mol% Y2O3.


Keywords: "Nickel alloys, Aluminum containing alloys, Phase transformations, Neutrons scattering, Reprints, "Aluminum nickel, Spinodal decomposition, Temperature dependence.

Small angle neutron scattering measurements on the isochronal annealing of Al-4 at.% Ni alloy in qualitative agreement with a recent nucleation theory based on cluster dynamics. The data exhibits an apparent linear temperature dependence of the power law exponents for the peak intensity and position.


Keywords: "Titanium intermetallics, Phase transformations, Crystalization, Reprints, "Metallic glasses, Amorphous materials, Copper titanium.

A metallic glass ribbon of Cu55Ti45 prepainted by melt spinning was examined by x-ray, neutron, and electron diffraction. In single-crystalline copper-titanium (SANT) transmission electron microscopy (TEM), and by differential thermal analysis (DTA). In the liquid quenched condition large angle diffraction data (both x-ray and neutron) show the broad banded structure typical of the amorphous state. The SANS data, however, exhibit-
it highly anisotropic patterns arising from phase decomposition during solidification. Ribbons annealed below the temperature at which melting (Debye temperature) pro-
duced neutron diffraction patterns of materials with the same amorphous structure combined with a new short range order; and the SANS patterns retained the asymmetry of the as-quenched material. Ribbons annealed above the crystallization temperature \( T_c \) exhibit both isotropic and anisotropic contributions to the SANS patterns. Formation of the equilibrium TiCu phase occurs directly from the metallic glass at \( T_c \) sub-cooling. The second glassy phase forms from the TiCu phase at a just slightly higher temperature.

Keywords: Distribution functions, Iron alloys, Nickel alloys, Load cells, X-ray diffraction, Tungsten containing materials, Metals and Alloys, Reprints, Amorphous materials, High pressure.

The determination of a radial distribution function of an amorphous material contained in a diamond anvil pres-
sure cell is described. The details of the method of computation are presented, and the results for two amorphous metals, Fe-W (72 at.\% Fe) and Ni-P (75 at.\% Ni), are presented and critically discussed. For the reduced structure function and its Fourier trans-
form, the differential radial distribution function, amplitudes, are not always negative, and minima are located with an absolute accuracy not better than three percent. However, for a single experi-
ment, the changes in the first neighbor distance as a function of pressure are readily detectable, even for variations on the order of 0.01. Measurements at 0.15, 2.5, and 5.5 GPa indicate that Ni-P (75 at.\% Ni) has a bulk modulus of about 370 GPa at room temperature.

Keywords: Solidification, Heat transmission, Micro-
stucture, Acoustic emission testing, Rapid solidification.

Heat flow models are now available for one- and two-
dimensional, molten and crystalline, systems comprising substrates subjected to high energy laser and elec-
tronbeam sources. The models can account for both stationary and moving heat sources. In theoretical studies, experimental observations have been limited to post-solidifica-
tion examinations of the microstructures and have resulted in establishment of correlations between fine-
ness of structure, interface stability and extent of al-
terd microstructure (e.g., melt depth) with various 
such as the heat flux distribution in space and time. Techniques are accordingly needed for in situ meas-
urement of the dynamics of laser and electron beam melting processes and the effects of control applications and the detection of defective conditions. Acoustic emission methods show promise for this purpose. Acoustic emission accompanying absorption of 100 ms stationary electron beams of variable flux density have been measured from 1100 and 2219 al-
nomyl alloys.

Use of Metastable Phase Diagrams in Rapid Solidifica-
tion.

Keywords: Solidification, Phase diagrams, Meta-
estable state, Rapid solidification.

During rapid solidification, the nucleation and/or growth of the thermodynamically stable phase may be difficult. In this case the liquids, solids, or other ther-
modynamic data for a metastable phase are important. The interface between the phases may be metastable and present in rapidly solidified materials. In this paper vari-
ous techniques are described to obtain information about the metastable interface. Some metastable equilibrium data. Extrapolations of phase boundaries as functions of temperature, pressure or composition (including a new component) into regions of meta-
sability can often be constructed directly on the equilib-
rium diagram. These constructions can be performed with great accuracy. The key to using ther-
modynamic modeling of the free energy functions consistent with measured data. A number of examples are considered including a discussion of metastable phase changes, the miscibility gaps, metastable eutectic and peritectic reactions, pressure diagrams and metastability in ternary alloys to indicate the possible product phase range. Some results of the coupling of metastable phase diagrams with a solidification kinetics analysis can contribute to

views 

effective alloy design and processing during rapid solidification.

Keywords: Molybdenum, Thermal expansion, High 
temperature tests, Interferometers, Pulse heating, Re-
prints, Standard reference materials.

The linear thermal expansion of molybdenum has been reported in the range 1500-2600 K by means of a transient (subsecond) interferometric technique. The molybdenum selected for these meas-
urements was the Standard Reference Material SRM 781 (a high-temperature enthalpy and heat capacity standard).

Keywords: Aluminum alloys, Coatings, Adhesion, Anodizing, Electrodeposits, Microhardness, Re-
prints.

One of the most difficult problems encountered in pre-
treating aluminum alloys for electrodeposition using the phosphoric acid anodizing process is the deform-
ation of the anodic oxide film during and after anodic adhesion. The paper presents a simple method for de-
termining the approximate coating adhesion without the use of any time consuming expense of adhesion testing. Investigations show that the coating adhesion is closely linked with the anodic film microhardness. The testing of anodizing potential, anodize temperature, anodizing time, anodize concentration, and post anodizing treatments are examined with respect to both micro-
hardness and coating adhesion. In each case an in-
crease or decrease in the anodic film microhardness predicts a corresponding increase or decrease in the metal coating adhesion.

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crease or decrease in the anodic film microhardness predicts a corresponding increase or decrease in the metal coating adhesion.
MATERIALS SCIENCES Nonferrous Metals & Alloys

molecular transformations: (1) metabolic utilization of metal species, (2) toxic metal resistance mechanisms, and (3) indirect metal biotransformations by exocellular metabolites. Bioaccumulation of lead sulfide ores and wastes by microorganisms represent powerful new14 processes for the bioremediation of pollutants. The parallel consideration of using microorganisms to accumulate or even synthesize metal compounds in selected forms of most value to further commercial processing.


Nature of Large Ti4Cu20 Particles Formed during Annealing of Cu5Si4Ti4 Metal Glass Ribbons.


Keywords: "Intermetallics, "Copper alloys, "Titanium containing alloys, Annealing, Crystalization, Electron diffraction, Spectroscopy, Reprints, Metallic glass.

Large particles observed in annealed Cu(sub 5)Si(sub 4)Ti metal glass ribbons have been identified using convergent beam electron diffraction and energy dispersive X-ray spectroscopy as Ti(sub 4)Cu(sub 2)Si(sub 2)O (diamond cubic, space group Fd3m) consistent with the structure derived earlier by Mueller and Kissel. The Cu(sub 4)Si(sub 2)O does not contain Cu(sub 3)Si(sub 2)O which is present in the Cu5Si4Ti metal glass ribbons (col. 26 p. 139). Using different experimental techniques. In addition, evidence is presented which suggests that these particles form prior to and independent of either of the two binary equilibrium phases, TiCu and TiSi(sub 2) which also form during the crystallization annealing treatment.


Constitution of an Al-37.5Ge Splat Quenched Foil: Implications on Nucleation Kinetics.

Final rep., M. J. Kaufman, M. Eliner, and H. L. Fraser. 1986, 4p. Contract NCC-AC02-76ER01198


Keywords: "Aluminum alloys, "Germanium containing alloys, Electron microscopy, X-ray diffraction, Foils(Materials), Nuclear, Kinetics, Microstructure, Solidification, Quenching(Cooling), Cooling, Reprints, Undercooled Liquid, Rapid solidification, Splat quenching.

An Al-37.5Ge splat quenched foil has been analyzed using transmission electron microscopy and X-ray diffraction. The results are supportive of previously proposed nucleation kinetics and enforce the view that these microstructures which are produced using rapid solidification can and should be related directly to the undercooling and the neutron scattering spectrum even at a level of < 1 at. % H. In contrast, the near density-of-states peaks normally expected with hydrogen, those of interest in the spectra between 259 and 210 K, an unexpected continuous onset from 105 to 115 K, indicative of possible mechanisms to explain these unusual observations are discussed and evaluated.

601.235 PB86-223157 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Polymers Div.

Hafnium-Rhodium Constitution Diagram.


Keywords: "Hafnium alloys, "Rhodium alloys, "Phase diagrams, Intermetallic compounds, Reprints.

A constitution diagram is presented for the Hf-Rh system. The liquids rises to a maximum near the equiatomic composition and then falls rapidly with increasing hafnium content to a deep eutectic minimum at about 73 at. % Hf. The congruently melting equiatomic phase delta apparently transits. The lower melting peak in the phase diagram is interpreted as a hafnium-rich phase formed nucleation of the hafnium iron phase the high diffusion rate results in the observed continuous at various compositions and temperatures. Also present is an hafnium-rich phase which forms in the reaction at 1500 C and 2040 C respectively.


Database Development under the ASM/NBS Program on Alloy Phase Diagrams.


Keywords: "Phase diagrams, Alloys, "Data bases.

The ASM/NBS Phase Diagram Data Program addresses the need of the metals industry for up to date, critically assessed phase diagram data. Computerization is needed because of the sheer volume of phase diagram information currently being published. The scope of the computerization project goes beyond the treatment of text and digitization of figures, first because of the need for continuous update of critical assessments and second because of complex relationships among phase diagrams, crystallographic and thermodynamic data. Through a collaboration between the Metallurgy Division and the Center for Applied Mathematics, NBS is currently creating a prototype of the computerized phase diagram database. In the paper, evaluation of phase diagram data and the development of a prototype database are discussed.


Vegard's Law.


Keywords: "Solid solutions, Lattice parameters, Reprints, Vegard law.

Vegard's Law is an empirical rule which states that the lattice constant of a solid solution varies linearly as a function of the composition of the components. It is found that metallic systems seldom, if ever, obey Vegard's Law exactly.


Orientation Relationship between Precipitated Al(Fe,Ni)2 Phase and Alpha-Aluminum.

Final rep., L. S. Bersonsky, Apr 85, 4p.


Keywords: "Aluminum alloys, Nickel containing alloys, Iron containing alloys, Phase, Orientation, Aluminum, Reprints.

The orientation relationship between Al(Fe,Ni)2 precipitates and the FCC aluminum matrix in rapidly solidified Al-3.7, Ni-1.5 Fe (wt%) alloy has been determined. The precipitates are products of the supersaturated alpha-Al, deoxidized by precipitation during continuous cooling immediately after solidification.


New Magnetic Phase Diagram of the Amorphous Pd-Fe-Si Ferroglass Alloy System.


Keywords: " Palladium alloys, Forr containing alloys, Silicon containing alloys, Phase diagrams, Reprints, Amorphous materials.

The magnetic phase diagram of amorphous Pb80-Fe6-Si6 is extended for 5 < or = x < or = 22. The authors use the peak in the magnetic component of the susceptibility to determine the ferromagnetic-like to spin glass transitions. It is found that the T sub P is strongly field dependent and increases monotonically with increasing Fe concentration, even around x = 22.
Diffusion-Induced Grain-Boundary Migration in the Au-Ag System.
Final report,

Keywords: *Gold alloys, Silver containing alloys, Diffusion, Grain boundaries, Microstructure, Transport, Reprints.*

Diffusion-induced grain boundary migration (DGM) is a recently recognized phenomenon that leads to unexpected motion of grain boundaries. Vastly enhanced mass transport characterizes the low-temperature aspect of the phenomenon, since the grain boundaries provide easy paths for diffusion redistribution of atoms in the regions traversed at the above temperatures. At which only temperature grain boundary diffusion is significant has been observed to induce grain boundaries to migrate in a number of binary metal systems. At relatively low temperatures (where lattice diffusion is frozen out and where grain boundary diffusion prevails), migrating boundaries sweep across grains mixing in (or removing) solute. At these temperatures, no compositional changes occur except in regions through which the migrating boundaries pass, resulting in a discontinuous concentration range across the moving boundary. The Ag-Au system is investigated here with the aid of optical metallography, electron microprobe, and SEM.

Microstructural and microchemical analysis has been performed on Ag-15 wt.% Cu alloys produced by electron beam melting with solidification velocities of 2.5, 12, and 18 cm/s. Cellular structures of the Ag-rich phase are produced with spacings of 0.8, 0.3, and 0.2 um, respectively. Intercellular regions contained fine eutectic at the lowest speed but only Cu-rich phase at the higher speeds. The composition within the rate was found to be nearly uniform and 12.5 plus or minus 1 wt.% Cu. The uniformity and the level of Cu content within the cells are discussed.

Effect of Rapid Solidification Velocity on Microstructure and Phase Solubility Extension in Nickel-Aluminum-Chromium (NIA-Cr) Quasibinary Eutectic.
Final report,

Keywords: *Silver alloys, Copper containing alloys, Microstructure, Silver alloy 15Cu, Rapid solidification.*

Microstructural and microchemical analysis has been performed on Ag-15 wt.% Cu alloys produced by electron beam melting with solidification velocities of 2.5, 12, and 18 cm/s. Cellular structures of the Ag-rich phase are produced with spacings of 0.8, 0.3, and 0.2 um, respectively. Intercellular regions contained fine eutectic at the lowest speed but only Cu-rich phase at the higher speeds. The composition within the rate was found to be nearly uniform and 12.5 plus or minus 1 wt.% Cu. The uniformity and the level of Cu content within the cells are discussed.
MATERIALS SCIENCES

Nonferrous Metals & Alloys

Nickel and Nitrogen Alloying Effects on the Strength and Toughness of Austenitic Stainless Steels at 4K.

Final rept., R. P. Reed, T. P. Turschke, and K. A. Yushchenko. 1986, 8p
Sponsored by Department of Energy, Washington, DC.

Keywords: *Austenitic stainless steels, *Tension strength, Low temperature tests, Tensile properties, Cryogenics, Nickel alloys, Reprints, *Fracture toughness, Nickel nitrogen alloys.

The tensile strength and fracture toughness at 4 K were studied as a function of N (6-15 wt %) and N (0.90-0.28 at %) in type 304 austenitic stainless steels. Results indicate that Ni increases the tensile yield strength and decreases the fracture toughness, Kic, and Ni has little effect on tensile yield strength but increases the fracture toughness. The temperature dependence of the yield strength is given by sigma(sub y)(T) = sigma(sub y)(0) + A*exp(-E/RT), where sigma(sub y)(0) is the yield strength at 0 K, and A is the slope of sigma(sub y)(T) vs. T. The parameter A is proportional to the stacking fault energy. Lower Ni alloys exhibited brittle facets on fracture surfaces. The quality index, a new parameter − sigma(sub y)(0)/sigma(sub u)(0), (J), relates to the capacity of the alloy to achieve greater strength or toughness but not at the expense of the other parameter. Nickel alloying increases the quality factor; nitrogen has little effect.

601,250
Sizing Planar Flaws in Weldments Using Low-Frequency EMATs (Electromagnetic-Acoustic Transducers).

Final rept., R. E. Schramm, and T. A. Siewert. 1986, 8p
Sponsored by David W. Taylor Naval Ship Research and Development Center, Bethesda, MD.

Keywords: *Weld defects, Weldments, Nondestructive tests, Ultrasonic tests, Transducers.

The report describes a significant improvement in flaw sizing capability using electromagnetic-acoustic transducers (EMATs) operating near 0.5 MHz. Previous work demonstrated the use of backscattered signals for determining the size of a planar flaw on the order of 0.5 mm; for deeper flaws the signal saturated. In the next procedure, a second receiver measures the forward-scattered signal transmitted through the weld. Using the backscattered to forward scattered ratio as a sizing parameter has extended the depth sizing range to at least 10 mm. Artificial flaws were used to generate a calibration curve used to size real lack-of-penetration weld flaws in 16-mm thick ferritic steel plates. True flaw depths, as determined by metallography, were in very good agreement with those determined by the ultrasonic measurements.

601,251
PB87-122560 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Roughening of Low-Angle Grain Boundaries.

Final rept., C. Rottman. 1986, 5p

Keywords: *Grain boundaries, Crystal dislocations, Interfaces, Melting, Reprints.

The possibility of roughening in low-angle grain boundaries is investigated. By exhibiting an analogy between grain boundary steps which do not have long-range strain and steps on solid surfaces, the author argues that a grain-boundary roughening transition of the same type as for solid surfaces, is possible.

601,252
PB87-122842 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.

Influence of Thermal Processing on Fatigue Crack Initiation and Propagation of Ti-4.5Al-6Mo-1.5Cr.

Final rept., C. M. Gilmore, M. A. Imam, A. C. Fracker, S. H. Yang, and A. C. Van Orden. 1985, 8p

Keywords: *Titanium alloys, Heat treatment, Crack propagation, Fatigue rupture, Martensites, Crack propagation, Mechanical properties, Microstructures, Titanium alloy 45 Al 1.5 Cr 5 Mo.

The effects of thermal treatment on the microstructure and mechanical behavior of the Al-Cr (5Mo-1.5Cr) (SCA-55) alloy were studied. The temperature range studied was 780°C - 965°C. Fatigue crack growth rates were not significantly affected by the presence of metastable martensite and its induced transformation to martensite. Fatigue crack initiation and fatigue life are affected by the presence of a metastable beta phase.

601,253
PB87-127940 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Optical Measurement of the Roughness of Sinusoidal Surfaces.


Keywords: *Surface roughness, Roughness, Scatter, Metal working, Reprints.

Results are presented for optical scanning measurements of six sinusoidal surfaces with a roughness average R(sub a) ranging from 0.3 to 3 micrometers and wavelengths ranging from 40 to 800 micrometers. The probe was an He-Ne laser beam with a 0.0382 micrometer wavelength. The multiplexed scanning detector used to provide a screen integral to find the amplitude and spatial frequency parameters that then yielded results for R(sub a) and the spatial wavelength for each surface. The agreement with the comparable parameters as measured by a stylus instrument is excellent. This leads to the observation that optical scanning with visible light in conjunction with a straightfoward optical theory can yield accurate measurements of roughness parameters where the surface roughness itself can be accurately modeled with a priori knowledge and provided that the surface slopes and heights are in the ranges represented by these sinusoidal surfaces.

601,254
PB87-127965 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Interaction of Line Singularities Near a Crack Tip and Their Application to Surface Stresses at Cracks.


Keywords: *Crack propagation, Crackfracturing, Dislocations(Materials), Ductility, Stresses, Reprints.

An elastic analysis of line singularities interacting with a crack is developed. The line singularities simulate the action of surface stresses which are present on all open surfaces, and which can be modified by adsorption of foreign chemical species on the cleavage surface near the crack tip. Results are presented showing that shielding k-fields at the crack are generated by anti-symmetric line dipoles. A symmetrical line dipole leads to net stress singularities. When dislocations are included near the crack tip, it is found that under elastic conditions for a tilt crack, dipoles of both kinds exert forces on the dislocation and can modify the ductility of materials.

601,255
PB87-128021 Not available NTIS National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Low Temperature Deformation of Copper and an Austenite-Stainless Steel.

Final rept., R. P. Reed, and R. P. Walsh. 1986, 10p

Keywords: *Deformation, *Copper, *Austenite-stainless steels, Cryogenics, Low temperature tests, Tensile properties, Stress strain diagrams, Reprints, Steel AISI 310, Copper 102 alloy.

The tensile-ductility characteristics and effect of strain rate were studied on relatively pure CDA 102 Cu and solid-solution-strengthened AISI 310 Tensile strain rate was varied between two orders of magnitude (0002.0 0005/s) at temperatures ranging from 4 to 295 K. The stress-strain-hardening values were determined for these temperatures. The effect of strain-rate changes on tensile flow stress was measured from strains near 0.001 (yield strength) to over 0.300. The data reflect three distinct ranges of face-centered cubic, polycrystalline plastic deformation, and different characteristics depending on solute content.

601,256
PB87-128799 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.
Stress/Strain Determination of Principal-Stress Differences for a Slightly Anisotropic Residual Stress Specimen.

Final rept., A. V. Clark, and J. C. Moulder. 1986, 11p

Keywords: *Dynamic structural analysis, *Aluminum alloys, Nondestructive tests, Stresses, Structural analysis, Ultrasonic tests, Anisotropy, Texture, Acoustical birefringence.

The authors have used the acoustical birefringence technique to measure the difference of principal stresses in a specimen in a well-characterized state of residual stress. In this technique, the difference in the stress state is indicated by a change in the birefringence at the specimen surface. The authors formed a good agreement with the theoretical predictions of the principal stress differences for the single-crystal aluminum alloy specimen.
COMPON, 601.258
PB87-128989 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.
Elastic-Plastic Response of Tensile Panels Containing Short Cracks.
Keywords: Cracking(Fracturing), Panels, Finite element analysis, Fracture properties, Deformation, "J" integrals
The finite element method (FEM) is used to predict applied J-integral values in highly strained tensile panels containing short center cracks. Experimental J-values are obtained by integrating strain and displacement quantities measured along an instrumented contour. FEM plane stress predictions for J-values and crack mouth opening displacements are much larger than experimentally measured values for short cracks (a/W < 0.05). Large geometry changes near the crack tip are demonstrated to have negligible effect on the FEM results. The introduction of a small stiffened zone near the crack tip using an overlay of plane strain elements brings FEM J and CMOD values into close agreement. For longer crack lengths, conventional plane stress FEM solutions are adequate to predict J and CMOD values.

601.259
PB87-137267 Not available NTIS
Absolute Ultrasonic Determination of Stresses in Aluminum Alloys.
Keywords: *Stresses, *Aluminum alloys, Nondestructive tests, Reprints, Acoustic birefringence, Ultrasonics.
Ultrasonic methods are currently being investigated as a means of nondestructive stress measurement. The authors have considered various methods to obtain individual stress components using shear-horizontal (SH)-waves in slightly anisotropic (textured) structural components. For rolled aluminum alloy plate, there are typically three two-fold modal symmetry axes. Referring stresses to these axes, the authors find that different methods of stress determination must be used, depending upon whether or not the principal stress and material symmetry axes coincide. Furthermore, the authors believe that an initial birefringence, the birefringence is defined as the normalized difference in phase velocity of orthogonally polarized, pure-mode SH-waves.

601.260
PB87-137275 Not available NTIS
Ultrasonic Techniques for Residual Stress Measurement in Thin Welded Aluminum Alloy Plates.
Keywords: *Metal plates, *Aluminum alloys, *Stress, Welding, Ultrasonic testing, Nondestructive tests, Reprints, Acoustic birefringence.
Thin aluminum alloy plates were single-pass butt-welded to produce a state of plane residual stress. Strain gages bonded to the plates prior to welding were used to measure the residual stresses. Residual stresses were also measured ultrasonically by three different methods. The acoustic birefringence technique was used to measure the principal stress difference, delta sigma, near the center of the welded plates. For comparison, contacting EMAT's were used to make measurement at intervals of SH-waves before and after welding. Near the plate edges, a shear stress sigma (xy) exists. The gradient of sigma (xy) was measured with the acoustic birefringence technique and substituted into the stress-equilibrium equation to calculate the normal stress. Values obtained were within about 20 MPa of the strain gage data.

601.261
PB87-128116 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Extraction Replica Method for the Study of Surface Films.
Keywords: *Surfaces, *Thin films, Wear, Surface chemistry, Substrates, Iron oxides, Iron sulfides, Reprints, *Extraction replica
An extraction replica method is described by means of which thin solid films on worn surfaces may be removed from selected areas for examination in the transmission electron microscope. A scratch or several scratches are made on the worn surface with a pointed stylus. Displaced or loosened fragments of film are then replaced with a plastic replica. After subsequent processing of the replica, sufficiently thin fragments can then be examined by transmission electron microscopy. The authors and the allied methods of x-ray energy dispersive analysis and electron energy loss spectroscopy. The latter two methods provide the determination of chemical composition which can then be correlated with crystallographic and microstructural observations. Application of this technique is illustrated with examples of films removed from worn steel specimens lubricated with paraffinic mineral oil, mineral oil with 1 wt.% ZDP, and with a formulated reference motor oil.

601.262
PB87-138274 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Equilibrium Solute Concentration Surrounding Elastically Interacting Precipitates.
Keywords: *Precipitates, Concentration(Composition), Thermodynamics, Elasticity, Metallurgy, Solutes, Stress analysis, Reprints.
Elastically induced equilibrium solute concentration profiles surrounding isolated and two elastically interacting precipitates are determined under the conditions of shear and tensile stresses, as well as an isotropic stress-free transformation strain. The self consistent open-system elastic constants approach is employed to account explicitly for the coupling between the stress and concentration fields. Substantial concentration changes are predicted near the surfaces of the particles which can easily exceed 50%. With self consistency to first-order in the concentration change, no net solute enhancement is observed surrounding isolated particles while net solute segregation is observed for elastically interacting particles.

601.263
PB87-138685 PC A06/MF A01 National Bureau of Standards, Gaithersburg, MD. Inst. for Materials Science and Engineering.
Institute for Materials Science and Engineering, Metallurgy: Technical Activities 1986
Annual rep., Oct 86, 1987 NBS/R-86/3438
See also P88-196771.
Keywords: *Metallurgy, Processing, Metals, Alloys, Nondestructive tests, Chemical properties, Mechanical properties, Corrosion, Wear, Electrodeposition, Magnetic materials, Metallurgy.
The report summarizes the FY 1986 activities of the Metallurgy Division of the National Bureau of Standards. The research covers the structure-property relationship of metals and alloys, and on the methods of their measurement. Efforts comprise studies of synchrotron radiation research for materials, corrosion and electrochemical, wear and mechanical properties, chemical metallurgy, corrosion and protection of metals, electrodeposition, nondestructive characterization, and magnetic materials. The work herein described includes three cooperative programs with American professional societies and the American Society for Metals. NBS Alloy Phase Diagram Program, the National Association of Corrosion Engineers-NBS Corrosion Data Program, and the American Iron and Steel Institute-NBS Steel Sensor Program.

Plastics

601.264
PB86-160779 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Response of Radiographic Film Dosimeters to Gamma Rays in Different Environments.
The high-dose gamma ray response (1000-5000 Gy) of radiographic film dosimeters, with ion-implanted (100-120 KeV) 25 G/Al, or polyethylene or polypropylene, self-calibrated film dosimeters, and a commercial polyamide were investigated when irradiated under different conditions in vacuum and in different atmospheres (air, oxygen, nitrogen, and nitrous oxide). In addition, the stability of the films was studied for storage periods up to one month after irradiation under these conditions. The responses and stabilities of the polyethylene and nylon films were only slightly affected by the different atmospheres of irradiation, but there were marked differences of response for the other film types. Emphasis must be given to differences in atmospheric conditions encountered by dosimeters in practical industrial situations, which may cause marked differences in ultimate response factors.

601.265
PB86-160777 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Radiochroic Dye Dosimetry Using Triphenylmethane Leucocyanide in Nylon or Polyvinyl Butyral.
The use of commercially-available radiochromic plastic films (nylon or polyvinylbutyral) containing the leucocyanide of hexa (hydroxyethyl) pararosaniline is well established in radiation processing dosimetry in dose range: 10-100,000 Gy, especially for (60)Co gamma-ray applications. These thin-film systems when analyzed by spectrophotometry provide a convenient and routine means of dose assessment and dose-distribution mapping, as long as they are properly calibrated in standard gamma-ray fields and as long as suitable control films are made for systematic error. In the present work, the following contributions to uncertainty in making absorbed dose evaluations with radiochromic film dosimeters were studied: variations in absorbed dose rate, photon energy, temperature, relative humidity, vacuum, and presence of gases other than air (oxygen, nitrogen, nitrous oxide) during irradiation and during storage. These influences on radiochromic dosimeter response and stability have been studied in detail for nylon-11 dosimeters made to minimize such uncertainties in practice.
Influence of Strain Deformation on the Solubility of Ethyl Acetate Vapor in Poly(vinylidene fluoride). 

Final report

J. Phillips, A. Peterlin, and P. F. Waters, 1984, 7p

Keywords: "Plastic deformation," "Solubility," "Ethyl acetate," "Vapor Pressure," "Heat of Vaporization," and "Temperature." 

The degree to which a polymer film develops plastic flow depends largely on the total strain and the work done during the process. The influence of the elastic component of strain, which is dependent on the total deformation, is of controlling factors, respectively, in the solubility and diffusion processes. The plastic deformation is attributed to the component transport properties of the film. The non-linearity in solubility due to epilation may be convexly handled. In the study, the solubility of Ethyl Acetate vapor in Poly(vinylidene fluoride) was determined as a function of pressure and total elongation at 30 deg C. These results indicate that the strain magnitude and time dependency of the component deformations play an important role in transport behavior.
is not as effective as for the case of head-to-head linkages. Possible mechanisms for end initiation and oxidative termination of radicals initiated from scission at the head-to-head linkages are discussed.

601.279
PB87-118964
Not available NTIS National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
FT-IR Studies of Molecular Organization in Polyethylene.
Final rept., B. Fanconi, and D. Sarazin, 1984, 2p
Keywords: *Polyethylene, *Molecular structure, *Spectroscopic analysis, infrared spectroscopy, Thermoplastic resins, Reprints, Fourier transform spectroscopy.

FT-IR studies of mixtures of perdeuteropolyethylene and polyethylene have been carried on single crystals suspended in cyclohexane. The spectra are compared to those obtained from dried and pressed single crystal mats to reveal substantial spectral changes caused by mechanical deformation of the crystallites. The impact of these spectral changes on the interpretation of the organization of polyethylene molecules in their real solid state is discussed. A method of analyzing the FT-IR spectra of mixed crystals that is based on lattice dynamical calculations and the electro-optical parameter approach for IR intensities is proposed. The method shows promise for characterizing the local concentrations of deuterated stems in melt-crystallized polyethylene mixtures.

601.282
PB87-122198
Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mg Engineering. Investigations in Array Sizing - 3. The Center Distance Finding Technique.
Final rept., A. W. Hartman, 1986, 12p
See also PB86-19001.
Keywords: *Particle size distribution, Dimensional measurement, Arrays, Microscopy, Polyethylene, Optical measurement, Microphotographs, Reprints, *Microspheres.

The feasibility of measuring the size distribution of microspheres by optical microscopy is investigated for monosize 3 micrometers and 10 micrometers polyisobutylene latex material. A new technique for doing this is presented based on the fact that reflective microspheres of transparent and uniform microspheres that are arranged in a two-dimensional or three-dimensional structure of spheres touching each other on a surface and illuminated with parallel light, the spheres bring this light together into small focal spots which are then used as high-resolution markers of sphere position. The sphere center distances are measured with better than 0.5% resolution from scaled microphotographs. The obtained center distance distributions are used to limit the diameter distributions of 3.0 micrometers and 10 micrometers polyisobutylene spheres.

601.283
PB87-122289
Not available NTIS National Bureau of Standards, Gaithersburg, MD. Polymers Div. Defect Motion and Relaxation Processes in Polyethylene.
Final rept., D. H. Reneker, and J. Mazar, 1981, 4p
Keywords: *Polyethylene, *Defects, *Mechanical, *Photodegradation.

The defect in polyethylene known as a point dislocation(1) or two dislocation loop(2), which transports a chain along its axis through a crystal by a process appropriately called reptation. In the following, the word dislocation is used in a general sense but as a short name for a point dislocation. Two sets of experimental data provide quantitative information on the rotation rate of the chain stems around their long axes. One set
Material Sciences

Plastics

is from C-13 nuclear magnetic resonance experiments and the second is from dielectric loss measurements on lightly oxidized polyethylene which contains approximately one polar group per main chain. Mechanical relaxation data can be interpreted as a consequence of the translation of a defect in a strain field.

Refractory Metals & Alloys

The Nb-Pt system was investigated over the entire composition range by metallography and X-ray diffraction analysis. The solubility limits of terminal and intermediate phases and solid solutions were determined. The presence of six intermediate phases was confirmed. Eight three-phase reactions are described, their phase equilibria are given, and crystal chemical relationships among the six homologous (Tsub 5)- (Tsub 10) systems (Tsub 5) = V, Nb, Tsub 6) = Pd, Pt) are discussed.

Wood & Paper Products

The effective dielectric constant of paper pulp flowing in a pipe with diameter equal to 6.25 inches was determined by measuring the wavelength, frequency, and attenuation of radio waves propagating inside the pipe. The solids percent was obtained from the effective dielectric constant by using a simple mixing model. Good agreement was obtained with values of percent solid obtained from grab sample measurement.

Keywords: *Gaussian quadrature, Numerical quadrature, Numerical integration, Error analysis, Reprints.*

The Gauss-Laguerre quadrature formula is defined by \( \int_{0}^{\infty} f(x) e^{-x} dx \) where \( f(x) \) is the function to be integrated. A common method of estimating the error of the rule is to evaluate the quadrature rule for two different values of \( n \) and then compare the difference in the answers. Unfortunately, none of the nodes or weights are in common for the two different quadrature rules, and so the function must be evaluated at each separate node. The authors investigate in the paper the addition of points to the Gauss-Laguerre rule such that the new points are real, lie in the interval of integration, and the associated weights are positive. Such rules enable one to estimate economically the error of quadrature, because the function values at the Gauss-Laguerre abscissae are reused. A collection of suitable low-order formulas are given.

When a \( C^{(n)} \) approximation to the Dirac delta-function, in the form of an inverse Gaussian kernel, is used as input into a linear time invariant system, the output waveform is an approximation to that system's Green's function, in which the singularities are explicitly smoothed out. The ill-posed deconvolution problem for the output signal arises at reconstructing these singularities. By exploiting the smoothing properties of the inverse Gaussian kernel, the authors prove that partial deconvolution of the output waveform, given \( L(sup 2) \) a priori bounds on the data noise and the waveform Green's function in \( L(sup 2) \) integral error bounds for the regularized solution and its derivatives. Consequently, when the L2 norm of the output noise is sufficiently small, partial deconvolution is a reliable \( C^{(n)} \) (sup symbol) function, which in turn approximates the desired Green's function in many applications.

1.300
PB87-12120 Not available NTIS National Bureau of Standards (NBL), Gaithersburg, MD. Radiation Physics Div.


Keywords: *Elliptic functions, Hypergeometric functions, Asymptotic series, Reprints, Numerical solution.*

In the present paper, the authors study a family of integrals which specialize in a large number of field problems. They obtain a series expansion and establish its relationship with Gauss' hypergeometric function. Asymptotic expansions valid in a neighborhood, and some recurrence relations are given. Results obtained earlier by Epstein and Hubbell, Weiss, and Kalla follow as particular cases of the formulas established here. Some numerical values are computed.

1.301
PB87-14596 Not available NTIS National Bureau of Standards (NBL), Gaithersburg, MD. Center for Applied Mathematics.


Keywords: *Elliptic differential equations, Partial differential equations, Nonlinear differential equations, Computer programs, B2DE computer program, Two-dimensional calculations, Laplace equation, Interactive graphics, Fortran 77 programming language.*

B2DE is a program for solving systems of nonlinear elliptic and parabolic differential equations (PDEs) in two dimensions. The program is a collection of modules with an interactive driver. Many types of interactive graphing functions are included, which may modify the driver, and may be able to construct a 'black box' program for a restricted class of PDEs. B2DE is available from the author.

Operations Research

1.302


Keywords: Quadratic programming, Curve fitting, Reprints, *Isotone regression, Isotone regression, Kuhn-Tucker theory.*

Isotone regression techniques are interpreted and extended to include upper and lower bounds on the ordered sequences in question. This amounts to solving the inequality constrained problem for the ordered simplex in \( (S sup n) \) in \( (R sup n) \). An \( (O(n)) \) algorithm is presented for this problem, verified via the Kuhn-Tucker conditions, and explained geometrically in terms of the Lagrange multipliers. In the context, isotone regression techniques are interpreted in terms of orthogonal projections onto faces of the order simplex (\( S sup n \)).
These projections provide a succinct characterization of the descent directions required for the design of gradient projection methods for minimizing differentiable functions on $\mathbb{S}^n$. The latter problem arises in parameterized curve fitting. The authors conclude by considering generalizations of these techniques.

A complex of PNAse A with a transition state analog, uridine vanadate, has been studied by a combination of neutron and X-ray diffraction. The vanadium atom deviates from linearity. The known r.m.r. mechanism of action of RNase, NE2 of His 12 was found to form a hydrogen bond to the equatorial oxygen O8, while N7 of Lys 41 makes another hydrogen bond to the apical O6. Nitro- gen ND1 of His 119 appears to be within a hydrogen bond distance of the other apical oxygen, O7. Two additional hydrogen bonds between the vanadate and protein are made by NE2 of Gln 11 and by the amide nitrogen of Phe 120. The observed geometry of the complex may necessitate reinterpretation of the mechanism of action of RNase.

Second-order sensitivity analysis methods are developed for analyzing the behavior of a local solution to a constrained nonlinear optimization problem when the problem functions are perturbed slightly. Specifically, formulae involving second-order and higher-order tensors are given to compute second derivatives of components of the local solution with respect to the problem parameters. In addition, the problem functions are factorable, it is shown that the resulting tensors are polycratic in nature.

Keywords: *Nonlinear programming, Perturbation theory, Tensors, Theorems, Constrained optimization, Sensitivity analysis, Matrices.*

**Statistical Analysis**

AD-A142 580/0 PC A02/MA A01
National Bureau of Standards, Gaithersburg, MD.


Contract F49562-82-C-0009


Keywords: *Mathematical models, Binary arithmetic, Regression analysis, Errors, Cardiovascular diseases, Variables, Mathematical prediction, Measurement, Estimates, Probability, Coronary disease, Risk, Blood pressure, Cholesterol, Reprints, Logistic regression, Prediction, Regression, Probabilities.*

The authors consider in detail probit and logistic regression models when some of the predictors are measured with error. For normal measurement errors, the functional and structural maximum likelihood estimates (MLEs) are considered, in the functional case the MLE is not generally consistent. Non-normality in the structural case is also considered. By an example and a simulation, the authors show that if the measurement error is large, the usual estimate of the probability of the event in question can be substantially in error, especially for high risk groups.

**MEDICINE & BIOLOGY**

**Biochemistry**

PB86-189123 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD.


Keywords: *Hemoglobin, Iron, Magnetic fields, Reprints, Electron paramagnetic resonance.*

Mossbauer experiments were performed on the oxy-derivatives of human hemoglobin and its products of digestion with carbonylhemoproteins. The hemoglobins were chemically enriched in $^{57}$Fe, and were free from hemochromatosis impurities. Spectra were taken at low temperatures in the presence and absence of a 5.0 T magnetic field. It was observed that the enzymatic digestion which removes residues at least 16 amine- stretches from the iron of the nearest hemep appear to modify the electronic environment of the metal.

PB86-190236 (Order as PB86-100186, PC A08/MF A01)
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.

Sponsored by Office of Naval Research, Arlington, VA. Incl. in Jnl. of Research of the National Bureau of Standards, v91 n3 p119-147 May-Jun 86.

Keywords: *Metals, Metalloids, Microorganisms, Materials recovery, Organometallic compounds, Inorganic compounds, Microbial processes, Biotechnology, Heavy metals, Metabolites.*

Biotechnological processing of inorganic, heavy elements has only begun to emerge as the authors start to understand microbial strategies and mechanisms of heavy metal uptake and metabolism. Some general principles for key, diagnostic intermediates and products of bioprocessing in gas liquid, and cellular phases, as well as the importance of thought reactions. Recent discoveries of microorganisms in metal-enriched thermal environments, and further investigation into isolation of microorganisms, genetic transformation of microorganisms, potential for bioremediation, and other exciting prospects for development of new technologies for strategic and precious materials recovery and processing.

PB87-106084 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

Weak Anion-Exchange High-Performance Liquid Chromatography of Peptides. Final rept., M. Dizdaroglu. 1985, 21p
Pub. in Jnl. of Chromatography 334, n1 p49-69 1985.

Keywords: *Peptides, Chromatographic analysis, Chemical analysis, Anion exchanging, Reprints, Liquid chromatography.*

In the survey, the principles and applications of a method recently developed for peptide separations are given. This method uses a bonded weak anion-exchange column and utilizes the functional group of the common- ion acetate buffer and acetonitrile as eluent. Its applications to the separation of a large number of peptides including diastereomers and other closely related peptides are discussed. Separation of the enzymatic digests of some proteins is also presented. The complementary use of this method to the reversed-phase method is outlined and their combined use for separation of enzymatic digests of proteins and assessment of purity of synthesized peptides is demonstrated. The results reviewed show that the weak anion-exchange method is an excellent approach for peptide
Molecular Dynamics Simulation Study of a Two-Dimensional Fluid Mixture System: A Model for Biological Membranes. Final rept., R. D. Mountain, R. M. Mazo, and J. J. Volwerink. 1986, 11p. Grins PHS-GM-25698, NSF-CH82-14668 Sponsored by Public Health Service, Rockville, MD., and National Science Foundation, Washington, DC. Pub. in Chemistry and Physics of Liquids 40, p35-45 1986. Keywords: "Lipids, Membranes, Computerized simulation, Reprints, "Protein lipid ordering, Molecular dynamics. The computer simulation technique of molecular dynamics was applied to model a two-dimensional fluid mixture system to examine the short-range ordering of lipid and protein molecules in biological membranes. The model system consists of small disks (lipids) and large disks (proteins) with a radius ratio of 6, constrained to move in a plane. The particles interact with pairwise additive repulsive short range potentials, so as to simulate hard disks. Periodic boundary conditions are assumed in order to minimize boundary effects. For values of the number density of the small disks and of the temperature appropriate for a lipid membrane, the fraction, if small disks 'next to' at least one large disk was computed by molecular dynamics. This was done as a function of concentration for several temperatures for several scenarios. The molecular dynamics results show that, at moderately low mole fractions of the large disks, the calculated values of 1 were found to be realistic, which would be expected in the absence of protein-protein proximity effects. The results are discussed in terms of current models of lipid-protein ordering in biological membranes.

Molecular Dynamics Simulation Study of Aqueous Systems. Final rept., R. E. Hule and P. Neta. 1985, 6p. Pub. in Chem.-Bioil. Interact. 63, n1-2:p233-238 1985. Keywords: "Free radicals, "Oxidation, "Sulfites, Biochemical, Chemical, Radicals, Tocopherol, Reprints, "Ascorbate, "Chemical reaction kinetics, Peroxylsufite radicals, Sulfite radicals. The sulfite radical, SO(3)(-), was produced by the pulse radiolytic oxidation of sulfite or bisulfite and its reactions were studied by kinetic and radiolytic methods. It was found to be a mild oxidant, reacting with ascorbate with k = 9.2 x 10 to the 6th power/Ms at pH = 6.8 and with tryptophan with a rate constant (k) with approx. 1 x 10 to the 6th power/Ms at pH = 9. It also reacts rapidly with CO (k = 1.5 x 10 to the 9th power/Ms) and with the persulfuric radical SO(3)(+), which reacts with ascorbate with k = 1.4 x 10 to the 6th power/Ms at pH = 6.8 and with tryptophan with k = 1.2 x 10 to the 7th power/Ms at pH = 9. Key words: Aqueous, free radicals, Persulphate, Sulfite radicals.
their reactions with free radicals in general and tryptophan radical in particular are presented.

Clinical Chemistry

601,321
PB86-242245
(Repair as PB86-242179, PC A04/MF A01)
Veterans Administration Medical Center, Omaha, NE
Prepared in cooperation with Nebraska Univ.-Lincoln. Sponsored by National Bureau of Standards, Gaithersburg, MD, included in Jnl. of Research of the National Bureau of Standards, v91 n2 p93-102 Mar-Apr 86.

Keywords: Storage, *Biomedical sampling, *Trace element analysis, *Neutron activation analysis, *Uranalysis.

The problems regarding storage and pre-neutron activation analysis treatment for the elements aluminum, calcium, vanadium, selenium, copper, iodine, zinc, manganese, and magnesium in a urine matrix are reviewed. The type of collection and storage procedure and pre-neutron activation analysis treatment of urine depend on the specific trace element, that is, its inherent chemical and physical properties. Specifically polystyrene in teflon containers are the most suitable for general determinations. Whether any preservative is added would depend upon the stability of the trace element and its tendency for surface adsorption. Preferably preservatives should contain no radioactivatable elements for maximum efficiency. Freezing drying or packing under dry ice needs to be explored on an individual basis. Each pre- or post-neutron activation analysis treatment is specific and optimized for the trace element analyzed.


Analyses of biological materials for trace elements cannot be considered as routine yet. Accurate analyses are indispensable to understand the role of trace elements in metabolic processes. One approach towards obtaining accurate trace element determinations is through the use of Certified Reference Materials such as the Standard Reference Materials issued by NBS. In general, these calibrations are homogeneous stable materials with certified chemical or physical properties for use in calibrating instruments, validating laboratory data, developing methods of known accuracy, and referring data from different laboratories to a common base. Whenever possible SMF's are certified on the basis of accuracy rather than method-dependent analyses. Certified concentrations are based either on the results of a definitive method or on the concordant results of two or more independent analytical methods.

Clinical Medicine

601,322
PB86-200714
Not available NTIS National Bureau of Standards, Gaithersburg, MD, Polymers Div.

Keywords: *Dental materials, Dental supplies, Toxicity, Zinc oxides, Esters, Fluorides, Reprints, *Vanillate, hexyll, *Syringate, ethyl-hexyl.

Addition of small concentrations of acid, metals or fluoroide to syringeable or syringeable dental cements was studied in order to improve their physical properties and anticarogenic behavior. Incorporation of acids into cement formulations lowers their setting time. Coating a portion of the zinc oxide powder ingredient with propionic acid offers a convenient way of adjusting the cure to a rate most suitable for clinical applications. The resulting cements are non-brittle, have high strengths, low solubility and bond strongly to non-preparative metals, porcelain or composites. Cements with zinc underculex are flexible and may be used as soft tissue packs. Metallic powders do not act as reinforcing agents for these cements. Hexyl vanillate or ethyl-hexyl vanillate or ethylhexyl syringeable cements can be prepared by adding 0.1% to 1% fluoride salts such as NaF, ZF4, ZnF2 or diethyleneamino methacrylate hydrofluoride to the powder ingredient.

601,323
PB86-209567


Keywords: *Chemical analysis, Chemical analysis, Mass spectrometry, Reprints, *Creatine, Isotope dilution, Standard reference materials, Carbon 13.

An Isotope dilution mass spectrometric (ID/MS) method for determining the creatinine content of urine is described. The urine sample is hydrolyzed with boiling NaF, H3PO4, and H2SO4, and the resulting crude creatinine is subjected to a liquid chromatography (LC) analysis using a reversed phase LC column (C18) and diode array detection (DAD). The concentration of creatinine and uric acid in the LC effluent is monitored by DAD. The creatinine is converted to its monoethylglycine with the addition of ethylamine and the DAD signal is at 210 nm. The LC effluent is then subjected to a Linde 4C molecular sieve column to remove the water. The creatinine and uric acid are then detected by DAD at 260 nm and 290 nm, respectively. The creatinine concentration is determined by a comparison of the optical density (OD) at 210 nm with that of a series of standard solutions of creatinine. The concentrations of the samples are determined graphically by interpolation.

Dentistry

601,329
PBATENT-4 616 073
Not available NTIS Department of Health and Human Services, Washington, DC
Hydrophobic Dental Composites Based on a Polyfluorinated Dental Resin. Patent.

Keywords: *Patents, Dental materials, *Composite materials, *Fluorine organic compounds, Polymers, Performance evaluation.

Dental resin systems prepared from polyfunctional or monofunctional highly-fluorinated methacrylate prepolymer are described. Several systems comprise a major amount of a polyfluorinated aliphatic polyfunctional methacrylate such as (PFMA), preferably in

MEDICINE & BIOLOGY
Biochemistry

601,324
PB86-212065
PC A04/MF A01 National Bureau of Standards, Gaithersburg, MD. Inst. for Materials Science and Engineering.
Sponsored by Food and Drug Administration, Rockville, MD. Center for Devices and Radiological Health.

Keywords: *Electromagnetic radiation, Models(Simulation), Design, Performance, Muscles, Dielectric constant, *Health physics, *Phantoms, *Radiation effects.

The report describes the design and performance of a synthetic material that has the same dielectric heating characteristics as living muscle in the 1-1000 MHz frequency range. The dielectric phenom is a combination of four components: (1) a 50/50 solution of ethylene carbonate and propylene carbonate chosen to have the same dielectric constant as water, (2) an organic salt to provide the same conductivity as biological electrolytes, (3) flakes of polyethylene tetraphthalate to provide the required thermal polarization at cell walls in biological tissue and (4) an inorganic and a polymeric gelling agents to provide mechanical rigidity. The resulting composite material is more stable to biological attack and drying than existing aqueous based phantom materials, and its dielectric properties are more closely matched to those of natural tissues over most of the frequency range of interest.

601,325
PB86-231503
Not available NTIS National Bureau of Standards, Gaithersburg, MD, Polymers Div.

Keywords: *Calcium phosphates, *Water, *Adsorption, Bone, Biological tissues, Reprints, Tooth enamel.

Adsorption of water was studied gravimetrically at 23 deg C in an open system at several relative humidities on a variety of apatitic calcium phosphates including enamel, dentin, and hydroxyapatite. The amount of adsorbed water increases linearly with the surface areas of the synthetic apatites and does not appear to be very sensitive to calcium to phosphorus ratio of the apatites. The adsorption results correlate very well up to about two monolayers with a conventionally determined equilibrium water content by 'saturated proteinized' enamel or bone may be due to the presence of pore structure and incompletely removed organic matter.

601,326
PB86-241190
Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.

Keywords: *Chemical analysis, *Chemical analysis, Mass spectrometry, Reprints, *Creatine, Isotope dilution, Standard reference materials, Carbon 13.

An Isotope dilution mass spectrometric (ID/MS) method for determining the creatinine content of urine is described. The urine sample is hydrolyzed with boiling NaF, H3PO4, and H2SO4, and the resulting crude creatinine is subjected to a liquid chromatography (LC) analysis using a reversed phase LC column (C18) and diode array detection (DAD). The concentration of creatinine and uric acid in the LC effluent is monitored by DAD. The creatinine is converted to its monoethylglycine with the addition of ethylamine and the DAD signal is at 210 nm. The LC effluent is then subjected to a Linde 4C molecular sieve column to remove the water. The creatinine and uric acid are then detected by DAD at 260 nm and 290 nm, respectively. The creatinine concentration is determined by a comparison of the optical density (OD) at 210 nm with that of a series of standard solutions of creatinine. The concentrations of the samples are determined graphically by interpolation.
combination with a dienyl monomer such as 1,10-decamethylene dimethacrylate (DMDMA), methylmethacrylate (MMA), neopentyl dimethacrylate (NDMA), 1,6-hexamethylene dimethacrylate (HMDMA), etc., or mixtures thereof; and (b) a minor amount of a polyfluorinated non-functional monomer, such as 1,1-dihydroxydecafluorocyclohexyl methacrylate (PDFOCA) as a minor or secondary dienyl monomer in a non-hydroxylated bis-GMA resin system.

601,332
PB86-160157 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Polyomers Div.

Base Metal Alloys in Restorative Dentistry.
Final rep.
R. W. Hinman, and J. A. Testk, 1984, 3p

Keywords: Dentural materials, Alloys, Metals, Reprints.
The use of base (nonprecious) metal alloys in dentistry is presented. Relevant physical and mechanical properties are described. Some pertinent comparisons of differences between gold and base metal alloys are cited. Attention is focused on processing of prosthetic dental alloys. Effects of casting and finishing and porcelain veneering; these are primary operations requiring special attention.

601,333
PB86-160144 Not available NTIS National Bureau of Standards, Gaithersburg, MD, Polymers Div.

Environmental Damage and Wear of Dental Composite Restorations.
Final rep.
J. E. McKinney, 1985, 15p

Keywords: Dental materials, Corrosion, Polymers, Restorations, Solutions, Solubility.
Microhardness and pin-disc wear measurements are used to determine in vivo degradation mechanisms for dental composite restorations. In order to simulate in vivo conditions, the wear test specimens are preconditioned in organic food simulating liquids, which have the potential to damage the polymer matrix; and inorganic acids and water, which have the potential to damage the inorganic filler. Subsequent wear and hardness may be influenced considerably by the chemical damage caused by preconditioning. The matrix damage is quantified by using the solubility parameter as an independent variable. The filler damage is interpreted in terms of static and stress corrosion, the latter which occurs during wear in the mouth. The results suggested for improving both the matrix and filler to enhance durability of composite restorations by eliminating wear, reducing vulnerability to interfacial environmental attack.

601,331
PB86-160751 Not available NTIS National Bureau of Standards, Gaithersburg, MD, Polymers Div.

Chemical Softening and Wear of Dental Composites. Final rep.
J. E. McKinney, and W. Wu. Nov 85, 6p
Contract N01-DE-3-0001
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Jnl. of Dental Research 64, n11 p1326-1331 Nov 85.

Keywords: Dental materials, Composite materials, Polymers, Wear tests, Softening, Solubility, Surfaces, Degradation, Solvents, Plastics, Reprints.
The purpose of the work was to determine the influence of chemical food-simulating liquids on the wear of various commercial dental composite restoratives. In many cases, pre-conditioning the restoratives in these liquids for one week produced swelling of the polymer matrix and considerable surface damage. The resulting degradation reduced the hardness and enhanced the wear as measured by a pin-and-disc apparatus. Four kinds of dental composites were investigated: a conventional quartz-filled, a strontium-glass-filled, a visible-light-activated, and a microfilled composite.

601,332
PB86-191337 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Polymers Div.

Adhesion of Zirconyl Salts and Their Acids on Hydroxyapatite: Use of the Salts as Coupling Agents to Dental Polymer Composites. Final rep.
D. N. Misra. 1985, 4p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 64, n12 p1405-1408 Dec 85.

Keywords: *Preventive dentistry, *Acids, *Dental enamel, Adsorption, Composite materials, Reprints, Hydroxyapatite, Zirconyl salts.
Zirconyl metacrylate (I) and zirconyl-2-ethylhexanoate (II) were synthesized, and their adsorption isotherms from solutions onto synthetic hydroxyapatite were studied. The isotherms of metacrylic acid and 2-ethylhexanoic acids were also determined from the same solutions. The adsorption of I was irreversible from methylene chloride, and that of II was irreversible from cyclohexane. The adsorption in both cases was constant from solutions above a certain concentration, and exhaustive below the threshold concentration. Both compounds rendered the dried apatite powder extremely hydrophobic; however, the adsorbate was slowly washed off by excess water.

601,333
PB86-191570 Not available NTIS National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Dental Applications. Final rep.
G. M. Brauer, and J. M. Antonucci. 1986, 22p
Grant Y01-DE-30001
Sponsored by National Inst. of Dental Research, Bethesda, MD.

Keywords: Dental materials, Restors, Composite materials, Adhesives, Polymers, Plastics.
Plastics have been edging into the dental market for the last fifty years. The consumption of resins for dental prosthetic devices, restorative, impression materials and sundries amounts to over 500 tons. Methacrylates are the most widely used resins for the construction of dentures, although many other polymers have been evaluated. Predominance of acrylics is not surprising since their monomer:polymer design can be polymerized readily and has minimal curing shrinkage. The hardened materials are strong, life-like, have good color and dimensional stability and are biocompatible with the oral tissues. Miscellaneous uses of these resins include tissue conditioners, crown and bridge resins, and fillers in impression compounds. The keys and patterns for metal castings. Over 13 million acrylic teeth are made annually in the U.S. They have a natural appearance, low breakage, bond to resin base and can be polished. Composites based on dimethacrylate have been very successful in non-stress bearing areas as anterior restoratives where esthetics is of prime importance.

601,334
PB86-200698 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Polymers Div.

History of the International Association for Dental Research Wilmer Souder Award in Dental Materials with a Short Biography of Wilmer Souder. Final rep.
G. C. Paffenbarger, and N. W. Rupp. 1986, 4p
Sponsored by American Dental Association Health Foundation, Chicago, IL.

Keywords: *Certification, Dental materials, Specification, Handwriting.
In the 39 years that Dr. Wilmer Souder was associated with the National Bureau of Standards, he accumulated many research projects in the principal areas of his recognition, criminology and dental materials research, were founded in his interest and capacity of making precise long-term measurements. In 1947 the Army Dental Corps asked the Bureau to assist in formulating a specification for the purchase of alloys for dental amalgam. Dr. Souder agreed to take on the assignment. From that beginning the Dental Materials Section grew to encompass all dental materials and equipment. His dedication to precision in all of his endeavors lead to Dr. Souder’s being recognized as the ‘Father of Dental Materials Research.’ He became President of the International Association for Dental Research and an honorary member of the American College of Dentists and the American Dental Association. A short biography covers his early years and his education in physics at the University of Chicago. It also includes his many contributions to dental materials research and some of his many successes in criminology.

601,335
PB86-200947 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Polymers Div.

Basic Alloys and Compositions. Final rep.
J. A. Testk. 1986, 13p

Keywords: Dental alloys, Composition, Structure, Gold, Nickel, Cobalt, Chromium.
There are today a great number of dental alloys covering a wide range of compositions. (Classification System for Cast Alloys, 1984; Tuccillo, 1977; and Dentists Desk Reference, 1983). Even with the exclusion of the metal-glassy metals, the various compositions and applica-
tion is almost unlimited as indicated in Table 1.1 (Classi-

601,336
PB86-200970 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Polymers Div.

Adsorption of Benzoic Acid on Pure and Cupric Ion-Modified Hydroxyapatite: Implications for the Use of Coupling Agent to Dental Polymer Composites. Final rep.
D. N. Misra. 1986, 6p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 65, n5 p706-711 May 86.

Keywords: Adsorption, Dental composites, Hydrogen bonding, Hydroxyapatite, Reprints, Benzoic acid, Coupling agents.
The adsorption isotherms of benzoic acid on synthetic hydroxyapatite (ca. 15 monolayers of synthetic hydroxyapatite were studied from ethanol, dimethyl sulfoxide, p-dioxane, methylene chloride, and benzene to discern the role of solvent in the process. The adsorption is reversible from the first three solvents and follows the Langmuir plots. It is irreversible from the last two, and a constant amount of absorbent is removed from solutions above a certain concentration. The isotherms of potassium benzoate on the apatite from ethanol and dimethyl sulfoxide were reversible. The isotherms of the acid on cupric ion-modified apatite surfaces from ethanol and benzene were identical with those obtained on the pure hydroxyapatite. This may demonstrate that any 'surface chelation' with the cation may not be a significant factor for adsorption to occur.

601,337
PB86-200988 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Polymers Div.

Recording Diatometer for Measuring Polymerization Shrinkage. Final rep.
R. W. Penn. 1986, 2p
Sponsored by National Inst. of Dental Research, Bethesda, MD.

Keywords: Dental composites, Dental cements, Reprints, "Diatometer," Polymerization shrinkage, Recording diatometer.
The volumetric changes which occur during curing of dental resins and cements is considered important to
their clinical performance. To measure these changes a diometer device is required. A device is described in the Special (diameter and Davidon 1981) but its stability has been found to be worse (by a factor of ten) than conveniently acceptable. Using the same principles, with modified components and accessories and improved stability has been developed. It is constructed from the female part of a spherical glass jointing ground flat and covered with a flat quartz plate. The stem of the joint is bent into a U-tube and filled with mercury. The height of the mercury in the U-tube becomes a function of the sample, which indicates volume changes in the sample which is placed in the joint on the bottom side of the quartz plate. The device is stable to 0.00001 cc over periods of several hours.

601,338
PUBS-86-11529
Not available NTIS National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Complexes of Iron Cations with N-Phenylnecylic or Oxalic Acid.
Final rept., R. L. Bowen, and D. N. Misra, Mar 86, 5p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 65, n9 p412-416 Mar 86.
Keywords: *Oxalic Acid, *Iron, Dentistry, Teeth, Dentin, Adhesion, Metal complexes, Reprints, *Glycine/N-phenyl, Tooth enamel.

N-phenylglycine plays a very important role in obtaining restoration of restorative composites to dentin and enamel (Bowen et al., 1982a). In a systematic investigation, ferric or ferrous N-phenylglycine complexes formed when aqueous ferrous nitrate or ferrous chloride was combined with solutions of potassium N-phenylglycine in stoichiometric proportions. The molar ratios of iron to N-phenylglycine in each complex were confirmed by osmometry measurements with a freezing-point osmometer. The reaction of aqueous solutions of oxalic acid with ferric nitrate indicated formation of ferric oxalate complexes with a stoichiometry of Fe2(oxalate)3 in solution, using Job’s method of continuous variations (1925;1929).

601,339
PUBS-87-122255
Not available NTIS National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Effects of Neutral Salts in a Bench-Scale Caries Model.
Sponsored by National Dental Association Health Foundation, Chicago, IL., and Public Health Service, Rockville, MD.
Pub. in Jnl. of Dental Research 65, n9 p1115-1120 Sep 86.
Keywords: *Fluoride, Membranes, Sodium fluoride, Reprints, *Dentacry, Hydroxapatite, Fluorapatite.

In an earlier paper on bench-scale simulation of the caries process, it was shown that the presence of ions through ion-pairing of cations could have profound effects on the composition of the solution within the 'lesion' at steady state. As indicated earlier, these changes are produced by unequal rates of diffusion of Ca and PO4 ions prior to reaching steady state. Comparable effects are attributable to F ions when present. Here, the authors used the two-compartment diffusion apparatus and membranes, as described in the earlier paper, to show that a neutral salt, such as NaCl, dramatically affects the membrane potential. Thus, although the Na and Cl concentrations are nearly equal in the 'plaque'-like compartment, they become very different in the 'lesion' solution.

601,340
PUBS-87-122271
Not available NTIS National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Composite Resin Chemistry: The Effects of Solvents on Surface Hardness.
Final rept., W. L. Pestaner, and R. L. Bowen, 1984, 14p
Sponsored by National Inst. of Dental Research, Bethesda, MD.

601,341
PUBS-86-241734
Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Accuracy of Participant Results Utilized as Target Values in the CAP Chemistry Survey Program.
Pub. in Jnl of Pathology and Laboratory Medicine 109, p849-903 Oct 85.
Keywords: *Definitive methods, Surveys, Reprints, *Organic serum analytes.

Samples of lyophilized human serum were circulated to more than 7,000 participants in the College of American Pathologists (CAP) survey program. The participants measured the concentrations of glucose, cholesterol, uric acid, and urea along with other conditions that are commonly found in clinical samples. Selected samples also were sent to the National Bureau of Standards (NBS) for analysis of these same analytes by definitive methods. Consensus mean values of participant results are used as target values.

601,342
PUBS-86-242179
PC A04/MF A01 National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 91, Number 2, March-April 1986, 486, 74p
See also PUBS-86-242187 through PUBS-86-242245, and PUBS-86-242363. Also available from Supp. of Dists at SN703-027-0009-1.
Keywords: *Tissues(Biologic), *Sampling, Humans, *Biomedical sampling, Trace elements, Uromysis, Neutron activation analysis.

Contents: Representative sampling of human tissue; Technical considerations for sampling and sample preparation of biomedical samples for trace element analysis; Environmental specimen banking; Presampling factors; the sampling and analysis of human tissues; The collection and preparation of human blood plasma or serum for trace element analysis; Storage and pre-neutron activation analysis treatment for trace element analysis in urine.

601,343
PUBS-86-242187
Medical Coll. of Ohio at Toledo.
Representative Sampling of Human Tissue, H. C. Hopps, 24 Oct 85, 4p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl of Research of the National Bureau of Standards, v91 n2 p475-50 Mar-Apr 86.
Keywords: *Tissues(Biologic), *Sampling, Quality control, Analysis, *Biomedical sampling, Trace elements.
The characteristics of the tissue sample for its atomic composition is a critically important step that is frequently overlooked. This is because the analyst often assumes a degree of homogeneity that does not exist. The means of obtaining a representative sample vary greatly depending on the organ or tissue involved, and also on the level of resolution chosen, i.e., the size of the sample.

601,344
PUBS-86-242195
(Order as PUBS-86-242179, PC A04/MF A01)
International Atomic Energy Agency, Vienna (Austria).
Sample Preparation of Biomedical Samples for Trace Element Analysis, R. D. Wohlrab. Oct 1983, 13p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl of Research of the National Bureau of Standards, v91 n2 p51-57 Mar-Apr 86.
Keywords: *Tissues(Biologic), *Sampling, Analysis, Contamination, Quality assurance, Handling, *Biomedical sampling, *Trace elements.

Sampling and sample preparation procedures are to a large extent determined by the analytical method used since different methods vary in the amount of material required for analysis and in how this is pretreated before being introduced into the measuring instrument. Judging from intercomparison studies conducted by the International Atomic Energy Agency (IAEA), the most widely applicable methods now in use are Neutron Activation Analysis, Atomic Absorption Spectrometry, and Plasma-Mass Spectrometry, though the latter still seems to have insufficient sensitivity for many trace elements of biomedical interest. Common to all these methods is the problem of contaminating the sample before or during analysis. For many elements sufficient control over contamination can only be achieved by the use of special reagents and reagents, and by working in a controlled (dust-free) environment. Several important elements are subject to losses on drying orashing, but can be recovered reliably if wet-ashed in a closed container such as a PTFE 'bomb'. For representative sampling it is almost always necessary to start with several grams of material, and to homogenize this, if the effects of sample heterogeneity are to be reduced to an acceptable level. Sampling and preparation of larger than this, however, are difficult both to define and to apply. However, much can be learned from the statistical evaluation of results for duplicate samples, and from a determination of the limit of quantitation of the analytical procedure.

601,345
PUBS-86-242203
(Order as PUBS-86-242179, PC A04/MF A01)
Ruener Univ. (Germany, F.R.).
Environmental Specimen Banking: The Selection, Collection, Preservation, and Storage of Biomedical Samples, F. H. Kemter, and N. P. Lupeke. 20 Oct 85, 7p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl of Research of the National Bureau of Standards, v91 n2 p59-65 Mar-Apr 86.
Keywords: Humans, Exposure, *Sampling banking, *Biomedical sampling.

In order to adequately ensure the protection of human health and the environment from the thousands of presently suspected hazardous substances and the new compounds added to those by new industrial processes, sophisticated approaches to hazard assessment and monitoring are being established. Environinental specimen banking (ESB) is necessary, useful, and important for environmental monitoring currently, and in the future for monitoring the past. ESB has already proved a good tool for recording inorganic and/or organic pollution trends over the years. Moreover, ESB offers the possibilities and potentials for retrospective analyses of authentic samples from the past by improved future analytical procedures, including the detection of presently unclassified environmental chemicals of biological interest. Among the specimens retrieved, the true value of ESB will lie in its human origin play a key role. The selection criteria for human specimens include ethical and legal considerations together with appropriate scientific and epidemiological criteria. Technical considerations for sampling, preparation, transportation, and storage of the specimens include the selection of specific materials and implements, cold storage, and clean room technology in order not to compromise the original composition of the sample.
Pharmacology & Pharmacological Chemistry

601,349
PB87-128401
Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Clinical Evaluation of a Hydroxyapatite Precipitate for the Treatment of Dential Hypersensitivity.
Supported by American Dental Association Health Foundation, Chicago, IL.

Keywords: Hypersensitivity, Dicalcium phosphate dihydrate, Sensitivity, Reprints, "Dentin tubule, "Hydroxyapatite, Tetracalcium phosphate.

A newly developed paste that precipitates hydroxyapatite has been clinically evaluated for the treatment of dental hypersensitivity. Both the experimental paste and the placebo (SnO2) produced a significant reduction in patient discomfort. Only a minor difference was observed in the paste over the placebo.

Physiology

601,350
PB87-113726
Not available NTIS
National Bureau of Standards (NLS), Gaithersburg, MD, Building Physics Div.


Keywords: "Noise, "Responses, Humans, Time varying noise.

No abstract available.

Public Health & Industrial Medicine

601,361
NUREG/CR-3400
PC A04/MF A01
National Bureau of Standards (NLS), Washington, DC. Center for Radiation Research.


Keywords: "Neutron power plants, "Radiation dosage, "Dosimeters, "Proportional chambers, Gamma rays, Calibrating, Nuclear reactor containment, Portable equipment, "Neutron dosimetry, "Dose equivalents, Remeters, Tissue-equivalent detectors. Published data from measurements made by Pacific Northwest Laboratory (PNL) and those made jointly by the Environmental Measurements Laboratory (EML) and by Rensselaer Polytechnic Institute (RPI) inside containment at nuclear power plants were examined for the purpose of determining the best method for estimating the neutron dose equivalent received by workers. These data included measurements with TLD and albedo dosimeters, 9-inch spherical remmeters, Anderson-Braun remmeters, multisphere sets, "Cute Pix" gamma survey meters, 392 spectrometers, tissue equivalent proportional counters. Results are presented.

601,354
PB86-230752
Not available NTIS


Keywords: "Neutron irradiation, Reprints, "Kerma. Kerma, K, is defined by the International Commission on Radiological Units and Measurements (ICRU) as the quotient of dE(tr) by dm, where dE(tr) is the sum of the initial kinetic energies of all the charged ionizing particles liberated by uncharged ionizing particles (such as neutrons) in a material of mass dm, that is K=dE(tr)/dm.
Ionization yield calculations were performed and compared to measurements for 13.9, 15.0, 17.0 and 19.0 MeV. The measured spectra were normalized to unit neutron fluence and the calculations take account of the neutron energy distributions at the detector positions. The computer code was tested by comparison with measured data at 0.57, 2.07 and 5.25 MeV because physical data are well known at these energies. Total kerma for 19 MeV as well as kerma due to alpha-particles between 17.0 and 19.0 MeV is significantly lower for the measured data. There is clear evidence that the (12C, n,p,alpha) cross section for 17 and 19 MeV used in the calculations and in kerma evaluations is too high.

The method used at the National Bureau of Standards for the calibration of strontium-90 - yttrium-90 beta-particle-ophthalamic applicators in terms of absorbed dose to water, is described. The method involves measurement of ionization density at the applicator surface with an extrapolation chamber, correction for the difference in backscatter between the collection electrode and water, and application of the Bragg-Grey equation. By this method it is possible to establish an independent measurement of the surface area of the applicator. The overall uncertainty of the surface calibration is about + or - 15 percent.

The United States National Bureau of Standards is now considering the desirability of supplying A-150 plastic as a research material with at least the homogeneity certified. The authors are, however, faced with a dilemma since the nylon used in A-150 has been discontinued by the manufacturer and the current stock of A-150 has been estimated to be adequate to supply the demand for only the next 2 or 3 years. Thus, it will be necessary to reformulate the plastic mixture that will be used in the future. This may be a blessing in disguise because it will permit reformulation of the composition of tissue-equivalent plastic to better conform to present-day requirements. To elucidate just what these requirements are, a postal survey of the opinions of neutron dosimetists was conducted.


Keywords: *Tyrosine, *Peptides, Chemical reactions, Amino acids, Chemical radicals, Chromatographic analyses, Crosslinking, Chemical bonds, Reaction kinetics, Reprints, *Hydroxyl radicals, Phenox radicals. Reactions of radiation-generated OH radicals with tyrosine and its homopolymers, i.e. L-Tyr-L-Tyr and L-Tyr-L-Tyr-L-Tyr solutions were shown to give crosslinks between the peptide chains with high yields. High-performance liquid chromatography of the products of pyrolysis and combustion from polystyrenes were used for isolation and identification of the monomeric and dimeric products. Evidence is presented for the crosslinking to occur through O-C and O-O bonds. Mechanisms of product formation are also discussed.

**Toxicology**


Keywords: *Polystyrene, *Decomposition, *Toxicology, Pyrolysis, Combustion products, Test methods, Fire safety, Literature surveys.

The current English literature through 1984 on the products of decomposition of polystyrenes and the toxicity of those products is reviewed. Among 57 compounds detected by chemical analyses of the thermal decomposition products produced under various atmospheric conditions (vacuum, inert, and oxidative), the main volatile component is the styrene monomer. Evidence is provided that the mass fraction of styrene increases with furnace temperatures at least through 500 C. At 800 C and above, the concentration of styrene decreases. In oxidative and pyrolysis (magnetic monoxide CO), carbon dioxide (CO2) and oxidative hydrocarbons are formed. The concentrations of CO and CO2 are a function of temperature and combustion conditions. The paper report on the pyrolysis production in the flaming than in the non-flaming mode. Eleven different test procedures were used to evaluate the toxicity of the pyrolysis and combustion atmospheres of polystyrenes.


Keywords: *Biocides, *Toxicology, Lethal dosage, Crabs, Organotins, Solubility, Molecular biology, Reprints, *Triorgonit, Computer applications, *Water pollution effects(Animals). Thermodynamic properties of sparingly soluble organometallics in water have been correlated with boiling points and toxicity, suggesting that appropriate physicochemical descriptions of molecular conformation or phase behavior can provide similar predictions. The paper presents a novel alternative to previous applications of substituent structure-activity coefficients based on experimental kinetic or equilibrium data to predict solubility and toxicity. The authors have developed a computer program utilizing SAREA and PROPHET NET which, respectively, permit independent calculations of total available surface areas TSA of organometallic molecules based upon bond distances and molecular conformations, and expectations for transformation of aqueous media. Our first demonstration is applied to a comprehensive series of neurotoxic organotin compounds of commercial or potential concern for which substitute LC50 toxicities toward crab larvae (Rhabdopean harrisii) in sea water were independently determined.


Poly(vinyl chloride) (PVC) constitute a major class of synthetic plastics. Many surveys of the voluminous literature have been performed. The report reviews the literature which, although often extensive, is often fragmentary, and sufficient, and endeavors to be more informative than comprehensive. PVC compounds, in general, are among the major fire hazards. The present literature primarily deals with the toxicology of the products of thermal decomposition which include hydrogen chloride, benzene and unsaturated compounds, hydrocarbons, carbon monoxide, carbon dioxide and water are included among the common combustion products. The major toxic products from PVC fires are hydrogen chloride (a sensory and pulmonary irritant) and carbon monoxide (an asphyxiant).

The concepts of fire hazard assessment are discussed. The development of these concepts into a framework for a hazard assessment model is described. This model, which is actually a group of interacting models, is presented in terms of the components functions and the interactions necessary to accomplish a hazard analysis. The most critical research issues which must be resolved in order to use this hazard analysis model for practical problems are identified. Preliminary results of experiments to assess the predictive accuracy of the multi-compartment transport models used within the model are presented. A simple, engineering approach to toxicity evaluation included in the current model is also discussed.

The National Bureau of Standards (NBS), Gaithersburg, MD. Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Toxicology, Hazardous materials, Validations, Statistical Analysis,* Fire tests, "Smoke models. The concepts of fire hazard assessment are discussed. The development of these concepts into a framework for a hazard assessment model is described. This model, which is actually a group of interacting models, is presented in terms of the components functions and the interactions necessary to accomplish a hazard analysis. The most critical research issues which must be resolved in order to use this hazard analysis model for practical problems are identified. Preliminary results of experiments to assess the predictive accuracy of the multi-compartment transport models used within the model are presented. A simple, engineering approach to toxicity evaluation included in the current model is also discussed.

PUB-86-210713 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Fire Safety Technology Div.


Keywords: *Toxicology, Hazardous materials, Validations, Statistical Analysis, Fire tests, "Smoke models. The concepts of fire hazard assessment are discussed. The development of these concepts into a framework for a hazard assessment model is described. This model, which is actually a group of interacting models, is presented in terms of the components functions and the interactions necessary to accomplish a hazard analysis. The most critical research issues which must be resolved in order to use this hazard analysis model for practical problems are identified. Preliminary results of experiments to assess the predictive accuracy of the multi-compartment transport models used within the model are presented. A simple, engineering approach to toxicity evaluation included in the current model is also discussed.
A series of literature reviews was undertaken by the National Bureau of Standards to examine the toxicity and chemical properties of the effluents produced when seven plastics were decomposed under various thermal and atmospheric conditions. These plastics include: acrylonitrile-butadiene rubber, nylons, polyesters, polyethylene, polypropylene, polysulfones, poly(vinyl chloride), and rigid polyurethane foams. The English language literature on each plastic was reviewed and published as a separate report of the National Bureau of Standards. Over 400 different thermal decomposition products, many of which were produced from more than one plastic, were identified. The toxicity of most of these individual products is unknown and an assessment of the toxicity of the multitudes of these products, even if all were feasible at this time. Therefore, a variety of bioassay toxicity protocols have been utilized in the toxicology of the various atmospheric conditions generated by the thermal decomposition of these plastics. In general, these seven plastics did not produce unusually or extremely toxic pyrolys or combustion products when compared to those of other synthetic or natural materials. In a few cases involving additives, toxic products of concern were produced.

MILITARY SCIENCES

Logistics, Military Facilities, & Supplies

PC A02/MF A01
National Bureau of Standards (NBS), Gaithersburg, MD, Office of Product Standards Policy.

Forestry

PC A02/MF A01
National Bureau of Standards (NBS), Gaithersburg, MD, Office of Product Standards Policy.

Geology & Geophysics

PC A02/MF A01
National Bureau of Standards (NBS), Gaithersburg, MD, Office of Product Standards Policy.

PC A02/MF A01
National Bureau of Standards (NBS), Gaithersburg, MD. Office of Product Standards Policy.


W. F. Manders. May 86, 23p NBSIR-87-3380

Keywords: "Lignin," "Hardwoods," "Softwoods, Magnetic resonance, Carbon isotopes, Decomposition, Thermokinetic analysis, Guaiacyl, Nitrobenzene, Oxidation reaction reductions, Siringyl/guaiacyl ratio.

The unprotonated aromatic regions of the solid-state 13C NMR spectra of several hardwoods and softwoods are examined. Spectra are acquired with cross polarization, magic-angle spinning, and delayed proton decoupling. The hardwood spectra are decomposed into siringyl and guaiacyl components with the aid of a sooty spectrum, which is assumed to be the same as the guaiacyl component of the hardwood spectrum. The molar ratio of siringyl/guaiacyl units to guaiacyl/guaiacyl units (S/G) in hardwood is determined from the intensities of their respective component spectra. These results were comparable to literature values that were obtained by a combination of methoxyl and elemental analyses.

Toxicology

PC A02/MF A01
National Bureau of Standards (NBS), Gaithersburg, MD. Office of Product Standards Policy.

MEDICINE & BIOLOGY

PC A02/MF A01
National Bureau of Standards (NBS), Gaithersburg, MD. Office of Product Standards Policy.

MEDICINE & BIOLOGY

PC A02/MF A01
National Bureau of Standards (NBS), Gaithersburg, MD. Office of Product Standards Policy.

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PC A02/MF A01
National Bureau of Standards (NBS), Gaithersburg, MD. Office of Product Standards Policy.

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National Bureau of Standards (NBS), Gaithersburg, MD. Office of Product Standards Policy.

MEDICINE & BIOLOGY

PC A02/MF A01
National Bureau of Standards (NBS), Gaithersburg, MD. Office of Product Standards Policy.

MEDICINE & BIOLOGY

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MEDICINE & BIOLOGY

PC A02/MF A01
National Bureau of Standards (NBS), Gaithersburg, MD. Office of Product Standards Policy.
The measurement of the acceleration of gravity (g) has long been a matter of scientific interest. Its value is of interest in a broad area of physical sciences, namely metrology, geophysics and geodesy. In this paper the author discusses the various kinds of instruments, the methods of measurement, and the applications of g.

601,371


Keywords: "Aromatic polychlorinated hydrocarbons, Chemical analysis, Minerals, Gas chromatography, Mass spectrometry, Nuclear magnetic resonance, Reprints, "Curtisite", "Idrialite", Liquid column chromatography.

Two polychlorinated aromatic hydrocarbons (PAH) minerals, curitsite and idrialite, have been characterized using high-performance liquid chromatography-mass spectrometry (HPLC-MS) and high-performance liquid chromatography (HPLC) with fluorescence detection. Using analytical techniques, the curitsite and idrialite were found to be unique complex PAH mixtures consisting of six specific PAH structural series with each member of a series differing from the previous member by addition of another aromatic ring. The curitsite and idrialite samples contained many of the same components but in considerably different relative amounts. The identification of these compounds supports the conclusions of M. Blumer that these minerals were formed by medium to high temperature hydrothermal alteration of organic compounds, followed by extended equilibration at elevated temperatures in the subsurface.

601,372
PB86-212842 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

GPS (Global Positioning System) Carrier Phase Ambiguity Resolution Over Long Baselines.


Keywords: "Geodesy, Navigation satellites, Carriers, Phase measurement, Resolution, Satellite orbits, "Global positioning systems."

As GPS satellite orbit determination accuracy improves, the spacing of baseline between GPS satellite baselines 100 km to 1000 km or more in length will be desirable. With phase delay single differences for the L1 and L2 frequencies from the i-th satellite, two particularly useful linear combinations can be formed. One is $d$, a measure of the difference in the geometric distance to the ground stations plus the clock correction. The other is $g$, a measure of the difference in the integrated electromagnetic content along the two paths. The information should make possible ambiguity resolution over baselines if the orbits, phase measurements, and tropospheric corrections are sufficiently accurate.

601,373
PB86-228657 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Geodetic Experiments for Monitoring Contemporary Plate Motions and the Earth's Rotation.


Keywords: Polar wandering, Earthquakes, "Plate tectonics, Earth rotation, Plates (Tectonics), Very long baseline interferometry."
Department of Commerce, Washington, DC.

Shale Oil Deasenation Process.


This Government-owned invention available for U.S. licencing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.


An improved process for shale oil deasenation comprises coking a retorted shale oil stream following by contacting the liquid oil coker product with water. Water washing is preferably carried out under ambient condi- tions to achieve a reduction to less than 3 ppm w solu- ble arsenic.

601.380
PB87-103271 PC A07/MF A01 National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.


Keywords: *Coal mines, *Fire safety, *Fire hazards, *Fire protection, Underground mining, Evaluation. A prototype Fire Safety Evaluation System has been developed and is ready to be evaluated by a Peer Consul- ting Panel and for performing field tests. The system can be used to determine combinations widely accepted fire safety equipment and underground coal mines features that provide a level of safety equivalent to those required by the Code of Federal Regulations-Title 30 for underground coal mines. In this evaluation, equivalently safety performance is gauged in terms of overall level of safety provided rather than by a compo- nent by component comparison.

601.381
PB87-117941 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.


Pub. in Oil and Gas Jnl. 83, n17 p80-86 1985.


No abstract available.

601.382
PB87-127881 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Pumbers Div.

Crystal Structures of Bobbertite and Synthetic Mg3SiO4(c), 8H2O.

Final rept., S. Takagi, M. Mathew, and W. E. Brown. 1986, 5p Sponsored by American Dental Association Health Foundation, Chicago, IL.


The crystal structures of two forms of Mg3SiO4 (c), 8H2O, bobbertite (1) and the synthetic polynick (11), have been determined by single-crystal X-ray diffraction. Crystal data for polymer I are space group C2/c, a = 4.667(1), b = 27.026(8), c = 10.670(3), beta = 105.01(2), Z = 4, R = 0.041 for 963 reflections. Crystal data for polymer II are space group C2/m, a = 10.034(1), b = 13.407(2), c = 4.657(1), alpha = 105.09(1), Z = 2, R = 0.025 for 510 reflec- tions. The structure of polymer I is closely related to that of the vivianite group, whereas polymer II is isostuctural with vivianite. Both structures consist of octahedral edge-sharing dimers MgO6H2O4(1) and indepen- dent MgO2H2O4 octahedra linked together by PO4 tetrahedra to form complex sheets parallel to (010). The arrangement of these sheets along b is dif- ferent in the two structures.

601.383
PB87-154318 PC A04/MF A01 National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.


Keywords: *Fire safety, *Blowouts, Diffusion flames,Extinguishing, Model tests, Spraying, Water, *Natural gas wells, Blow off.

For water spray suppression of well gas blowout fire applications, reasonably large scale (1-10 MW) meth- ane diffusion flames have been investigated near the high Froude number limit. Flame blow-off has been ob- served with pipe sizes to 30 mm diameter. Flame and lift-off heights, centerline temperatures and incident radiation flux to nearby targets have been measured with and without water spray suppressant. Using the Dayan-Tien formulation for a cylindrical flame model an effective gray absorption coefficient approaching 0.2/m was determined at the blow-off limit. The de- rived shape of the functional dependence of decreasing radiative fraction with yet Froude number in the limit is consistent with small scale experiments. The effect of spraying water internal to the flame envelope at the base to shift or raise the flame above its normal position and to lower peak flame temperature and radiation levels despite increased absorptivity due to the radiati- vely active steam. Extinguishment near blowoff is thought due to the former effect. Calculations of flame entrainment based on increased water vapor emission are consistent with literature estimates of entrainment when account of the effects of buoyancy due to the liquid spray is provided.

Navigation, Guidance, & Control

601.384
PB87-105779 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD.


Keywords: *Time standards, *Chronometers.

An historical outline of USNO time dissemination serv- ices prior to radio is presented. The various needs for accurate, such as for longitudinal determinations, for the general public, and for sea navigation are mentioned. The talk emphasizes the development and deploy- ment of visual time signals, or time balls, for rating ship chronometers.

Navigation Systems

601.385
PB87-111654 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Weighting and Smoothing of Data in GPS Common View Time Transfer. Final rept., M. A. Weiss. 1986, 16p


Keywords: *Time transfer, *Global positioning sys- tems, *Time transfer.

It is now possible to compare a clock with UTC(NBS) anywhere in common view of a GPS satellite with Boul- der, Colorado at the full level of accuracy and stability of the United States. The GPS system is now in operation times of about four days and longer via the NBS Global Time Service. The availability includes Japan, Europe, and the entire United States. The service includes a dial-up service for current estimates of the user's clock per- formance, and a monthly report with improved esti- mates. Further the fact. The authors discuss here the exact method by which the common view time transfer values in the monthly reports are computed.

Nuclear Science & Technology

Fusion Devices

601.386


Keywords: *Electrical insulation, Supernatting magnets, *Neutron irradiation, Cryogenics, *Physical radiation effects, Gamma radiation, *Fusion reactors.

Current knowledge of cryogenic irradiation effects on organic-matrix electrical insulators required for the superconducting magnets in magnetically-confined, fusion energy systems is reviewed. It is concluded that the performance of presently available materials is marginal for such applications. Since the cost of substituting inorganic materials as insulators appears to be inordinately expensive, a program to develop or- ganic insulators having improved performance is under way. The program will make use of the National Low Temperature Neutron Irradiation Facility currently being constructed at ORNL. The main features of the program are described.

601.387
PB86-243375 PC A15/MF A01 National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.


Keywords: *Superconducting magnets, *Stainless steels, Cryogenics, Copper, Aluminum, Weldments, Mechanical properties, Toughness, Fusion reactors, Steel 316, Steel 304, Steel 308, Fiber reinforced composites, Physical radiation effects.

The report contains results of a research program to produce material property data that will facilitate design and development of cryogenic structures for the superconducting magnets of magnetic fusion energy power plants and prototypes. Research results for 1985 are summarized in an initial "Highlights of Re- sults," and expanded upon in detail in the technical papers that form the main body of the report. The tech- nical papers are presented under four headings reflect- ing the main program areas: Welding, Nonmetal- lic, Structural Alloys, and Technology Transfer. Ob- jectives, approaches, and achievements are summa- rized in an introduction to each program area.
Fusion Devices


In a project funded jointly by the National Bureau of Standards (NBS) and the Nuclear Regulatory Commission (NRC), NBS has developed a calibration facility for beta-particle instruments and sources used in radioprotection dosimetry. The facility consists of beta-particle and nearly monoenergetic electron beams characterized in terms of absorbed-dose rate to plastic and in terms of beta spectra. A second phase of the project was concerned with establishing calibration of beta-protection dosimeters. The final report includes a detailed discussion of (1) the determination of absorbed-dose rates at a reference point of nearly monoenergetic electron beam, dose-rate dependence on altitude above sea level, and an estimate of the uncertainty in dose-rate measurements, (2) beta-particle and nearly monoenergetic electron spectra and their dependence on source configuration, and (3) degree of achievable uniformity of beam cross sections. Included also is a review of the results of a first attempt to predict instrument response to realistic beta-particle environments from their response to monoenergetic electrons and knowledge of the approximate beta-particle spectra. Attached to the report is a table for establishing the results of secondary calibration laboratories for radiation-protection instruments.


Keywords: Neutron flux, Efficiency, *Neutron detectors, MeV range 01-10. The absolute efficiency of the National Bureau of Standards (NBS) Black Neutron Detector at 2.3 MeV has been determined using the time-correlated associated particle method. The measurement extends the usefulness of the Black Neutron Detector as an absolute neutron flux monitor to the higher energy region.

601.399 PB86-232725 Not available NTIS National Bureau of Standards, Gaithersburg, MD.

Nuclear Instrumentation


Keywords: *Accelerator facilities, *Fastbus System, Data Acquisition Systems, Reviews, Specifications, ERDA/441014.

The FASTBUS modular high speed data acquisition and control system which is a highly flexible, parametric, space and time-domain data system which is currently in use in several major nuclear and high energy physics laboratories and is also finding application in other areas. 10 refs. (ERA citation 10.3715/26.)


Keywords: *Standards, *Calibrating, Radiation protection, Ionization chambers, Dose rate, *Beta sources, *Beta dosimetry, Electron sources, Beta detection, KeV range 100-1000, MeV range 01-10, Calibration standards.

In a project funded jointly by the National Bureau of Standards (NBS) and the Nuclear Regulatory Commission (NRC), NBS has developed a calibration facility for beta-particle sources for use in radiation-protection dosimetry. The facility consists of (1) beta-particle and (2) nearly monoenergetic electron beams. A detailed discussion of the characteristics of the beams is presented, followed by a description of the associated instrumentation. The final report includes a detailed discussion of a) the determination of absorbed dose rate to plastic and in terms of beta spectra, and b) the selection of the source configuration. In addition, the uncertainty in the measurement of the dose rate is presented, including the long-term stability of the source. Included in the report is a description of the instrumentation used to measure the dose rate and the uncertainties associated with these measurements.


Keywords: \*Neutron scattering, Inelastic scattering, Molecular vibrations, Excitation, eV range, Time-of-flight method.

The increasing availability of pulsed spallation neutron sources such as WNR at Los Alamos National Laboratory and IPNS at Argonne National Laboratory has spurred interest in these kinds of experiments. Among these are measurements of inelastic neutron scattering in the eV energy range. Such research offers the possibility of studying high-lying molecular rotational-vibrational states, atomic and molecular electronic excitations, and measurements of scattering laws at higher energies. In this paper the emphasis will be primarily on the methods used in measuring inelastic neutron scattering (in the eV region), where at NBS the first measurements of this kind have recently been performed. Emphasis will also be placed on interpretation of these inelastic scattering spectra and the implications to the problems of neutron moderation.

601.400

Keywords: \*Radiation measuring instruments, \*Radiation protection, Beta, Gamma, Bremsstrahlung, gammas, Radiation, dosimeters, NBS.

An account is given of the NBS radiation facilities available for the study of radiation protection instruments. Covered are: The customary bremsstrahlung, cobalt-60, and cesium-137 beams, the new 6 to 7 MeV, essentially monoenergetic photon beam produced by (19)Fip, alpha gamma(16)O reaction in the positron production reactor at Gaithersburg; the (methyl)benzene, (propane-137, thallium-204, and strontium-90 + yttrium-90); the essentially monoenergetic electron beams covering the energy range from about 0.2 to 2.5 MeV, produced in the electrostatic accelerator and the electron Van De Graaff accelerator; and the facility using a semiconductor detector containing a noble-gas radon Ruthenium. The characterization of the facilities in terms of exposure rate or absorbed-dose rate to water at various low and intermediate levels of instrument calibration and in terms of spectral distributions are described. Finally, examples are given of the result of studies of instruments in these radiation facilities.

601.388

Keywords: \*Calibrating, \*Remeters, \*Neutron dosimetry, Linearity.

It is shown that the measured calibration factors for many neutron remeters vary considerably for nominally identical instruments, and even from one scale to another for the same instrument.

601.399

Keywords: Radiation protection, Calibrating, \*Gamma sources, Thermaicommoneutrons, Neutal detectors, MeV range 01-10, Response functions.

A photon source has been developed at the National Bureau of Standards to measure the response of radiological survey instruments to high-energy photons. The response of six commercial radiological survey in-
Probability Based Safety Checking of Nuclear Plant Structures, B. Ellingwood, 84, 85p BNL-NUREG-51737

Keywords: *Nuclear power plants, *Structures, Design criteria, Safety, Loads(Forces), Reinforced concrete, Structural engineering, Probability.

This report describes the basis for the development of practical probability-based design criteria for nuclear plant structures. A brief critical review of existing criteria is provided to highlight desirable features of probability based-safety checking. A specific deterministic design criteria format is recommended. Finally, the selection of a set of structures to test the validity of the probability-based checking equations is described. Statistical data on structural loads are summarized in an appendix.

NUREG/CR-3876 PC A05/MF A01 Brookhaven National Lab., Upton, NY.


Keywords: *Concrete structures, Design criteria, Reliability, Loads(Forces), Containment buildings, *Earthquake engineering.

The report describes a research effort for the development of a probability-based load combination criteria for design of concrete containment structures. This probability-based criteria is a load and resistance factor design (LRFD) format. In order to test the performance objectives of the proposed criteria, four representative structures are selected using a Latin hypercube sampling technique. Next, the reliability analysis methods developed by Brookhaven National Laboratory is employed to assess the reliability of these representative containment structures. The load factors for accident pressure due to the design basis accident and safe shutdown earthquake are derived for two target limit state probabilities. Also discussed are the basis of prior experience with probability-based design criteria for ordinary building construction.

PB88-195542 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Structures Div.


Keywords: *Nuclear power plants, *Structural engineering, Loads(Forces), Reinforced concrete, Prestressed concrete, *Probability theory, Reliability, Criteria, Reprints, Containment buildings.

The paper describes a procedure for developing probability-based load combinations for the design of concrete containment structures. The proposed criteria are in a load and resistance factor design (LRFD) format. The load factors and resistance factors are, in general, derived for use in limit state design and are based on target limit state probability. In the paper, the load factors for accident pressure due to the design basis accident and safe shutdown earthquake are derived for three target limit state probabilities. Other load factors are recommended on the basis of prior experience with probability-based design criteria for ordinary building construction.

PB88-195989 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Structures Div.


Keywords: *Nuclear power plants, *Structural engineering, Design, Reliability, Stells, Reinforced concrete, Fragility, Probability theory, Probability distribution functions, Reprints, Containment.

Calculations of reliabilities of safety-related nuclear plant structures require a knowledge of the probability distributions that describe their resistance. The study considers the applicability of existing statistical data for describing the resistance of steel and reinforced concrete nuclear plant structures. Probability distributions and critical factors which can be used in assessing the probability of containment failures are then compared to the results of experiments, developing fragilities, and selecting appropriate resistance criteria for probability-based structural design.

601,407


Keywords: *Dosimetry, Monte Carlo method, Radiation protection, *Reprints, *Neutron energy, *Neutron dosimetry, Computer applications.

At higher neutron energies calculations using the analytic method yield microdosimetric spectra in which the peak number is narrow and shifted in peak energy when compared to experiment. The difference is usually attributed to the neglect of straggling in the calculation. In order to extend the calculation to this situation, the authors have written a Monte Carlo neutron energy deposition code which includes straggling of the energy depositions by charged particles in the sensitive volume. As a first consistency check, Monte Carlo calculations without straggling have been compared with the analytic method, and found to agree within the statistics of the Monte Carlo program. For 'thin' sensitive volumes for which the Landau distribution should be appropriate, the authors are using the Monte Carlo calculation to calculate linear energy (l) distributions with proton straggling included for energies up to 15 MeV.

Radioactive Wastes & Radioactivity

601,410


Keywords: *Radioactive wastes, Chemical analysis, Precission, Concentration(Composition), Zinc, Calcium, Barium, Cesium, Molybdenum, Sodium, Silicon, Strontium, Reprints, *Leach tests.

The overall precision of the static leach test is determined by the summation of random effects caused by: (1) variance in the experimental conditions of the leaching procedure, (2) the homogeneity of the material to be leached, (3) variance of the analytical techniques used to determine elemental concentrations in the leachate. The study, strict control of key experimental parameters to reduce the source of variance. In addition, special attention to preparation of glass samples to be tested as a high degree of homogeneity described here are the details of the reduction of these two sources of variance to a point where the overall test precision is limited by that of the analysis step. Of the elements determined B, Ba, Ca, Cs, Mo, Na, Sr, Si, and Zn; only Ca and Zn exhibited replicate precision significantly greater than that observed in the analysis of the leachate solutions.

Reactor Materials

601,411


Keywords: *Uranium alloys, *Uranium reactor materials, Extrusions, Texture, Neutron diffraction, Tungsten, Fibers, Reprints.

The pole-density distributions of two hydrostatically extruded samples, a U-075 wt % Ti alloy and a U-075 wt % Ti/W composite alloy, were studied by neutron diffraction methods. Analysis of U 112, U 131 and U 111 confirmed that the U phases of both samples posses a (010) (340) duplex fiber texture with a probability of approximately 2:8:1 in favor of the (010) direction. The W phase of the composite sample had a (110) texture. The orientation distribution profiles of the fiber axes obtained from the rocking curves (as a function of the tilt angle) were represented best by a Gaussian-Lorentid combination function. The full widths at half maximum of the distributions were approximately 21, 11, and 5 degrees for the U (010), U(340) and W (110) fiber axes, respectively.

Reactor Physics

601,412


Keywords: *Fission chambers, *Fission fragment detection, Design, Diagrams, Fabrication, Performance, Testing, ERDA/390101.

A prototype fission chamber was tested and several chambers were built. The design and performance characteristics are presented. (ERA citation 05:008632)


Keywords: *Electron scattering, Reprints, *Atomic angular momentum, Superelastic scattering, *Exchange scattering.

Measurements are presented of spin asymmetries observed in the superelastic scattering of 10 eV electrons from laser excited Na(3P), Asymmetries as large as 40% have been observed, despite the fact that the target is not spin-polarized. Data are presented both as a function of scattering angle and laser polarization angle. An interpretation of the effect is given in qualitative terms.
ORDNANCE

Ammunition, Explosives, & Pyrotechnics

601,417
PB87-145058
PC A04/MF A01
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.
Statistical Characterization of Electroexplosive Devices Relevant to Electromagnetic Compatibility Assessment.
Also available from Sup. of Docs as SN003-0074-4. Sponsored by Army Aviation Systems Command, St. Louis, MO.

Keywords: Initiators(Explosives), Electromagnetic compatibility, Electromagnetic pulses, Thermodynamic properties, Firing tests(Ordnance), Firing likelihood plots.

Electroexplosive devices (EEDs) are electrically fired explosive initiators used in a wide variety of applications. The nature of most of these applications requires that the devices function with near certainty whenever required and remain inactive otherwise. Recent concern with pulsed electromagnetic interference (EMI) and nuclear electromagnetic pulse (EMP) made apparent the lack of methodology for assessing EED vulnerability. A new and rigorous approach for characterizing EED firing levels is developed in the context of statistical linear models and is demonstrated in the paper. The authors combine statistical theory and methodology with thermodynamic modeling to determine the probability that an EED, of a particular type, fires when excited by a pulse of a given width and amplitude. The results can be applied to any type of EED for which the hot-wire explosive binder does not melt below the firing temperature. Included are methods for assessing model validity and for obtaining probability plots, called Firing Likelihood Plots. A method of measuring the thermal time constant of an EED is given. This parameter is necessary to evaluate the effect of a train of pulses.

United States in 1975 for issue to officers as part of a Law Enforcement Assistance Administration demonstration project, was tested for V50 ballistic limit. The program was a joint effort of the U.S. Department of Justice National Institute of Justice and the National Research Council of Canada Public Safety Project Office. Tests of ballistic limit were conducted on virgin armor or that had never issued. The armor showing evidence of light, moderate, and heavy wear both dry and wet while. The results show that armor does not lose ballistic efficiency as a consequence of age.

Guns

601,419
AD-A130 809/7
PC A03/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Nonlinear Inverse Heat Transfer Calculations in Gun Barrels.

Keywords: Nonlinear analysis, Heat transfer, Gun barrels, Interior ballistics, Conduction(Heat transfer), Thermocouples, Temperature, Measurement, Diffusion, Partial differential equations, Algorithms, Numerical analysis, Boundary value problems, Problem solving, Frequency, Time intervals, Cannons.

We consider the problem of determining the temperature history inside a gun barrel from embedded thermocouple measurements at some distance away from the inside wall. This inverse problem leads to an improperly posed initial value problem for a non-linear system of partial differential equations, whenever the thermal properties are temperature dependent. We discuss a step-by-step marching algorithm for the numerical computation of such problems. The scheme is stabilized by appropriately filtering in the frequency domain at each step. We illustrate this technique with a numerical experiment on a nonlinear problem whose exact solution is known. The basic ideas are applicable to other unstable evolution equations.

PHOTOGRAPHY & RECORDING DEVICES

Recording Devices

601,420
PB86-209301
Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electro systems Div.
Transient Response Characterization of Waveform Recorders.

Keywords: Waveforms, Recording instruments, Transient response, Tests.

Test methods for characterizing the transient response of waveform recorders are presented, together with typical test results. The methods, based on the use of a precision, programmable step generator developed at NBS, are suitable for recorders having up to 10 bits of resolution and 100 MHz bandwidth.
Acoustics

601,421
AD-1149 921/0
PC A02/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Acoustic Emission Transducer Calibration by Means of the Seismic Surface Pulse.
Technical rep., F. R. Breidenbach, Apr 82, 2p Rep. no. TR-82-1
Contracts N00014-81-F-0009, N00014-82-F-0004
Also Pub. in Jnl. of Acoustic Emission, v1 n2 p87-94 Apr 82.

Keywords: *Transducers, Calibra$tion, *Acoustic emissions, Elastic waves, Voltage, Output, Error analyses, Naval research.

A system for calibrating transducers as receivers of elastic waves at the surface of a solid medium has been developed and is now in use at the National Bureau of Standards (NBS). The method provides the voltage output of the transducer when mounted on a surface whose motion is known. The measurement is made over the range of 100 Hz to 1 kHz and is designed with the calibration of acoustic emission (AE) transducers in mind. An error analysis is given.

601,422
PB86-185303
Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Gas-Filled Spherical Resonators: Theory and Experiment.
Final rept., M. R. Moldover, J. B. Mehl, and M. Greenspan. Feb 86, 18p
Pub. in Jnl. of the Acoustical Society of America 79, n2 p267-270 Feb 86.

Keywords: *Acoustic resonators, Acoustic velocity, Argon, Thermodynamic properties, Reprints.

Gas-filled spherical resonators are excellent tools for routine measurement of thermophysical properties. The radially symmetric gas resonances are nondegenerate and have high Q's (typically 2000-10,000). Thus they can be used with very simple instrumentation to measure the speed of sound in a gas with an accuracy of 0.02%. The authors have made a detailed study of a prototype resonator filled with argon (0.1-1.0 MPa) at 300 K, with the objective of discovering those phenomena which must be understood to use gas-filled spherical resonators to measure the thermodynamic temperature and the universal constant R. The resonance frequencies (fn) and half-widths (gn) were measured for nearly symmetric modes and nine triply-degenerate nonradial modes with a precision near 10 to the -7th power of fn. The data were used to develop and test theoretical models for the geometrically simple oscillating system.

601,423
PB86-188471
Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mechanical Production Metrology Div.
Transverse Waves in an Elastic Plate: Theory and Experiment Compared.

Keywords: *Wavesform, Detectors, Transducers, Reprints, Acoustic emissions.

Wavesform calculated by generalized ray theory for a thick plate driven by a step-function point force are compared with experimental wavesforms obtained on a glass plate using an improved piezoelectric displacement-sensing transducer.

601,424
PB86-239969
PC A08/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. ElectroSystems Div.
Electrical Performance Tests for Audio Distortion Analyzers.
Sponsored by Army Communications-Electronics Command, Fort Monmouth, NJ.

Keywords: *Sound analyzers, Performance tests, Distortion, Computer programs.

Electrical performance test procedures for audio distortion analyzers were developed by the National Bureau of Standards for the U.S. Army for purposes of evaluating audio distortion analyzer bid samples. Examples of data sheets and tables are also provided for recording interim and final results. The report discusses the philosophy of each measurement procedure with a view toward providing an understanding of the basic metrology required to perform the measurements. In addition, the sources of measurement error are discussed. The primary applications and basic principles of modern audio distortion analyzers are also presented.

601,425
PB87-110086
Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Uncertainties in the Cross-Spectral Method for Acoustic Intensity under Semireverberant Conditions.
Pub. in Jnl. of the Acoustical Society of America 79, n3 p691-701 Mar 86.

Keywords: *Acoustic measurement, Intensity, Reprints.

Measurements were performed under semireverberant conditions to examine uncertainties in the two-microphone cross-spectral method for determining acoustic intensity. Calculations of the pressure gradient error, its correction for phase mismatch, and the cross-spectrum random error are discussed. The results of preliminary tests performed under free-field and plane-wave conditions are also presented. The influence of semireverberant conditions on the accuracy of the intensity measurements was studied through the use of a standing-wave tube as a reference sound source. With the tube source placed in a 112-cu m room having reverberation times of less than 0.5 s, the radiated power was determined both from the intensity measured inside the tube and from the intensity integrated over a spherical surface enclosing the source.

601,426
PB87-134276
Not available NTIS
Practical Sound-Reducing Enclosure for Laboratory Use.
Final rept., D. Hils, J. E. Fallier, and J. H. L. Hall. 1986, 3p

Keywords: *Acoustic absorption, *Enclosures, Laboratory equipment, Noise reduction, Design, Reprints, Acoustic attenuation.

The authors describe the design of a sound-reducing laboratory enclosure. The unit fits directly over the experiment and is hoisted to the ceiling during setup and adjustment stages. The advantages of the design are its modest cost, saving of space, and the fact that no door is required. The average sound isolation achieved is 30 dB, typical for a wall mass per unit area of 35 kg/sq m.

601,427
PB87-134488
Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Institute of Electrical and Electronic Engineers (IEEE) Ultrasonics Symposium.
Final rept., G. V. Blessing. 1986, 3p
Pub. in Ultrasonics 24, n6 3p Nov 86.

Keywords: *Meetings, Reprints, *Ultrasonics.

The 1985 IEEE Ultrasonics Symposium, a three-day international conference held in San Francisco 16-18 October 1985, is reviewed here. The Conference covers the theory, development, and application of ultrasonic techniques and tools. Over one-third of the papers presented were from outside the United States. Symposium Proceedings have been published and are available from the IEEE publishing headquarters in New Jersey.

Fluid Mechanics

601,428
PB86-160793
Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysical Properties Div.
Decay of Swirling Gas Flow in Long Pipes.
Final rept., S. E. McManus, B. R. Bateman, J. A. Brennan, I. Vazquez, and D. Mann. 1985, 5p

Keywords: *Gas flow, *Flow measurement, Swirling, Decay, Pipe flow.

A characterization of swirling flow of nitrogen gas at ambient temperature, pressure of 4 MPa (600 psi), and Reynolds numbers of 800,000 to 1,400,000 is presented. Possible flowmeter measurement errors in a pipe of circular cross-section are given. An instrumented test section containing a hot wire anemometer and a directional pitot tube for the measurement of swirl angles and velocities are described. Results suggest that large values of swirl are possible in gaseous flow, that the instant of swirl is very slow at high Reynolds numbers, and that reliance on long lengths of pipe to reduce swirl to acceptable levels may not be a practical solution to eliminating potential flow measurement errors attributable to swirl.

601,430
PB86-187266
Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Double-Diffusive Convection with Sidewalls.
Final rept., G. B. McFadden, S. R. Coriell, and R. F. Boisvert. Sep 85, 4p
Sponsored by National Aeronautics and Space Administration, Washington, DC. Pub. in Physics of Fluids 28, n9 p2716-2722 Sep 85.

Keywords: *Diffusivity, *Fluid flow, Convection, Stability, Reprints, Sidewalls.

The effect of rigid vertical boundaries on the onset of convective instability is calculated for the salt finger regime of double-diffusive convection. The unper- turbed state is a quiescent fluid with constant vertical gradients of temperature and salinity, which are stabilizing and destabilizing, respectively. Vertical boundaries are taken to be stress-free and perfectly conducting. The lateral boundaries are perfectly insulating for solutions ranging from thermally insulating to thermally conducting sidewalls results in a strong destabilization of the flow for large thermal Rayleigh numbers even in the limit that the separation between the sidewalls approaches infinity. Further, for thermally conducting sidewalls, a decrease in the separation of the sidewalls may destabilize the system.
The nonlinear Boltzmann and Boltzmann-Lorentz equations are used to describe the dynamics of a tagged particle in an nonequilibrium gas. For the special case of Maxwell molecules with uniform shear flow, an exact set of equations for the average position and velocity, and their fluctuations, is obtained. The results apply for arbitrary magnitude of the shear rate and include the effects of viscous heating. A generalization of the solutions for the regression of light fluctuations is found to apply for the relationship between the equations for the average dynamics and those for the fluctuations, which is described. The connection between fluctuations and dissipation is described by the equations for the equal-time correlation function.


Keywords: *Turbulent flow, Chemical reactions, Rayleigh scattering, Light scattering, Reynolds number, Flow visualization.

The report summarizes the results of the first three years of a study on chemically reacting turbulent flow. The development of new diagnostics for variable density flows is described. These include Rayleigh light scattering for real-time, spatially-resolved concentration measurements, combined Rayleigh light scattering and hot-wire (or hot-film) anemometry for simultaneous concentration and velocity measurements, and the development of a digital line camera which has allowed the concentration measurements to be made along a line. A study of heat transfer from heated cylinders is discussed which has generated a much improved correlation of experimental results. These studies have also included a limited investigation of Reynolds number effects. The observed dependence of the mixing behavior on the density ratio and Re have led us to make new hypotheses concerning the nature of turbulent mixing.


Keywords: *Flow measurement, Turbulent flow, Rayleigh scattering, Hot wire anemometers, Velocity measurement, Cross correlation.

A new experimental method is described which allows the simultaneous real-time measurement of concentration and velocity in simple flow fields of binary gas mixtures. This method combines the use of Rayleigh light scattering for concentration measurements and hot-wire (or hot-film) anemometry. Calibration methods and representative results are discussed.


Keywords: *Air flow, Flow visualization, Convection, Domes.

Recent flow visualization tests performed at the National Bureau of Standards Passive Solar Test Facility, indicated that the natural convective interzonal flow through a doorway is three dimensional with the velocity components in the plane of the opening and the plane of the floor appearing dominant. In order to further investigate the velocity components of the interzonal airflow through a doorway an experimental study was undertaken.


Keywords: Two dimensional flow, Vortices, Stability, Jets, Computational fluid dynamics, Mixing layers.

The paper presents numerical solutions for spatially-developing axisymmetric mixing layers. The vortex merging inside these mixing layers is driven by small perturbations derived from linear inviscid stability theory. It is found that, as seen experimentally in the two-dimensional case, the merging process is controlled by the frequency content of the forcing function. Thus it is possible to manipulate the downstream behavior of the mixing layer by altering the applied perturbation. Although the forced temporally-developing mixing layer with its simpler boundary conditions has been studied computationally, this is not as desirable as studying the spatially-developing case which occurs in most physical situations.


Keywords: Two dimensional flow, Unsteady flow, Vortices, Mixing, Reprints, *Computational fluid dynamics, Mixing layers.

Numerical solutions are presented for forced spatially-developing axisymmetric and two-dimensional mixing layers. The numerical scheme employs quadratic upwind differencing for convection and a Leith-type of temporal differencing in order to solve the incompressible Navier-Stokes and continuity equations. The applied forcing function is derived from linear inviscid stability theory. The resulting large-scale vortex dynamics is visualized by means of streamlines and isotherm and isocontour plots. It is seen that the vortex merging behavior in both types of mixing layers is determined by the forcing function, manipulation of the vortex dynamics in a predictable fashion is possible through alterations in the frequency content of this applied forcing. Reynolds number is shown to be of only minor importance.


Keywords: *Compressibility, Thermophysical properties, Non-Newtonian flow, Concentric cylinders, Weissenberg effect.

Previous studies of the flow of a model soft-sphere liquid between rotating vertical concentric cylinders have predicted an enhanced depression of the free surface at the inner cylinder and the necessity and importance of accounting for finite compressibility. In those studies the rheological properties of the liquids were taken directly from computer simulations, manipulations as in the present work the liquid properties are altered in a controlled manner and the fluid dynamics problems are solved numerically and self-consistently with the original boundary conditions. Specific alterations include the removal of all non-Newtonian properties, the introduction of a change in sign of a generalized viscosity to create a rodclimbing or Weissenberg effect, and the removal of shear dilatancy or increase in pressure with shear to mimic non-Newtonian effects. These changes need to be taken into account only in the presence of shear dilatancy.


Keywords: *Gas flow, *Leakage, Calibrating, Vacuum, Reprints.

The confusion in the literature and in the laboratory surrounding the terminology and units of gas flow rate as applied to calibrated leak rate facts, has prompted this discussion of leak rate units. Special attention is paid to conflicting usages of the term and solutions applied to calibrated leak rates which lead to loss of crucial information about the gas temperature and hence the true gas flow rate. The advantages of expressing these rates in "moi/s," avoiding the complexity of calculations of both the explicit mention of temperature in the unit and the need for agreement on "standard" temperature and pressure, are also discussed.

601.440 PB87-128328 Not available NTIS National Bureau of Standards (NBL), Boulder, CO. Chemical Engineering Science Div. 155

601.440 PB87-128328 Not available NTIS National Bureau of Standards (NBL), Boulder, CO. Chemical Engineering Science Div.
Thermometer for Fast Response in Cryogenic Flow.

Final rep., B. L. Leib, R. Radebaugh, and S. R. Early, 1986, 12p Sponsored by Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH.


The measurement of transient temperatures in cryogenic fluid flow requires a highly sensitive, intrinsically fast sensor that is in good thermal contact with the fluid but in poor thermal contact with the solid walls confining the fluid. A resistance thermometer made from a 1 micron thick silicon layer on a 125 microns thick sapphire substrate has a calculated intrinsic response time of about 10 ns at 4 K, and its sensitivity is comparable to germanium or carbon thermometers in the range of 1 - 80 K. The paper describes a novel construction method to mount the small silicon-on-sapphire thermometer in an oscillating fluid flow.

601,441
PB87-134383 PC A16/MF A01 National Bureau of Standards (NLS), Gaithersburg, MD, Building Equipment Div.


H. D. Ross. Nov 86, 35p NBSIR-86/3450

Portions of this document are not fully legible. Sponsored by Department of Energy, Washington, DC.

Keywords: *Heat transfer, *Refrigerators, Two phase flow, Boiling, Fluid flow, Mixtures.

The research involved determining experimental heat transfer coefficients (HTC), examining the phenomena involved in the physical process, and analyzing the predictive ability of available models and correlations. This work was done for pure R152a and R133a and for mixtures of these refrigerants. The mixtures yielded sharply lower heat transfer coefficients than either pure refrigerant. With pure refrigerants full suppression of nucleate boiling was found to a sub-cools of about 10 K at lower pressures. Correlative evidence suggests that suppression is easier to achieve with mixtures than pure fluids. In the evaporation-dominated heat transfer regime, Chen's correlation was successfully applied to the refrigerants with and without the occurrence of FNSB conditions. In the nucleate boiling dominated regime, the Stephane and Abdelslam method was validated for pure fluids, and used successfully with Thome's method for mixtures. Pressure drop correlations for pure fluids were also extended to mixtures without modification.

601,444
PB86-160629 Not available NTIS National Bureau of Standards (NLS), Gaithersburg, MD, Atomic and Plasma Radiation Div.

Monochromatic Source of Lyman-alpha Radiation.


Pub. in Applied Optics 24, n1 p2263-2266, 15 Jul 85.

Keywords: *Lyman alpha radiation, Far ultraviolet radiation, Monochromatic radiation, Standards, Radioactivity, *Light sources, Hydrogen atoms.

A source has been developed which produces a pure spectrum of Lyman-alpha radiation (1215.7A). The source incorporates a wavelength selective filter and an rf-excited helium-filled lamp containing a mixture of uranium and uranium hydride in a sidearm. The urani- um hydride, when heated, supplies H2 in a reproducible manner. The filter consists of a flowing-oxygen cell and a narrow-bend interference filter. The distinctive advantage of the devices is that radiation in the region at a well-defined wavelength is obtained without the use of a monochromator. Characteristics of the source and measurements of the irradiance of the spectral line are given for a typical lamp. The irradiance and spectral purity are seen to be not strongly dependent on oxygen flow.

601,445
PB86-161023 Not available NTIS National Bureau of Standards (NLS), Gaithersburg, MD, Mechanical Production Metrology Div.

Free-Space Propagation of Ultrashort Light Pulses.


Keywords: *Light pulses, Maxwell's equations, Boundary value problems, Reprints.

A boundary-value problem for Maxwell's equations is cast in terms of a time-dependent solutions represent ultrashort pulses of electromagnetic energy that travel along an axis. A paraxial approximation to the solution is introduced that in the case of Gaussian boundary data, is expressed as a single integral over frequency. Calculations are presented for a pulse of Gaussian cross section and Gaussian profile. A careful study is made of the error introduced by the paraxial approximation, and an error bound is derived.

601,446
PB86-163490 Not available NTIS National Bureau of Standards (NLS), Gaithersburg, MD, Gas and Particulate Science Div.

Characterization of Aircraft-Related Particles Present in the Arctic: Alaskan Arctic, Spring 1983.


Keywords: *Electron microscopy, Particles, Reprints, *Aerosols, *Laser microprobe analysis.

Eight hundred submicrometer and 516 large and giant (> 1 micrometer) particles collected by cascade impactor were examined in the aerosol chamber characterized using analytical electron microscopy. Selected particles were also analyzed using laser microprobe mass spectrometry by National Oceanic and Atmospheric Administration submicrometer particles showed high sulfate concentrations, and a large majority (96 percent) of these appeared to have been collected directly as H2SO4 droplets. Anthropogenic particles, including graphic carbon (soot), coal and oil fly ash, and Cu-Ni smelter emissions were observed in the cleared particle fraction. Air trajectories indicate much of the aerosol passed over industrialized regions in the U.S.S.R.

601,447
PB86-164464 Not available NTIS National Bureau of Standards (NLS), Boulder, CO, Quantum Physics Div.


N. C. Wong, and J. L. Hall. 1985, 7p Final rep., N0014-77-C-0565, Grant NSF-PHY-82-0085 Sponsored by Office of Naval Research, Arlington, VA, and National Science Foundation, Washington, DC.

Pub. in Jnl. of the Optical Society of America B2, n9 p1527-1533 Sep 85.

Keywords: *Amplitude modulation, Laser beam, Sensitivity, Servomechanisms, Water vapor, *Frequency modulation spectroscopy, *Laser spectroscopy.

The authors have developed and demonstrated an active servo system to suppress the AM noise of a phase modulated laser beam to achieve shot-noise limited detection in a linear absorption experiment.

601,448
PB86-164468 PC A16/MF A01 National Bureau of Standards (NLS), Boulder, CO, Quantum Physics Div.

Characterization of Aircraft-Related Particles Present in the Arctic: Alaskan Arctic, Spring 1983.


Keywords: *Electron microscopy, Particles, Reprints, *Aerosols, *Laser microprobe analysis.

Eight hundred submicrometer and 516 large and giant (> 1 micrometer) particles collected by cascade impactor were examined in the aerosol chamber characterized using analytical electron microscopy. Selected particles were also analyzed using laser microprobe mass spectrometry by National Oceanic and Atmospheric Administration submicrometer particles showed high sulfate concentrations, and a large majority (96 percent) of these appeared to have been collected directly as H2SO4 droplets. Anthropogenic particles, including graphic carbon (soot), coal and oil fly ash, and Cu-Ni smelter emissions were observed in the cleared particle fraction. Air trajectories indicate much of the aerosol passed over industrialized regions in the U.S.S.R.

601,449
PB87-168259 PC A16/MF A01 National Bureau of Standards, Gaithersburg, MD, Laser Induced Damage In Optical Materials: 1983.

Final rep., H. E. Bennett, A. H. Guenther, D. Milam, and E. Newman. Nov 85, 58p NBS/SP-688 See also PB84-175126, Proceedings of a symposium held at Boulder, Colorado, 14-16, 1983. Also available from Sup't. of Docs as SN003-003-
New Far Infrared Laser Lines Obtained by Optical-Ly Pumping (13)CD3OD.

Final rept.,

Grant NSF-INT80-19014

Sponsored by the National Science Foundation, Washington, DC, and Conselho Nacional de Pesquisas, Rio de Janeiro (Brazil).

Pub. in International Jnl. of Infrared and Millimeter Waves 6, n11 p117-1167 1985.

Keywords: *Infrared lasers, Far infrared radiation, Carbon dioxide lasers, Reprints, *Methyl alcohol lasers, Carbon 13.

Laser action was obtained in 34 far infrared lines for the first time by fully dextored methyl alcohol with the (13) isotopic (13)CD3OD. The frequency of 13 lines was measured. The molecule was pumped by cw CO2 laser. The wavelength, the relative polarization, the relative intensity of most lines, the frequency, and the CO2 pump frequency offset of the strongest lines were measured. The new lines are distributed in the wavelength region from 75.27 micrometers to 46.47 micrometers.

New Far Infrared Laser Lines Obtained by Optical-Ly Pumping (13)CD3OD.

Final rept.,

Grant NSF-INT80-19014

Sponsored by the National Science Foundation, Washington, DC, and Conselho Nacional de Pesquisas, Rio de Janeiro (Brazil).

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Keywords: Light transmission, Stark effect, Stochastic processes, Noise, *Multi-photon processes, Laser radiation.

Aspects of how to formulate and solve the problem of resonant multiphoton processes in stochastic fields and in cases with recent results are discussed including Stark shifts in incoherent fields and multiphoton-induced line splitting, and Stark splitting in stochastic fields with non-Gaussian statistics. A theory is developed which considers the consequences of classical light statistics during propagation in a nonlinear medium.
density of about 10 to the -8th power to 10 to the -4th power W/sq cm, and energy density of about 10 to the -16th power to the -11th power J/sq cm. These power and energy transfer standards use avalanche (APD) and PIN silicon photodiode detectors, respectively. They are stable and have total uncertainties of about 10%. The system for calibrating them and other devices consists of a cw Nd:YAG laser beam acoustooptically modulated to provide low-level laser pulses of known peak power and energy.

Keywords: *Sapphire, Single crystals, Near infrared radiation, Reprints, *Refractive index.

The index of refraction of the ordinary ray in sapphire for temperatures from 24 to 1093 C and for wavelength of 633 and 799 nm was found to be expressed to 0.02% (99% confidence level). These expressions were derived from measurements of the relative change with temperature in the reflectance for a plane surface normal to the c axis of single-crystal sapphire.

Keywords: *Fiber optics, Near infrared radiation, Optical measurement, Diameters, Reprints, *Optical fibers, Intercomparison.

The National Bureau of Standards, in cooperation with the Electronic Industries Association, conducted an interlaboratory measurement comparison among fiber manufacturers. Evaluated were transverse splice offset, near-field, far-field, and variable aperture far-field methods for determining mode-field diameter. Measurements were performed on five single-mode fibers, both 1300- and 1550-nm wavelengths. At 1300 nm, agreement was fairly good with the average one standard deviation being 0.15 micrometer for modediameter measurements in the 8-11 micrometer size. Distinct systematic differences among various techniques were observed at 1550 nm where mode distributions are not as Gaussian.

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Keywords: *Fiber optics, Near infrared radiation, Optical measurement, Diameters, Reprints, *Optical fibers, Intercomparison.
ments with etched gratings that have the appearance of scratches but diffract light into a broad peak be-
tween 5 and 10 degrees off the axis of the incident beam. Some prototypes have been classified both by 
comparison to the master standards and by a photo-
electric measurement; agreement between the two 
methods is good. Such gratings, used as the second-
ary standards, should display less interlaceration van-
able than scribed or other artifacts. The paper con-
cludes by presenting evidence that the original primary 
standards have been stable over a long time.

601.469
PB87-105193
Not available NTIS
High-Resolution Spectra of Laser Plasma Light Sources in the Grazing Incidence Region.
Final rep.
P. Gohle, V. Kaufman, and T. J. Mcllrath. 1986, 2p
Contract F40620-83-C-0130
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Applied Optics 25, n13 p2039-2040, 1 Jul 86.
Keywords: Far ultraviolet radiation, Reprints, "Laser-
produced plasma, "Copper" plasma, "Ytterbium plasma, "Tungsten plasma, "Light sources, YAG lasers.

An investigation was conducted on the UV radiation from laser-produced plasmas using a chacteristic electron multiplier detector and a 1.5-m grazing incidence spec-
trometer. Results for the spectrum in the 8 to 40 nm were obtained from the plasmas generated by a 0.5-J Nd:YAG laser focused on nine different target materials. The effects on the plasma emission of laser energy and focus were measured.

601.470
PB87-106761
Not available NTIS
Investigation of a Laser-Produced Plasma VUV Light Source.
Stabilized Lasers.
Spectra.
Final rep.
J. M. Endiges, C. L. Cromer, and T. J. Mcllrath. 1986, 7p
Contract F40620-83-C-0130
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Applied Optics 25, n13 p2206-2214, 1 Jul 86.
Keywords: Far ultraviolet radiation, Radiometry, Reprints, "Laser-produced plasma, "Light sources, YAG lasers.

A system for measuring optical fiber bandwidth using the Pulse Spectrum Analysis method (PSA) has been established that produces problems inherent in that system such as signal-to-noise ratio and off-peak error. Included are the results of bandwidth measure-
ments made on telecommunication grade fibers. Finally, the PSA method is compared to other band-
width measurement methods: the frequency domain (FD) method, and the time domain (TD) method.

601.473
PB87-106892
Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Electromagnetic Technology Div.
Comparison of Three Bandwidth Measurement Techniques for Multimode Optical Fibers.
Final rep.
Y. Shao, and R. L. Gallowa. Jun 86, 6p
Keywords: Optical fibers, "Bandwidth, Comparison, Reprints, "Optical fibers, Multimode.

The paper presents the results of an experiment in-
tended to compare three distinct methods of measur-
ing the bandwidth of a telecommunication grade, multi-
mode optical fiber. The three methods are: (1) the time-domain method; (2) the frequency-domain method; and (3) the pulse-spectrum analysis method. Good agreement was found between the frequency-
domain method and the pulse-spectrum analysis method with the last method yielding results that are lower than the other two for the cases consid-
ered.

601.474
PB87-111092
Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Precise Wavelength Measurements and Optical Phase Shifts. 2. Applications.
Final rep.
L. W. Lichten. 1986, 7p
Grants NSF-PHY-82-17458, NSF-PHY-84-19105
See also PB86-210739. Sponsored by National Sci-
ence Foundation, Washington, DC, and Office of Naval Research, Arlington, VA.
Pub. in J.of the Optical Society of America A 3, n7 p909-915 Jul 86.
Keywords: Wavelengths, Phase shift, Optical measure-
ments, Reflectron, Length, Standards, Reprints.

The paper calculates the optical phase shifts on reflec-
tion from dielectric coated mirrors. The technique con-
stitutes of measuring the transmission spectrum of the mirrors. These data are fitted with a theoretical expres-
sion based on the equivalent, quarter-wave stack. This expres-
sion then gives the phase-shift correction for the mirrors. A fast algorithm, based on a series repre-
sentation of the exponential function, is used to calculate the re-
spectivity and phase shift for a single wavelength in 3 sec in BASIC on an inexpensive home computer. An application of this method is to measure absolute-wavelengths with equipment common present in laser laboratories, namely, scanning Fabry-Perot interferometers with di-
etic coated mirrors. The method is that of exact frac-
tions, which requires one primary wavelength standard, with a less accurate, secondary standard (or wave- meter). The accuracy of the technique is equal to that of the primary standard. The precision is that of reading the interferometer and can be many times that of the secondary standard.

601.475
PB87-117727
Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Electromagnetic Technology Div.
Final rep.
L. J. Eckerle, S. Chang, and J. J. Hsaia. 1986, 6p
Keywords: Optical filters, "Standards, "Spectrophoto-

In 1983, a new supply of didymium glass filters was pre-
pared, as the stock calibrated in 1976 have been very
useful and the inventory has been depleted. Re-
sults for representative samples of the new filters are
presented. The new supply of glass has been calibrat-
ed by the batch mode and will be designated Standard Reference Materials (SRM) 2002A and 2010A. During the latter part of 1976, research was begun to charac-
terize didymium glass filters for use with spectrophoto-
meters with bandwidths in the range 1.5 to 10.5 nm. These filters were to have a smaller uncertainty than previously issued filters. Also, it was found that points of inter-
section of the transmission with the glass filters could be used to supplement the data for transmittance minima. The results of that research were SRM 2009, 2010, 2013, and 2014. The same techniques were applied in 1983. Also, the results from 1983 and 1976 for one of the Major filters are compared.

601.476
PB87-118329
Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Scanning Tunneling Microscopy Applied to Optical Surfaces.
Final rep.
Pub. in Optics Letter 11, n9 p560-562 Sep 86.
Keywords: "Optical measurement, "Surface rough-
ness, "Gratings(Spectra), "Reflectron, "Scanning tunneling microscopy, Diamond turning.

The technique of scanning tunnel microscopy has been applied to topographic mapping of two optical surfaces: a ruled grating replica and a diamond-turned glass master. The authors described the use of the scanning tunneling microscope to measure sur-
face topography of a ruled-grating replica over an area of at least 2 x 2 mm. Furthermore, they observed a surface structure on a diamond-turned gold mirror that was used for the scanning tunneling microscope to measure trans-
mission and reflectance. The data was available and were impressive. The results presented here are the first to be published and the first to be available. The results were presented at a conference in 1983. The authors concluded that the technique would be useful for the characterization of the surface texture of optical surfaces and for the determination of the surface roughness. The results presented here are the first to be published and the first to be available.
PHYSICS
Optics & Lasers

technical Commission (IEC) recommends the PSA method, but the Electronics Industries Association (EIA) takes no position in this regard. This paper gives results of an experiment which compared the three methods.

601.479
PB87-122628 Not available NTIS National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Single Mode Fiber Dispersion Measurements Using Optical Sampling with a Mode-Locked Laser Diode.

Keywords: "Laser beams, Optical dispersion, Light pulses, Fiber optics, Reprints, Mode locked lasers, Optical fibers."

Pulses from a wavelength-tunable, mode-locked laser diode were measured after 21 km of single-mode fiber propagation by optical sampling with another mode-locked, 1510 nm laser diode which is achieved in the chromatic dispersion measurement. In another related experiment, 78-psec-duration pulses from an ordinary, multimodal/single-mode laser diode are clearly displayed by optical sampling after 36 km of fiber propagation. System bandwidth increases to approximately 500 GHz as the laser-diode wavelength is temperature tuned through the zero-dispersion region.

601.480
PB87-122636 Not available NTIS National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Optical Waveform Measurement by Optical Sampling with a Mode-Locked Laser Diode.

Keywords: "Laser beams, Waveforms, Optical measurement, Reprints. Aluminum gallium arsenide lasers, Gallium indium arsenide phosphide lasers, Optical fibers, Lithium iodates, Mode locked lasers."

Optical pulses from a GaAs/AIAs laser diode directly modulated at a frequency f0 = 971 MHz are mixed in a LiIO3 crystal with optical sampling pulses at a frequency of 10 Hz from a mode-locked GaAs/AlAs laser diode. The optical signal obtained by sum-frequency mixing in the crystal is observed with a photomultiplier and an oscilloscope. The original pulse waveform is reproduced clearly with a temporal resolution equal to the mode-locked laser-diode pulse width and at a repetition frequency of 10 Hz. Similar results are obtained with InGaAsP laser diodes at a wavelength of 1.3 micrometers.

601.481
PB87-122644 Not available NTIS National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Final rept., E. G. Johnson. 1986, 9p. Sponsored by Department of Defense Calibration Coordination Group, Redstone Arsenal, AL. Pub. in Applied Optics 25, n7 p2876-2875, 1 Sep 86.

Keywords: "Laser beams, Electric fields, Light pulses, Fiber optics, Reprints, Optical fibers."

An electric-field measuring apparatus was made by using optical processing, tapered optical fibers, and a pair of detectors at the end of each optical fiber. Using an appropriate computer-generated hologram (CGH), the author shows it is possible to discriminate among a set of orthonormal modes used to represent the spatial structure of the electric field with a SNR of at least 100 to 1. The tapered fiber is a mode filter which is used in the transform plane of the CGH. The fiber allows precise determination of the structure of each of the orthonormal modes being used as the spatial basis of the electric field before the optical processing.

601.482
PB87-122677 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Linearity Study of a Diode-Array Radiometer.

Keywords: "Radiometers, Arrays, Photodiodes, Linearity, Silicon, Detectors, Spectro-radiometers, Reprints."

No abstract available.

601.483
PB87-122685 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Comparison of the NBS SURF (National Bureau of Standards Synchrotron Ultraviolet Radiation Facility) and Tungsten Ultraviolet Irradiance Standards.

Keywords: "Irradiance, Standards, Near ultraviolet radiation, Comparison, Reprints, Synchrotron Ultraviolet Radiation Facility."

Detailed comparisons of the spectral irradiance of the NBS Synchrotron Ultraviolet Radiation Facility II and tungsten FEL Scale of Spectral Irradiance at 297 and 254 nm with an uncertainty of about 1% show that the irradiance levels are consistent with both wavelengths to within the uncertainties assigned to them by NBS.

601.484
PB87-125738 PC A04/ MF A01 National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Keywords: "Electromagnetics, Metrology, "Fiber optics, Lasers, Optical communication, Superconductors, Standards, Cryoelectric, National Bureau of Standards."

The Electromagnetic Technology Division was formed during the reorganization of NBS in April 1978 by combining parts of the former Electromagnetics and Cryo- genics Divisions. It develops measurement methods and standards and provides metrological support for laser systems; optical communication equipment, cryoelectronics; superconductors; and other unusual electrical engineering materials.

601.485
PB87-128034 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Optical Frequency Measurements.

Keywords: "Frequency measurement, Dimensional measurement, Length, Standards, Reprints, Laser radiation, Light speed."

The paper is a review of the history of the measurement of light frequency with a reference to optical frequencies, including lasers. It is a review of laser frequency measurement. The development of frequency measurement from the Co frequency standard to the visible is tracked. Two related aspects of optical frequency measurements, the speed of light and the redefinition of the meter, are also discussed.

601.486
PB87-128112 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Angular Momentum of Trapped Atomic Particles.

Keywords: "Angular momentum, Radiation pressure, Reprints, "Ion traps, "Atom traps, Ion storage, Laser spectroscopy, Laser cooling."

In axially symmetric atomic-trap particles, the angular momentum of the particles about the symmetry axis is conserved in the absence of external torques. Changes in this angular momentum owing to laser scattering are discussed.

601.487
PB87-128997 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Intercomparison between Independent Irradiance Scales Based on Silicon Photodiode Physics, Gold, and Blackbody Radiation, and Synchrotron Radiation.

Keywords: "Irradiance, Synchrotron radiation, Photodiodes, Reprints, Intercomparison."

An intercomparison has been conducted among three independent scales of spectral irradiance: two source-based and one detector-based. Specifically, a radnometer composed of a silicon photodiode, an interference filter, and an integrating sphere was characterized and calibrated against an absolute silicon detector standard at 600 nm using a cw dye laser. The radnometer was then used to measure the spectral irradiance at 600 nm from spectral irradiance lamps, calibrated against a gold-point blackbody, and the spectral irradiance at the same wavelength from the NBS electron storage ring, SURF II. Intercomparisons of this type are an important check of the agreement between these independent radiometric techniques. It was found that the detector scale indicated a spectral irradiance at 600 nm that was 0.76% lower than predicted by the gold-point blackbody scale and 0.25% higher than predicted by the electron storage ring scale. This result implies agreement within the overall quadrature uncertainties of plus or minus 0.25% for the detector scale and plus or minus 0.6% for the electron storage ring scale.

601.488
PB87-132294 PC A08/ MF A01 National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
See also PB85-114700. Also available from Supt. of Docs as SN003-003-02772-3. Library of Congress catalog no. 86-605636. Prepared in cooperation with Institute of Electrical and Electronic Engineers, Inc., New York, and Optical Society of America, Washington, DC.

Keywords: "Fiber optics, Meetings, Optical measurement, Dimensional measurements, Diameter, Electro-optics, Optical communication, "Fiber optics, Multimode."


601.489
PB87-134193 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Excited-State Stability and X-ray Lasers.

Keywords: "Stability, Reprints, X ray lasers, Multi-photon processes."

Based on the results of recent studies of microwave ionization of Rydberg states, estimates are obtained for the stability of excited states of highly charged ions under irradiation from a powerful excimer laser. The short lifetimes and associated line broadening suggest
Plasma Physics

641.492
DE85007605
PC A04/MAF A01
National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.
Survey of Experimental and Theoretical Electron-Impact Ionization Cross Sections for Transition Metal Ions in Liquid Gases of Ionization.
Contract AC05-84OR21400

601.492
PB86-192424
Not available NTIS

601.409
PB87-134920
Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Time and Frequency
Pressure Effects on the Frequency of Continuous-Wave Optically Pumped Far-Infrared Lasers.
Final rept.
M. Inguscio, and K. M. Evenson. 1984, 2p.
Keywords: *Infrared lasers, Far infrared lasers, Frequencies, Reprints, Pressure dependence.

601.491
PB87-136644
PC A19/MAF A01
National Bureau of Standards, Gaithersburg, MD.

The Symposium was divided into sessions concerning Materials and Measurements, Mirrors and Surfaces, Thin Films, and Fundamental Mechanisms. As in previous years, the emphasis of the papers presented at the Symposium was directed toward new frontiers and new developments. Particular emphasis was given to materials for high-power apparatus. The wavelength range of prime interest was from 0.064 micrometers to the uv region. Highlights included surface characterization, thin film properties, and measurements in fundamental laser-matter threshold interactions and damage mechanisms.

601.495
PB86-195591
Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Time and Frequency
Final rept.
Keywords: Computerized simulation, Line spectra, Reprints, *Hydrogen plasma, Lyman lines.
A computerized simulation technique is used to calculate hydrogen spectral lines emitted by a plasma. These calculations are used to study ion dynamic effects and line profile effects. Results are obtained for Lyman alpha, Lyman beta and Lyman gamma lines, and comparisons are made with experimental results and with other theoretical methods.

601.496
PB87-130530
Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
Atomic and Plasma Radiation Div.
Shifts of Ion Lines in Plasmas.
Final rept.
Keywords: *Plasma(Physics), Polarization, Reprints, Shift.
A review of the experimental and theoretical aspects of the topic is presented. The authors begin with a brief summary of the subject's history. An overview of the current experimental situation for hydrogenic and isoelectronic ions is presented in the discussion of a recent formal theoretical approach to the problem. An important conclusion of the theory is that the 'plasma polarization effect' does not exist in the following sense: If one properly includes the effects of ion fields and of electron collisions in their nearly hyperbolic paths, then all the results for the hydrogenic case are obtained. The main difficulty in making accurate calculations of the shift is to properly account for strong collisions. A close coupling calculation procedure is used to treat some of the self-consistent equations, such as the importance of low partial waves and exchange. Current efforts being made in the direction are described.

Radiofrequency Waves

601.497
PB86-197191
PC A06/MAF A01
National Bureau of Standards (NML), Gaithersburg, MD. Center for Mgnt. Engineering.
SCAT: A Vector Program to Solve a Transient MFE (Magnetic Field Integral Equation),
E. Marx. Apr 86, 105p NBSR-86/3362
Keywords: *Computer programs, *Electromagnetic scattering, Magnetic fields, integral equations, Mie scattering, Electric dipole.
The FORTRAN program SCAT is used to solve the magnetic field integral equation (MFE) to determine the fields scattered by a perfectly conducting sphere. The incident field is a plane-wave pulse, and a stepping time integration is used to determine the surface current density induced on the sphere. The program does not take advantage of the special symmetry of the scatterer because it is intended to serve as a verified starting point for more general programs. The output is compared to that of the program PERF, which computes the same fields via a Fourier transform of the monochromatic fields obtained from the Mie formulas. The contributions of the self-term and neighboring patches to the singular integral are option- ally computed by using their expansions in the linear size of the patches. The self-term is important for the solution of other integral equations that may be of the first kind. For the MFE, these corrections are small but negligible. The program takes advantage of the vector programming features of the CYBER 205.

Solid State Physics

601.499
PB86-160728
Not available NTIS
National Bureau of Standards (NML), Boulder, CO.
Electromagnetic Technology Div.

161
Solid State Physics

Electron Tunneling into Superconducting Films Using Mechanically Adjustable Barriers.

J. Moreland, and J. W. Ekin. Jul 85, 3p

Contract DE-A10-84ER45213


Keywords: *Superconductors, *Electron tunneling, Nb- 
obium, Energy gap, Filaments, Reprints.

A new type of squeezeable tunneling (SET) junction has been developed for tunneling into superconducting films. Stable, mechanically adjustable tunneling barriers, were between the native surfaces of sputtered Nb films and 30-micrometers-diam Nb films were established in liquid helium at 4 K. The current versus voltage characteristics of this SET junction were used to determine the superconducting energy gap at the surface of the films. Since the filaments were etched from commercial superconducting magnet wire, the type of tunnel junction shows promise as a diagnostic probe of superconducting materials for high-field magnets.

601,500

PB86-162120 Not available NTIS National Bureau of Standards (NBS), Boulder, CO. Electromagnetic Technology Div.


J. Moreland, and J. W. Ekin. Nov 85, 6p

Contract DE-A10-84B45213

Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy, and National Research Coun-

cil, Washington, DC.


Keywords: *Superconductors, *Electron tunneling, Energy gap, Reprints, Niobium In.

An Nb-Nb filament mounted on a flexible glass beam can be broken to form an electron tunneling junction between the fracture elements. Breaking the filament in liquid helium prevents oxidation of the freshly ex-
posed fracture surfaces. A sharp superconducting energy gap in the B-V characteristics measured at 4 K indicates the formation of a high-quality tunneling bar-
rier between the fracture elements. The resistance of the junction can be continuously adjusted by varying the surface bending span of the beam. An estimated 0.1 nm change in the barrier thickness produces an order of magnitude change in the resistance over the range from 100,000 to 100,000 ohms. The expo-
ential character of the dependence shows that the tunnel junction is freely adjustable without intimate contact of the junction elements. *Break junctions* made in this way offer a new class of tunneling experi-
ments with layered or exposed surfaces of a fractured sample without the oxide barrier previously required for junction stability. Such experiments provide a simple technique to measure the positions and shapes of the fracture elements and to elucidate complications that can be encountered during interpretation of data obtained using oxide bar-
riers.

601,501


Precision and Accuracy in Structure Refinement by the Rietveld Method.

E. Prince. 1985, 9p


Keywords: *Crystal structure, Standard deviation, Least squares method, Precision, Accuracy, Bias, Re-

Whenever the values of a set of experimental observa-
tions can be predicted by a model containing adjusta-
bility parameters, the values of those parameters can be estimated by the method of least squares. Statistical methods may be used to test whether the fitted model is consistent with the data and, on the assumption that the model is the correct one, to estimate the standard deviations of the parameters. Standard deviations, however, are measures of precision rather than of ac-
curacy. Various workers have attempted to assess the accuracy of the method, by defining a number greater

than one by which the standard deviations may be multi-
plied, or by using alternative procedures, such as the weighted least squares method. None of these ap-
tehms are hampered by the absence in the data, of any information about the distributions of systematic and random errors, and other sources of bias, and the parameters being estimated.

601,502

PB86-164530 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Radiation Physics Div.


Pub. in Jnl. of Microscopy 139, p2 pR1-R2 Aug 85.

Keywords: Ferromagnetism, Microstructure, Reprints, "Electron spin polarization, Scanning electron micro-
copy, Imaging techniques, Magnetism.

In recent measurements it was shown that the low energy secondary electrons generated when an elec-
tron beam is incident on a ferromagnetic material are spin-polarized, reflecting the net spin density of the val-
ence electrons of the ferromagnet. (Ungurs, et al. 1982). Additionally, it was predicted that the electron spin polarization should provide an efficient contrast mechanism for imaging ferromagnets with a resolution higher than that achieved by conventional imaging with a 100 keV Mott spin analyzer that used polarization analysis, which is independent of the topographical contrast. This prediction was first tested by Kolke and Hayakawa (1984), who used a scanning 10 micrometer diameter electron beam in conjunction with a 100 keV Mott spin analyzer to show that the polarization contrast was large and could be obtained independently of the topographical contrast.

601,503

PB86-165337 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Semiconductor Materials and Processes Div.

Raman Spectrum of Carbon in Silicon.

N. S. Miller, R. A. Forman, I. M. Bell, D. R. Myers, and D. Wood.


Keywords: *Silicon, *Carbon, *Raman spectra, Impuri-
ties, Infra-red spectra, Reprints, Semiconductors.

Raman spectroscopy is used to characterize carbon-
doped silicon samples prepared by ion implantation and annealing in different environments. The problem in the Raman spectra due to the (12) 2 local mode at 504 + 1 cm and the (13) 2 mode at 586 + 1 cm. Identical spectra are obtained from given carbon doped samples using a slow pulsed ruby laser or the significantly longer pulse of an RG6 dye laser. It is shown that Raman spectroscopy has sufficient sensitivity to detect strained carbon distri-
butions in an overgrown commercial silicon. Finally, at high carbon density, where the local modes begin to broad-
en in the implanted and laser-annealed samples, a dis-
order-induced, first-order Raman spectrum is observed produced by the mass defect of the substitutional carbon.

601,504

PB86-165451 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Surface Science Div.

Magnetoplasmaw Excitations from Partially Filled Landau Levels in Two Dimensions.


Keywords: Electron gas, Magnetic fields, Excitation, Reactions, Magnetoplasmaw, Heterostructures, Quantum Hall effect.

For a noninteracting two-dimensional electron gas in a strong perpendicular magnetic field, the excitation en-
ergies are multiples of (h/2e)(omega sub c). These excitations are shifted in an interacting system. Because of the singular nature of the noninter-
acting-system energy spectrum it has previously been

possible to evaluate the excitation energies of the interac-
ting system only when all Landau levels are either completely empty or completely full. In this article they suggest a nonperturbative approach which overcomes this difficulty but recovers existing results in the appropriate limits.

601,505

PB86-165865 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Semiconductor Devices and Circuits Div.

Monte Carlo Calculation of One- and Two-Dimensional Particle Diffusion and Damage Distributions for Ion-Implanted Dopants in Silicon.

J. Aiken. Oct 85, 10p

Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.

Pub. in IEEE (Institute of Electrical and Electronic Engi-


Keywords: *Silicon, *Crystal defects, *Radiation damage, Semiconductor doping, Vacancies(Crystal defects), Interstitials, Monte Carlo method, Reprints, on implantation, Physical radiation effects.

The two-dimensional distributions of particles, primary damage, and electronic and nuclear energy loss were calculated for implantation of a line source into silicon targets using the TRIM Monte Carlo code. In addi-
tion, the Kinchin-Pease equation was used to calculate approximate two-dimensional distributions of the Fren-
kel pairs and vacancy-impurity (stitial) created by the primary displacement damage of the target atoms. These dis-
tributions allowed for the calculation of the one-dimen-
sional distributions of these quantities for implantation into unmasked targets. The two-dimensional particle and approximate Frenkel pair distributions for implan-
tation into a mask were constructed by means of superposition. The results are important for under-
standing the mass, energy, and dose dependence of implantation and the associated displacement damage.

601,506

PB86-166061 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Radiometric Physics Div.

Near Ultraviolet Quantum Yield of Silicon.

J. Aiken. Dec 85, 8p

S. P. G. Wilkinson, A. D. Farmer, and J. Geist.


Keywords: *Silicon, *Quantum efficiency, *Photodiodes, Near ultraviolet radiation, Reprints, Band theory.

New values for the quantum yield of silicon in the 3 to 5 eV ultraviolet region are derived from reflectance and photo-response measurements on oxide/p+/n+/n+ photodiode structures. The new values fall between higher and lower state is analogous to superfluidity with the collective excitations being phonons, magnet-rotons, and fractionally charged vortices.
Magnetic-Roton Theory of Collective Excitations in the Fractional Quantum Hall Effect. 

The authors present a theory of the collective excitation spectrum in the fractional quantum Hall effect, which is closely analogous to Feynman's theory of superfluid helium. The predicted spectrum has a large gap at k = 0 and a deep magneto-roton minimum at finite wave vector, in excellent quantitative agreement with recent numerical calculations. They demonstrate that the magneto-roton minimum is a precursor to the gap collapse associated with the Wigner crystal instability occurring near nu = 1/7. In addition to providing a simple physical picture of the collective excitation modes, the theory allows one to compute rather easily and accurately the experimentally relevant quantities such as the susceptibility and the ac conductivity.

Keywords: Roton theory, Superfluidity, Reprints, Fractional Quantum Hall effect, Roton states.
Neutron Rietveld Analysis of Structural Changes in NASICON Solutions (N+1-x)Zr2Si2P3-xO12 at Elevated Temperatures: X = 0.8, and 2.0 at 300 deg C Final rept.
J. J. Didisheim, E. Prince, and B. J. Wiesensch. 1986, 35p
Gold TE-A003-76SF00098 Sponsored by Department of Energy, Washington, DC.

Keywords: "Crystal structure, Solid solutions, Sodium ion conductors, NASICON compounds, Reprints, Rietveld method, Phosphates.

601.519 PB96-192507 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Radiation Physics Div.
Chemisorption-induced Changes In Surface Magnetism and Electronic Structure: Oxygen on Ni(110). Final rept.
A. Seiler, C. S. Feigerle, J. L. Pena, R. J. Celotta, and D. T. Pierce. 1985, 35p
Sponsored by Office of Naval Research, Arlington, VA., National Science Foundation, Washington, DC, and Consejo Nacional de Ciencia y Tecnologia, Mexico City.

Keywords: "Surfaces, Nickel, Chemisorption, Oxygen, Ferromagnetic materials, Reprints, "Magnetism, "Electronic structure, Band theory, Electron spin polarization, Photoemission.

The effect of oxygen chemisorption on the Ni minority-spin 3d holes and the Ni magnetic moment is measured by spin-polarized inverse photoemission. A dramatic reduction of the minority-spin 3d holes is observed, indicating a strong involvement of these states in the chemisorption bond. This reduction can be explained by a Ni3d-3p2p interaction which reduces the density of states; no indication of a reduced exchange splitting is found. Majority-spin states are shown to be unchanged at coverages below the onset of nucleation and oxide formation.

601.520 PB96-193208 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Radiation Physics Div.
Spin Polarized Inverse Photoemission Studies of Surface Magnetism and Electronic Structure. Final rept.
Sponsored by Office of Naval Research, Arlington, VA., and National Science Foundation, Washington, DC.

Keywords: "Surfaces, Chemisorption, Nickel, Reprints, "Magnetism, "Electronic structure, Photoelectron spectroscopy, Band theory.

Spin polarized inverse photoelectron spectroscopy (SPIPES) is shown to be a powerful new technique to study surface and near-surface electronic structure and magnetism. The proposal information obtained, and the apparatus required in a spin polarized inverse photoemission measurement are compared to the corresponding spin polarized photoemission measurement. Other SPIPES studies, such as the temperature dependent behavior of empty bands in ferromagnetic Fe, and future directions and applications of SPIPES are reviewed.

Neutron Rietveld Analysis of Structural Changes in NASICON Solid Solutions Na(N+1-x)Zr2Si2P3-xO12 at Elevated Temperatures: X = 0.8, and 2.0 at 300 deg C Final rept.
J. J. Didisheim, E. Prince, and B. J. Wiesensch. 1986, 35p
Grant DE-AC03-76SF00098 Sponsored by Department of Energy, Washington, DC.

Keywords: "Crystal structure, Solid solutions, Sodium ion conductors, NASICON compounds, Reprints, Rietveld method, Phosphates.

601.522 PB96-197357 Not available NTIS National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Reliability of the Isothermal Bulk Modulus Depicted from Model Equations of State. Final rept.
R. G. Munro, S. Block, and G. J. Pimmarini. Oct 84, 3p
Pub. in Jnl of Applied Physics 56, n7 p2174-2176, 1 Oct 84.

Keywords: "Bulk modulus, Equations of state, Compressibility, Reprints, High pressure.

The evaluation of bulk material properties by the technique of fitting model isothermal equations of state to experimental data is discussed. Specifically, the evaluation of the isothermal bulk modulus is considered in terms of eight model equations. A sometimes serious difficulty in the application of model equations is identified, and the relationship between the error in deduced value of the bulk modulus and the error in the measured lattice parameter or the pressure is investigated. It is found that certain of the eight equations should be avoided, and limits on the reliable application of the remaining equations are identified. Implications for the acquisition of data are discussed.

601.523 PB96-199080 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Research Associate Division.
D. P. Penn, S. P. Apell, and S. M. Girvin. 15 Dec 85, 16p

Keywords: "Transition metals, Iron, Nickel, Polarization(Spin alignment), Glass, Reprints, "Electron spin polarization, Secondary electrons.

A theory of the spin polarization of the secondary electrons in transition metals and glasses is presented. In contrast to the secondary-electron intensity distribution, the spin polarization is shown to yield useful information about the electronic band structure. The ratio of the lifetimes of majority- to minority-spin electrons can be determined directly from the measured values of the spin polarization. The theory is applied to both Fe and Ni.

601.524 PB96-220000 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Radiation Physics Div.
D. A. Penn, S. P. Apell, and S. M. Girvin. 29 Jul 85, 40p

Keywords: "Transition metals, Polarization(Spin alignment), Reprints, "Electron spin polarization, Secondary electrons, Magnetism.

It is shown that in contrast to the secondary-electron intensity distribution, the spin polarization, $P(E)$, yields useful information about the electron-electron interaction. The ratio of lifetimes of majority- to minority-spin electrons can be determined directly from the measured values of $P(E)$.

601.525 PB96-220045 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
D. P. Penn, S. P. Apell, and S. M. Girvin. 1986, 35p

Keywords: Polarization(Spin alignment), Reprints, "Electron spin polarization, Secondary electrons, Magnetism.

It is shown that the spin polarization of the secondary electrons, $P(E)$, yields useful information about the electron-electron interaction. The ratio of majority- to minority-spin lifetimes is related to the measured values of $P(E)$.

601.526 PB96-201803 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Secondary Materials and Processes Division.
K. P. Pande, and A. C. Seabach. 1983, 9p

Keywords: Galium arsenides, Semiconductors(Materials), Deposition, Epitaxy, Substrates, Plasma(Physics), Chemical vapor deposition, Reactants.

Low-temperature (<450 C) deposition of single crystal GaAs using a new plasma-enhanced MO-CVD technique is described. In the technique, plasma is created by a dc potential and the substrate is not directly exposed to the plasma. Deposition of GaAs was achieved at extremely low plasma power (<5 W) using trimethylgallium (TMGa) and arsine (or trimethylarsenic) reactants. The resulting epitaxial films show excellent surface morphology and thickness uniformity over a large area substrate. A linear dependence of growth rate upon TMGa concentration was observed with a growth rate of 0.1 micrometer per minute for a TMGa flow rate of 15 cc min -1 per minute. Undoped films were found to be n-type with a room temperature carrier concentration of 2x10 20 cm -3. Measurements on Schottky barrier devices fabricated on n- (+) layers show uniform impurity doping profile and 55-s reverse breakdown voltage. Temperature dependence of the capacitance indicates a deep trapping centers as low as 6 x 10 4 to 13th power/cu cm. Data on photoreponse of these devices are also presented.

601.527 PB96-203090 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Temperature and Pressure Measurements and Standards Div.
Experimental Constraints on the Parameters Describing Unordered bcc 3He. Final rept.
C. T. Van DeGrift. 1983, 16p

Keywords: Helium 3, Spin lattice relaxation, Body centered cubic lattices, Solidified gases, Nuclear magnetic resonance, Specific heat, Elastic properties, Magnetostriction, "Solid helium, Magnetism.

A wide variety of experimental results on the unordered phase of bcc (3) He are reviewed in light of recent high precision magnetostriction measurements made at NBS. Specific formulas are given for the...
volume dependence of the elastic constants, Debye temperature, exchange parameters J(1) and K(1), and the Zeeman-exchange spectral density function. Some topics for further research are identified.

**601,529**
PB86-202036B: Not available NTIS National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.

**Effect of Applied Fields on the Magnetic Order of Amorphous Tb(x)Fe(1-x) Alloys.**

Final rept.

M. L. Spamo, and J. J. Ryne, 1986, 3p


Keywords: Rare earth alloys, Neutron scattering, Magnetic fields, Reprints, *Iron terbium,* Magnetic ordering, Small angle scattering, Amorphous materials, Magnetism.

The effect of applied magnetic fields on the scattering cross section and spin correlation length $\xi$ in the amorphous alloys Tb5(Fe25) and Tb2(Fe) has been studied using small angle neutron scattering. In Tb5(Fe25), which shows effects of strong local random anisotropy, the correlation length $\xi (T/10)$ approx 0.3 and $\xi (T/0.7)$ is relatively independent of field up to the maximum 16 kOe used. In contrast, Tb2(Fe) showed a sharp reduction in $\xi (T)$ and a simultaneous abrupt drop in overall scattering intensity reflecting the formation of a near-infinite percolating cluster.

Keywords: Neutron scattering, Cyrogenics, Single crystals, Magnons, Reprints, *Iron terbium,* Nickel intermetallics, Terbium intermetallics, Small waves, Crystal field

Spin waves and single-ion type magnetic excitations have been studied by inelastic neutron scattering at 4 K in a single crystal of Tb5(Fe25) and Tb2(Fe) and been studied using small angle neutron scattering. In Tb5(Fe25), which shows effects of strong local random anisotropy, the correlation length $\xi (T/10)$ approx 0.3 and $\xi (T/0.7)$ is relatively independent of field up to the maximum 16 kOe used. In contrast, Tb2(Fe) showed a sharp reduction in $\xi (T)$ and a simultaneous abrupt drop in overall scattering intensity reflecting the formation of a near-infinite percolating cluster.

Keywords: X-ray diffraction, *Crystal structure,* Least squares method, Lattice parameters, Reprints, *Powder patterns.*

Patterns useful for identification are obtained by automated scanning techniques. Results from the experimental work are refined by least-squares methods; reflections are assigned hkl indices once the relative intensities are refined. Calculated densities, literature references, and other relevant data are included.

**601,532**

Final rept.


Keywords: Polarization,Spin alignment, Electron beams, Microstruct, Scanning electron microscopy, Magnetic single-ion, Magnetism, Electron spin polarization, Scanning electron microscopy, Secondary electrons.

A field emission scanning electron microscope was fitted with an electron spin polarization analyzer in order to image submicron magnetic microstructures. Spin polarization analysis of the emitted secondary electrons provides a direct measurement of the magnitude and direction of the magnetization in the area probed by the incident electron beam. The polarization measurement, independent of topographic contrast which is measured simultaneously. The polarization was measured using a new type of analyzer which is very simple, compact, and at least as efficient as a Mott detector. The small detector size allowed the use of multiple orthogonal detectors so that all three components of the magnetization vector could be measured. The apparatus was used to examine the domain structure of a in-Fe-3% Si Crystals.

Keywords: X-ray diffraction, *Crystal structure,* Least squares method, Lattice parameters, Reprints, *Powder patterns.*

Patterns useful for identification are obtained by automated scanning techniques. Results from the experimental work are refined by least-squares methods; reflections are assigned hkl indices once the relative intensities are refined. Calculated densities, literature references, and other relevant data are included.
Solid State Physics


Keywords: Mathematical models, Charge carriers, Angles(Geometry), Algorithms, Reprints, Semiconductor devices, Spreading resistance, Bevels.

The semiconductor equations are used to obtain the carrier profile along a beveled surface. The spreading resistance is calculated on a scale much finer than the present experimental resolution of the technique. Spreading resistance algorithms are used on data plots at the present experimental resolution. The difference between atomic and carrier densities along the bevel and the errors inherent in finite-order algorithms are investigated. This is meant to provide insight into limitations of spreading resistance due to these sources.


Keywords: Mathematical models, Charge carriers, Angles(Geometry), Algorithms, Reprints, Semiconductor devices, Spreading resistance, Bevels.

The semiconductor equations are used to obtain the carrier profile along a beveled surface. The spreading resistance is calculated on a scale much finer than the present experimental resolution of the technique. Spreading resistance algorithms are used on data plots at the present experimental resolution. The difference between atomic and carrier densities along the bevel and the errors inherent in finite-order algorithms are investigated. This is meant to provide insight into limitations of spreading resistance due to these sources.


Keywords: X-ray absorption, Reprints, Quasicrystalline materials, Alloys(Geometry), Alloys, Amorphous materials, Aluminum intermetallics, Manganese intermetallics. Extended x-ray absorption fine-structure measurements have been performed on Mn K edge of quasicrystalline and crystalline forms of an AlMn alloy. Two different quasicrystalline Mn sites were discerned to be populated in the ratio of 50:50. The mean metal distribution experimental value is on the order of 0.5. Crystal chemistry and the distribution of Mn sites are observed by X-ray absorption fine-structure measurements with a resolution of about 0.5-monolayer CO coverage and attributed to a reduction in the Ni-atom magnetic moments. Transitions into the CO (p star) band are also observed with an intensity that increases nearly linearly with coverage. No spin polarization from the Ni substrate to the CO (p star) band is found.


Keywords: Surfaces, Free energy, Optimization, Reprints, Crystal surfaces, Flat surfaces. A conjecture about the equilibrated shapes of faceted surfaces, which J. W. Cahn and others have believed to be incorrect, is disproved by a counterexample.


Keywords: Dielectric properties, Reprints, Semiconductor devices, Penn model. A simple model for a semiconductor is proposed. The model is isotropic and the electrons occupy a sphere in a momentum space and are surrounded by an isotropic energy gap. The wave-number dependent dielectric function is calculated.


Keywords: Ferromagnetic materials, Oxygenics, Reprints, "Aluminum nickel, Ferromagnetic resonance, Nickel intermetallics, Aluminum intermetallics.

Ferromagnetic resonance at microwave frequencies of 9.55 and 23.9 GHz has been measured in the archetypal weak itinerant ferromagnet Ni3Al at the temperature 11.4 K. The 2p bands in the band structure of Ni3Al exhibited a strong Dynsonian asymmetry and were well described over the whole temperature range by Maxwell's equation that included a contact contribution, and by a small angle of transition between the rigid-band (L-L) equation of motion including either Gilbert or LL damping terms.


Keywords: Gallium arsenides, Crystall defects, Czechoslovakia, Crystal growth, X-ray topography, Defects.

The design of a low-cost, high-throughput x-ray topography system is described, and its use in the examination of commercial GaAs wafers is demonstrated. Double-crystal reflection (Bragg) topographs are obtained in two minutes and transmission (Laue) topographs in fifteen minutes, using copper (Ka) radiation from a conventional x-ray system. Reflection topographs of typical GaAs wafers using selected diffusing planes are presented, and their relative sensitivity to various defects is discussed. In crystals grown by the liquid encapsulated CZochralski method, transmission topographs using the (220) planes display the well-known large-scale distortion patterns produced by relaxation of thermoelastic stress.


Keywords: Samarium, Vapor plating, Tungsten, Reprints, Epitaxial growth, Low energy electron diffraction.

Samarium epitaxial crystalline layers have been grown by vapor deposition on either tungsten field-electron emitters or a single macro-crystal, (011)-oriented tungsten low-energy-electron diffraction specimen. Optimum growth occurred for substrate temperatures in the range 450-570 K. The epitaxial relationship most commonly observed was (0001)Sm // (011)W with (11-20)Sm // (001)W. The surface lattice constant of Sm(0001) appears to be a few percent larger than the bulk value.

601,548 PB87-107864 PC A05/1F A01 National Bureau of Standards, Gaithersburg, MD. Journal of Research of the National Bureau of Standards, Volume 91, Number 4, July-August 1986. Aug 86, 84p See also PB87-109782 through PB87-109864, and PB87-109861. Also available from: Dupes of NBS as SN703-027-00011-3.

Keywords: Research, Ophthalmology, Calibrating, Electron tunneling, Measurement, Radiation doses, Electron dosimetry.
Contents: Calibration of Beta-Particle Ophthalamic Applicators at the National Bureau of Standards; Room Temperature Gold-Vacuum-Gold Tunneling Experiments; Conference on Precision Electromagnetic Measurements.


An experiment has been completed which demonstrated quantum mechanical tunneling of electrons between two gold electrodes separated in vacuum. The tunneling current between the gold electrodes has been measured, for fixed voltages of 0.1 and 0.91 volts, as the electrode spacing was varied from a distance of approximately 2.0 nm to a point where the electrodes touched. Current changes of over five orders of magnitude were found for electrode spacing changes of approximately 1.2 nm. For the first time, these data enable one to deduce the work function of the electrodes in a tunneling experiment and, to the experimental parameters independent of the tunneling device. Also obtained were current-voltage characteristics for the electrode spacings in the direct tunneling region where electrode spacings were less than 2.0 nm.


The recent developments in the thermodynamics of stressed solids with mobile components and defects are reviewed. Stress affects solubility and phase equilibria. The strain energy in the composition field is equivalent to an additional elastic compliance and many problems of the equilibrium redistribution of mobile defects in a single field can be formulated as a purely elastic problem using what we call open-system elastic coefficients. The stress fields generated by an anisotropic homogeneous composition field are an implicit part of the formulation. Diffusion in either an applied or self-generated stress field is considered. The concept of open-system elastic coefficients is presented. It greatly simplifies the equations of the thermodynamics of stressed solids. It is used to study the interactions of dislocations and composition in isostropic and cubic crystals. The vacancies equilibrium is reviewed, in the interior and near the surfaces of a solid. The effects of these thermodynamics results on the diffusion equations and on their boundary conditions are examined. Problems connected with diffusional creep are discussed.

601.551 PB87-119756 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Standard X-Ray Diffraction Powder Patterns from the JCPDS Research Associateship. Final rep., H. F. McMurdie, M. C. Morris, E. H. Evans, B. Parezkiewicz. 1985, 14p. Sponsored by JCPDS-International Centre for Diffraction Data, Swarthmore, PA. Pub. in JCPDS Diffraction Data, n2 p64-77 Jun 86. Keywords: *Crystal structure, X-ray diffraction, Standards, Reprints, Powder patterns. Standard X-ray powder diffraction patterns are presented for 20 substances. These patterns, useful for identification, were obtained by automated diffractometer methods. The lattice constants from the experimental work were refined by least-squares methods, and reflections were assigned hkl indices consistent with the indexing. Relative intensities, calculated densities, literature references, and other relevant data are included.


Squreable electron tunneling (SET) junctions consisting of superconducting NbTi filaments (extracted from magnet wires) and sputtered Nb thin-film counter electrodes were used to determine the energy gap at the surface of the filaments. The current versus voltage curves of junctions immersed in liquid helium at 4 K, where the energy gap was larger than the Fermi level, were measured for a series of filaments taken from the same wire. Each filament had been etched to remove a surface layer of varying thickness so that the energy gap could be determined as a function of depth into the surface of an *average* filament. It was found that some manufacturing processes yield filaments having surface layers with reduced energy gaps of 0.4 meV compared to measured internal bulk values ranging from 1.2 to 1.3 meV.

601.553 PB87-125753 PC A06/MF A01 National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Contents: Uniaxial-strain-effect characterization of high-field experimental superconductors; High-field uniaxial-strain effect characterization of candidate Nb3Sn superconductors for fusion applications; Internal tin, jelly roll, bronze testing; Construction and initial testing of a transverse-stress apparatus; Thermal contraction of several candidate sheathing and strengthening materials for superconductors; Electron tunneling into superconducting filaments using mechanically adjustable barriers; Appendix A-Effect of stainless steel reinforcement on the critical current versus strain characteristic of multilaminated Nb3Sn superconductors; Appendix B-further investigations of the solid-liquid reaction and high-field critical current density in liquid-infiltrated Nb-Sn superconductors; Appendix C-Japan trip report, December 5-14, 1984.

In the tutorial overview, thermal fluctuations in several interfaces, especially small-angle grain boundaries, are discussed. The problem is placed on large-distance fluctuations, which are important in characterizing equilibrium interfacial phases. Capillary wave fluctuations have to be crucial in fluid-fluid interfaces and in the high temperature solid-solid interfacial phase. In small-angle grain boundaries the energy cost of simply forming the surface waves in the dislocation configurations which make up the boundary is much more than that of the corresponding capillary waves in fluid-fluid or solid-solid mixtures. The introduction of dislocation loops with a different Burgers vector may be an important fluctuation in high temperature small-angle grain boundaries. Possible experimental consequences are presented.

The density of states of the valence and conduction bands of n-type GaAs has been calculated for a donor density of 10 to 15 power/cc at 300 and 20 K. Both the donor-carrier and carrier-carrier interactions have been included. Band tails appear on both bands with the same gap in the density of states. The band tails also performed for a donor density of 10 to the 15 power/cc at 300 and 20 K. These results show the formation of an impurity band at 20 K, whereas a band tail exists at 300 K.

The effects of strain on flux pinning in superconductors are discussed. Significant differences between the strain scaling law, temperature scaling law, and the flux-line-scaling model of Kramer are demonstrated. The strain scaling law is more general than current flux-pinning models, and as such, it may serve as a guide to future work on flux pinning theory. Flux-pinning measurements at fields up to 24 T have been made on a series of high-quality Nb3Sn samples with third (and fourth) element additions. The data show that the usual extrapolation procedures for determining the bulk-average upper critical field in Nb3Sn lead to significant errors when additives such as Ti, Ta, Ga, and H are present.

601.557 PB87-128355 Not available NTIS National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Commercially pure, oxygen-free copper is the material of choice for nearly all superconductor stabilization. Straining relatively pure copper at 4 K can result in significant increases in the residual resistivity and, thus, a decreased ability of the copper to stabilize the super
Solid State Physics

conductor. In the paper the authors quantify the effect of strain on the resistivity and magnetoresistivity of a number of oxygen-free copper-tungsten alloys from various sources and in various tempers. In addition, the low temperature stress-strain behavior of these materials and its dependence on temperature and data and the resulting resistivity ratio (RRR) prior to straining is discussed. An apparatus developed for testing of mechanical properties of relatively small wire samples at low temperatures is described.

601.559
PB87-134995
Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Stacking Fault Tetrahedron.
Keywords: *Crystal defects, *Stacking fault, *Tetrahedrons, Crystallography, Reprints.

601.560
PB87-135182
Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electronic Properties, Superconductivity and Stability of the Zr-Rh Alloys.
Sponsored by American Dental Association Health Foundation, Chicago, IL.

601.561
PB87-135190
Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermal Fluctuations in Low-Angle Grain Boundaries.
Keywords: *Grain boundaries, *Dislocations, Entropy, Crystallography, Reprints, Thermal fluctuations.

601.565
PB87-044144
PC A04/MF A01
Also available from Supt. of Docs as SN003-002-2.

601.566
PB86-160975
Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO.
Sponsored by Minerals Management Service, Washington, DC.

Keywords: *Fracture tests, *Toughness, Fracture Toughness: Mechanical properties, Tests, Crack propagation, Notch tests, Fracture properties, Structural steels.

Fracture toughness tests have been performed on five geometries of single-edge notched bend (SENB) specimens machined from a 25.4-mm (1.0-in.) thick plate of ABS Grade EH36 steel, a normalized carbon-manganese steel. Critical values of the J integral and the crack-tip opening displacement (CTOD) were measured as a function of temperature. Test temperatures, which ranged from -196 to 25 degrees C, covered the range between the two gamma-grain stability temperatures.

On the upper shelf, critical values of J and CTOD at the onset of stable crack growth were insensitive to specimen geometry. However, in the ductile-to-brittle transition region, where fracture occurred by unstable cleavage, fracture toughness decreased with increasing specimen thickness. The effect of each variable on fracture toughness in the transition region is attributed to changes in crack-tip geometry and constraint.
Cycle-Counting Methods for Fatigue Analysis with the Guided Wave Technique: A Fortran IV User Guide
Y. W. Cheng, and J. J. Broz. Aug 86, 52p NBSIR-86/3055
Sponsored by Minerals Management Service, Reston, VA.

Keywords: "Fatigue(Materials), Counting, FORTRAN, Computer programs, Loads(Fracture).

Rainflow and mean crossing-range methods are used in counting the stress ranges and cycles of a random load history. Each method is defined and then applied to a simple random load history example. Fortran IV computer programs were written to make analysis of long random load histories possible. The stress ranges and cycles obtained by these programs have been used for fatigue crack growth analysis under sea-wave loading.


Acoustic Reflection of Off-Axis Shear Horizontal Waves in Slightly Anisotropic Plates.
Final rept., A. V. Clark, and P. P. Delisanto. 1986, 6p Prepared in cooperation with Naval Research Lab., Washington, DC.

In Ultrasonics, p25-30 Jan 86.

Keywords: "Acoustic refraction, Anisotropic plates, Stress analysis, Anisotropy, Reprints, Acoustical birefringence.

Several techniques have recently been proposed to perform acousto-birefringence measurements, using off-axis SH-waves, in order to determine stress in slightly anisotropic materials. These techniques tacitly assume that refraction effects, due to joyful homogenous stress distributions and/or local variations in material properties are negligible. In the paper the authors investigate the conditions under which this assumption is valid.


Fracture Mechanics.
Final rept., H. I. McHenry. 1985, 6p


Keywords: Standards, Fractography, Reprints, "Fracture(Mechanics).

The article reviews some of the early ideas that have shaped fracture mechanics, some notable failures that have spurred its development, some ways it is currently used to help prevent cracks, and some work underway in ASTM Committee E-24 to extend its usefulness.

601,568 PB86-201019 Not available NTIS National Bureau of Standards, Gaithersburg, MD. Institute for Materials Science and Engineering.

Dislocation Shielding of Cracks and the Fracture Criterion.


Keywords: "Fractures(Materials), Cracks, Dislocations(Materials), Shielding, Theories, "Fracture(Mechanics).

A theory of fracture for review with application to moving cracks in two applications. The results show a brittle break-away effect at a critical stress intensity.


Fracture Mechanics Characterization of Crack Arrest and Reinitiation In Two Unconventional Specimen Geometries.

Sponsored by Office of Naval Research, Arlington, VA., and David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.

Keywords: "Crack propagation, Fracturing, Fracture properties, Steel structures, Crack arrest.

A simple elastic-plastic-fracture-mechanics-based model is used to characterize crack propagation, arrest, re-initiation, and propagation is described. This model requires much less computing resources than dynamic, elastic-plastic finite element computer analysis. And allows estimates of applied J-integral, load, and crack mouth opening displacement during initial rapid crack propagation, re-initiation and re-propagation. A comparison of this new model to other available models and to experimental results indicates that it can successfully reproduce the essential features of the behavior of specimens containing propagating cracks.


AD-P002 453/9 National and International Time and Frequency Comparisons.
D. Allan. 1983, 6p

Pub. in the Proceedings of the Annual Symposium on Frequency Control (37th), 1-3 Jun 83, Marriott Hotel, Washington, DC, A02/MF A01.

Keywords: "Frequency standards, Atomic clocks, Comparison, Time, Global positioning system, Measurement, Clocks, Accuracy, Methodology, Component Reports.

The advent of satellite time and frequency comparison technology provides an opportunity for measuring the time and frequency difference between remote clocks with greatly improved accuracies. The paper gives an overview of various remote clock comparison techniques, in particular the Global Positioning System (GPS) will be highlighted.

601,575 DE3010760 PC A02/MF A01 Argonne National Lab., I.L.


Contract W-31-109-ENG-38

Conference on the application of accelerators in research and industry, Denton, TX, USA, 8 Nov 1982, Presented only, copy does not permit paper copy reproduction.


Keywords: "Synchrotron Radiation, Ultraviolet Radiation, Monochromatic Radiation, Research Programs, Molecular Structure, Solid State Physics, Atomic Physics, ERDA/430303, ERDA/640300, ERDA/665000.

The National Bureau of Standards (NBS) Synchrotron Ultraviolet Radiation Facility (SURF) is used in conjunction with several high throughput monochromators to study the interaction of vacuum ultraviolet photons with solids and gases. Recent work has been concerned with the photon stimulated desorption of atomic and molecular ions from surfaces, with the effect of electric fields on molecular absorption and with the study of molecular photodissociation by angle resolved photoelectron spectroscopy. These research programs yield new information about molecular bonding at surfaces, molecular dynamics near ionization thresholds, and the coupling of the electronic and nuclear motion nonclassically in molecules. In addition to these programs in basic research SURF is used for the calibration of transfer standard detectors over a photon energy range 20 to 250 eV. Calibration of these transfer standards is achieved by the photon energy range 5 to 250 eV by using the now calculable spectral intensity radiated by the electrodes, which is truly known in a nearly circular orbit. (ERA citation 08:032321)

601,574 DE84004071 PC A02/MF A01 National Bureau of Standards, Washington, DC.

Description of the DLC-9/HUGO Package of Photon Interaction Data in ENDF/B-V Format.


A new photon interaction data library, DLC-9/HUGO, is described. The library was prepared by incorporating existing data from Nuclear Data Services (NDS) and from National Bureau of Standards with that from an existing data library, DLC-7HP (IPICE), which is the ENDF/B-IV photon interaction data that contains pairs and triple cross sections, photoelectric cross sections, and atomic form factors and the corresponding coherent scattering cross sections. The data set in DLC-9 (HUGO) format is provided for elements Z = 1 to 100. The data package is available from the Radiation Shielding Information Center

Experimental electron-impact ionization cross sections for thirty-seven target ions are presented, summarizing measurements made at ORNL during the period from 1980 through early 1984. Target ions range in atomic number from Z = 5 (boron) to Z = 73 (tantalum), with charge states ranging from +2 through +6 and energetics ranging from below the ionization threshold to 1500 eV in most cases. All data are presented in both tables and graphs. Maxwellian ionization rate coefficients in both range 10 to 3000 eV, and fitting parameters are given to allow the calculation of rates at intermediate electron temperatures or for inclusion in computer programs for plasma modeling. (ERA citation 10:032502)

Microtrons, Beam Bunchers, Beam Injection, Performance, ERDA/459302.

The purpose of the chopper/buncher system for the RTM injector is to chop a 100 keV beam into 60 pps using a 2300 Hz and then bunch the beam to 60 pps using a 100-kV pulse from the 5 MeV injector linac. These beam manipulations must contribute a minimum increase in the phase space of the beam such that, at the time the beam hits the injector linac, the transverse emittance is less than 5 µm-mm-rad. Phase-shift measurements on the chopped beam at the buncher/bunching fields are sufficient to achieve the required longitudinal compression. Beam envelope measurements, using wire scanners on the chopped and buncher beam, show that the emittance remains within design goals. (ERA citation 10:006079)

Microtrons, Computerized Control Systems, ERDA/430300.


Keywords: Microtrons, Computerized Control Systems, ERDA/430300.


Keywords: Microtrons, Computerized Control Systems, ERDA/430300.


Keywords: Microtrons, Computerized Control Systems, ERDA/430300.


Keywords: Microtrons, Computerized Control Systems, ERDA/430300.
through strangeness content, of the new form of nuclear matter.

501.587
PB86-163433
Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD, Radiation Div.
Plan Radiation by Hot Quark-Gluon Plasma.
Final rept., J. B. Rijkers, and M. Danos, 1983, 4p
Keywords: Quarks, Strong interactions, Antiparticles, Pions, Nuclear plasma, Quantum chromodynamics, Gluons.

The authors consider an approximately spherical region of vacuum, filled with quarks, antiquarks, and gluons. The particle densities are assumed to be reasonably well described by local thermal and chemical equilibrium distributions. The basis for these assumptions is the point that the mean free path of a color-charged particle in the plasma is of the order of 1/3 - 1/2 fm. Outside the perturbation region, colored particles cannot exist and hence any matter found there is in the form of colorless hadrons. Even through indirect evidence supports the picture of the true and perturbative QCD states, they must remember that no direct evidence is available as of now. They remark that an effort of the quark-gluon plasma state as the direct confirmation of the ideas about the nature of strong interactions and quark confinement.

501.588
PB86-163508
Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD, Radiation Div.
Development of Monoelectronic Energy Beam Sources for Radiation-Induction Calibration.
Keywords: *Electron beams, *Dosimetry, *Calibrating, Sources, Reprints, *Beta dosimetry, Electron dosimetry.

Accelerator-produced electron beams are being studied for use in obtaining the response of beta-particle dosimetry instrumentation as a function of electron energy. The NBS 4 MV Van de Graaff and 500 kV cascaded radiotherapy accelerators are being used to generate electron beams from 200 keV to 2.5 MeV. A device capable of scanning the electron beam in two dimensions over a range large enough to cover radiation survey instruments uniformly is attached to the beam-handling system of each accelerator. The scanned beam exits from vacuum through a 16 sq cm window consisting of either 25 micrometer Kapton (for energies below 500 keV) or 100 micrometer aluminum. The electron beams produced have been characterized in terms of (1) spatial distribution, (2) energy spectrum, and (3) absorbed dose to plastic. Spatial distributions were determined using film, while spectra were measured using a 5 mm-deep Si surface barrier detector. An extrapolation chamber is being used for beam standardization in terms of absorbed dose to plastic.

501.589
PB86-163516
Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD, Radiation Physics Div.
Bremsstrahlung Spectra from Electron Interactions with Screened Atomic Nuclei and Orbital Electrons.
Final rept., S. M. Saltzer, and M. J. Berger, 1985, 40p
Sponsored by Department of Energy, Washington, DC., and Office of Naval Research, Arlington, VA.
Keywords: *Photon cross sections, *Bremsstrahlung, Electron scattering, Reprints, Electron-electron collisions, Electron-atom collisions, KeV range, MeV range.

Through the synthesis of various theoretical results, a comprehensive set of bremsstrahlung cross sections (differential in the energy of the emitted photons) has been prepared. The set includes results for electrons with energies from 1 keV to 10 GeV incident on neutral atoms with atomic numbers Z = 1 to 100. The paper also contains numerous comparisons between calculated and measured bremsstrahlung spectra, which indicate generally good agreement.

501.590
PB86-175841
PC A08/MF A01
National Bureau of Standards (NML), Gaithersburg, MD, Center for Basic Standards.
Investigation of Fundamental Interactions with Cold Neutrons: Proceedings of a Workshop.
Final rept., G. Greene, Feb. 86, 167p NBS/SP-711
Keywords: *Meetings, *Neutrons, *Cold neutrons, National Cold Neutron Facility, Research reactors, Life.

The National Bureau of Standards is establishing a National Cold Neutron Facility at its 20 MW reactor located in Gaithersburg, Maryland. In order to provide guidance in the development of research plans for the Facility, the Department of Energy and NBS sponsored, on November 14-15, 1985, a workshop on the Investigation of Fundamental Interactions with Cold Neutrons. The 25 papers presented at the workshop are printed in the proceedings.

501.591
PB86-185857
Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD, Radiation Division.
Mass Independence of the Electromagnetic Nuclear Response in the Delta Region.
Keywords: *Nuclei(Nuclear physics), Electron scattering, Inelastic Electron-Photon Cross sections, Photons, Absorption, Measurement, Reprints, MeV range 100-1000, Response functions.

Recent measurements of the photon absorption and inelastic electron scattering cross sections on nuclei in the excitation region 140-450 MeV show a response that differs from that of a free nucleon but is quite similar (per nucleon) for complex nuclei.

501.592
PB86-186053
Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD, Radiation Division.
Electrometer Designs for Use in an Unbend-Quark Search.
Keywords: *Electrometers, *Quarks, Searching, Reprints.

An instrument capable of modulating a small capacitance is described. It is to be used as an electrometer in a search for stable fractionally charged particles in test masses of several grams each, the largest yet studied. The new approach uses Gauss's law to sense charge directly and does not require the measurement of the electric field in the regions of quark searches. Preliminary results from an unoptimized experiment are encouraging, showing sensitivities of a few 100 Hz (square root of Hz) at atmospheric pressures and without any special precautions.

501.593
PB86-189206
Not available NTIS
National Bureau of Standards (NML), Boulder, CO, Quantum Physics Div.
Absolute Dosimetry of Efficiencies of Microchannel Plates for 0.1-2.3 keV Electrons and 2.1-4.4 keV Mg(+) Ions.

Keywords: Electrons, Efficiency, Reprints, *Microchannel electron multipliers, KEV range 0.1-10, Magnesium ions.

The absolute detection efficiencies of detectors consisting of two microchannel plates (MCP) in a chevron arrangement, were experimentally determined for 0.1-4 keV and Mg(+) Ions. Both detectors tested included a grid with 92.5% transmission in front of the first MCP. For the measurements, the observed detector count rates were compared to the corresponding particle currents collected in a Faraday cup and measured with a vibrating reed electrometer. A linear relationship between the detector, including the grid, decreases from 0.82 at 0.1 keV to 0.65 at 2.3 keV for electrons incident normal to the surface. The Mg(+) ion detection efficiency for the same arrangement, but with 43 degree incident angle, increases from 0.49 at 2.1 keV to 0.81 at 4.4 keV.

501.594
PB86-190569
Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD, Radiation Division.
Laser Cooling of Atomic Beams.
Final rept., J. M. Phillips, 1984, 1p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Physics Today 37, n1 p26 1984.
Keywords: *Atomic beams, Motion, Reprints, *Laser cooling.

Atomic motion often limits the precision and accuracy with which measurements can be made. Recent experiments at NBS have produced laser-cooled atomic beams where the motion is greatly reduced and is well defined.

501.595
PB86-191905
PC A04/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD, Electromagnetic Systems Div.
P. M. Fulcomer, Dec 85, 54p NBSIR-86/3330
Sponsored by Department of Energy, Washington, DC.
Keywords: *Magnetic measurement, *Magnetic fields, Calibrating, Field strength, Magnetometers, Magnetic field meters.

The report describes a portable, battery-powered magnetic fieldmeter which has been developed to provide improved accuracy in the measurement and analysis of the ambient power-frequency magnetic fields. Accurate measurement of such fields is becoming increasingly important as public concern grows over the possibility that exposure to such fields may produce effects on human health. Included in the report are a description of the instrumentation, a circuit analysis, a discussion of the calibration procedure together with an uncertainty analysis, and some sample measurement results. The instrumentation enables measurement of power-frequency magnetic field in air with an overall uncertainty of less than one percent over a range from 50 nanotesla (50 microgauss) to 200 microtesla (2 gauss) and an overall uncertainty of less than two percent down to 2 nanotesla (20 microgauss). It also enables the percentage of each harmonic present in the field to be determined to an uncertainty of less than three percent.

501.596
PB86-191947
PC A05/MF A01
Bibliography of the NBS (National Bureau of Standards) Electromagnetic Fields Division Publications.
K. A. Gilson, J. M. Page, and C. K. S. Miller, Feb 86, 80p NBSIR-85/3040
Supersedes PB81-143158.
PHYSICS

General

The bibliography lists the publications of the personnel of the National Bureau of Standards Electromagnetic Fields Division in the period from January 1970 through September 1985 with selected earlier publications from the Division's predecessor organizations.

601,597

Electron Production in Proton Collisions: Total Cross Sections
Final rep.,
Grants NSF-PHY80-25599, NSF-PHY83-10644
Sponsored by National Science Foundation, Washington, DC, and Department of Energy, Washington, DC.

Keywords: Proton irradiation, Atoms, Molecules, Electrons, Production, Reprints, *Ionization cross sections.

Existing data on the ionization of neutral atoms and molecules by proton impact are reviewed, and electron production cross-section data are collected. The three major experimental methods are discussed and possible sources of error identified. Some theoretical cross-sections are discussed, and well-established methods of relating them to measured cross sections are reviewed. The data are used to weight the experimental data for each target, and these fits are adjusted to be consistent with appropriate theoretical calculations and with electron impact photoionization data. Recommended values of total cross sections for proton-impact ionization are given.

601,598
PB86-192270 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Electrodynamics Div.

Water Vapor-Enhanced Electron-Avalanche Growth in SF6 for Nonuniform Fields
Final rep.,
R. J. Van Brunt. 1986, 10p
Pub. in Jnl. of Applied Physics 59, n7 p2314-2323, 1 Apr 86

Keywords: *Sulfur hexafluoride, *Gas ionization, Water vapor, Reprints, *Electron avalanche.

When water vapor content is increased from 10 to 100 ppm in SF6 at pressures between 200 to 300 kPa, a dramatic increase in electron avalanche occurred in the presence of a positive-point electrode. Although the effect can be attributed to a change in gas composition, it is not due to a change in the ionization rate for the gas. It is proposed that the avalanche enhancement is due primarily to an increased probability for initiating shower released from minor negative ions associated with water vapor that collisionally detach more readily at a given field strength than the predominant negative ions associated with SF6.

601,599

Collimation of X-rays with Cylindrically Bent, Asymmetrically Cut Crystals
Final rep.,
R. Spal. 1984, 3p

Keywords: *X rays, *Collimators, Diffraction, Crystals, Reprints.

Sagittal and meridional collimation of x-rays from a monochromatic point source, using cylindrically bent, asymmetrically cut crystals, is studied. The optimum bending radius and the width of the angular acceptance window are derived analytically, while the degree of collimation is computed numerically.

601,600
PB86-193307 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.

Gamma-Ray Energies from the Reaction (35Cl(n,γgamma))
Final rep.,

Keywords: Neutron reactions, Gamma rays, Reprints, *Chlorine 35, *Gamma spectroscopy.

A two-axis flat-crystal spectrometer has been used to measure accurately gamma-ray energies up to 2 MeV from the reaction (35Cl(n,γgamma)). This represents a fourfold extension of the range of directly opticalized gamma-ray energies. The crystal and spectrometer have performed in a manner which demonstrates that sub-ppm measurements are possible at energies as low as 0.5 MeV. The reported transition energies (in eV) are given. The sum rule is satisfied by three of the lines within an uncertainty of about 1 ppm.

601,601
PB86-193562 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

Energy Loss Straggling of Protons in Water Vapour
Final rep.,
M. J. Berger. 1985, 4p
Sponsored by Department of Energy, Washington, DC.

Keywords: *Protons, Water, Reprints, Energy losses, MeV range 01-10, MeV range 10-100.

The paper describes a calculation of energy loss and energy deposition distributions in a 1 micrometer diameter spherical site in a water medium irradiated by 20 MeV or 2 MeV protons. The calculation is designed to indicate the effects of proton energy loss straggling and of energy transport by secondary electrons.

601,602
PB86-193596 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.

Quarks in the Nuclear Ground State
Final rep.,
M. Danos and A. Johnson. 1986, 5p

Keywords: *Nuclear structure, *Quarks, Reprints, Bag model, Structure functions.

The authors synthesise the recent deep-inelastic electron scattering data of Arnold et al in terms of a constituent quark model, and a MIT bag model. The quarks in one component are confined to the nucleons while in the other they are free to move over the nuclear volume. An admixture proportional to (A to the 1/3 power) which reaches about 9% for gold reproduces the experimental data well.

601,603
PB86-193901 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.

Direct Determination of the Stored Electron-Beam Current at the NBS (National Bureau of Standards) Electron Storage Ring, SURF-11
Final rep.,
A. R. Schafer, L. R. Hughley, and J. B. Fowler. 1984, 3p

Keywords: Electron beams, Measurement, Reprints, *Synchrotron Ultraviolet Radiation Facility, *Storage rings.

A method of determining the absolute beam current in the NBS SURF-11 electron storage ring is presented. The counting is described. Recent improvements and the present implementation of the technique are discussed, along with the results of an intercomparison with the NBS spectral irradiance scale.

601,604
PB86-193799 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

L sup 2 Discretization and Complex Coordinates in the Calculation of Bound-Free Amplitudes in the Presence of Long-Range Forces
Final rep.,

Keywords: *Potential scattering, Wave functions, Reprints, Discretization(Mathematics), Photoabsorption.

The formalism of Moller wave operators is shown to provide a simple basis for the construction of bound-free transition amplitudes for both short and long range potentials without the direct calculation of scattering wave functions. The method, which relies on the techniques of expansion in finite (L sup 2) bases and rotation of the coordinates into the complex plane, is applied to both an exponential potential and one that has a power-law dependence (as 1/r to some sup 2) and shows that one obtains not only accurate magnitudes of the matrix elements, but also the scattering phase shift as well. Some relevant theoretical results with regard to the application of wave operators are also presented. Although couched in terms of potential scattering, the procedures are readily extendible to multichannel problems.

601,605
PB86-196029 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Stereogram Presentation of Monte Carlo Electron Trajectory Simulations
Final rep.,
D. S. Bright, R. L. Myklebust, and D. Newbury. 1984, 8p
Pub. in Jnl. of Microscopy 136, p113-120 Oct 84.

Keywords: *Particle trajectories, *Electron beams, *Stereography, Monte Carlo method, Simulation, Reprints, Three dimensions.

Electron trajectory data from Monte Carlo simulation techniques is three-dimensional in nature, and thus is best represented by methods that most preserve the spatial information. Stereograms provide a method that gives the three-dimensional illusion effectively without requiring any special equipment beyond what is required to make standard two-dimensional plots. Stereograms of this type are presented and illustrate the advantages of the spatial illusion in the context of examining in detail some of the interactions of the electron beam with planar bulk metallic specimens.

601,606
PB86-197314 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Evaluation of X-ray Loss Due to Electron Backscatter
Final rep.,
R. L. Myklebust. 1984, 2p

Keywords: *X-rays, *Electron scattering, Back scattering, Monte Carlo method, Elastic scattering, Ionization, Attenuation, Microanalysis, Reprints, Electron microprobe analysis.

The loss of x-ray intensity due to backscattered electrons has been re-evaluated with the aid of a Monte Carlo simulation for electron scattering in solids. Initial electron energies in the range 4-50 keV were considered and the results are presented as the ratio, R, of x-rays generated within the solid to the total x-rays that would have been generated had none of the electrons been scattered. Polar and azimuthal fits are presented and the results compared to previous work.

601,607
PB86-199908 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.

Laser Cooling of Free Neutron Atoms in an Atomic Beam
Final rep.,
Sponsored by Office of Naval Research, Arlington, VA.

Keywords: *Atomic beams, Laser beams, Spectroscopy, *Laser cooling, Sodium atoms.
A free atomic beam of neutral sodium atoms has been decelerated using a near-resonant, counter propagating laser beam. Two methods are described which compensate for the changing Doppler shift of the atoms as they decelerated: Rapidly changing the frequency of the laser, and providing a spatially varying magnetic fields so that the resonant frequency of the atoms changes. Deceleration and dramatic compression of the velocity distribution have been observed for both methods.

**References**

PB86-19916
Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electrody.

Laser Cooling to an Atomic Beam.
Final rept.,
1983, 1p
Sponsored by Office of Naval Research, Arlington, VA.


Keywords: *Atomic beams, Frequency standards, Laser beams, Spectroscopy, *Laser cooling, Sodium atoms.

A thermal atomic sodium beam is decelerated and cooled by absorbing photons from a counter propagating laser beam. Final velocities as low as 4% of initial thermal velocities and 'temperatures' of 70 mK have been achieved.

**References**

PB86-20038
Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD, Center for Basic Standards.

Final rept.,
24 Feb 86, 4p
Sponsored by National Institute of Standards and Technology, Gaithersburg, MD.

Pub. in Physical Review Letters 56, n8 p819-822, 24 Feb 86.

Keywords: *Deuterons, *Neutrons, Gamma rays, Reagents, *Relating, *Energy levels.

A new value for the deuteron binding energy of D(0) = 2.3881788(24) x 10^-3 u is reported based on an absolute wavelength determination of the 2.2-MeV n-p capture gamma ray. Derived values of the n-p and n-p mass differences are also given. The authors also derive M(n) = 1.008 664 919(14) u. The authors note that the uncertainties in the neutron-mass data are now dominated by uncertainties arising from mass spectroscopy.

**References**

PB86-200061
Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD, Center for Applied Studies.

Steamer Initiation in Liquid Hydrocarbons.
Final rept.,
Oct 85, 6p

Keywords: *Electric discharges, *Dielecic breakdown, Hydrocarbons, Insulation, Toleum.

Using 95x magnification and a framing rate of 2 x 10 to the 7 power frames/s, the initiation of prebreakdown streamers in toleum, isocetane, and a white oil have been photographed. The initial growth from a nm a negative point electrode was a thin pencil-like structure having a growth rate of 2-3 x 10^6 cm/sec, which subsequently branched into a tree-like structure. Positive streamers were found to develop into a more filamentary structure than negative streamers. Under nominally identical conditions, a positive streamer may grow then disappear, may grow to bridge the gap, or may grow to a certain length then persist.

**References**

PB86-201753
Not available NTIS
National Bureau of Standards, Gaithersburg, MD, Metrology.

The NBS (National Bureau of Standards) Materials Science Beamlines at NSLS.
Final rept.,
1984, 4p

Keywords: *Sychrontron radiation, Monochromators, Topography, Spectroscopy, Reprints, Small angle scattering, CAMAC system.

Sychrontron radiation beamlines for topography, spectroscopy, and small angle scattering, at energies from 5 to 20 keV, are described.

**References**

PB86-201877
Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD, Mechanical Production Metrology Division.

Scattering of Transient Waves by a Dispersive Body.
Final rept.,
E. M. 1983, 4p
Sponsored by Antenna and Propagation Society (IEEE), New York.

Keywords: *Electromagnetic scattering, Electromagnetic fields, Wave equations, Transient waves.

A transient electromagnetic field interacts with a conducting body. The permittivity and conductivity of the medium generally depend on frequency, that is, the medium is dispersive. Instead of decomposing the pulse into its Fourier components, the determination of the scattered and transmitted fields can be carried out in the time domain to take advantage of marching-in-time procedures. Maxwell’s equations and the derivation of the fields from a single tangential vector field that obeys a singular integral equation are suitably modified. A simple conductor is presented as an example.

**References**

PB86-201951
PC AOS/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD, Center for Mg. Engineering.

Composite Proton,
E. Marx. Apr 86, 9p NTIS-86-3370.

Keywords: *Elementary particle theories, *Nuclear models, Strong interactions, Weak interactions, Electromagnetic interactions, Lophtons, Relativity, Strange particles, Hadrons, Quantum mechanics, Bound state, Beauty model, Charm particles, Composite models, Nuclear resonance.

A model is proposed in which the proton and other barions are particles composed of only two basic particles: an archisacchiom (archyon) and one or more pions. The first barion of pions alone. A third basic particle is the neutrino, which is a component of all leptons. The interactions between the three correponding fields and the electromagnetic field are derived from a Lagrangian density that has only two masses and three coupling constants. The interactions are expressed in terms of conserved currents, one for each particle. All particle reactions are reduced to four processes: particle scattering, antisymmetric scattering, particle creation, and particle annihilation. The last two correspond to the reflection of the wave function in the time direction. There is no longer a need for a separate theory of unstable particles. The plan is the only elec- trically charged particle, which accounts for the equality of the magnitude of all charges of elementary parti- cles. Strong and weak interactions of hadrons are differ- ent manifestations of a single interaction; the distinc- tion is related to pair creation or annihilation, energy barriers, and the flux of particles and antiparti- cles.

**References**

PB86-202239
Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Quantum-Mechanical Noise and Squeezed-State Techniques in an Interferometer.
Final rept.,
W. T. Ni, 1984, 2p
Sponsored by the Congress of the International Commission for Optics (13th), Sapporo, Japan, August 20-24, 1984, Optics in Modern Science and Technology, P48-49.

Keywords: Uncertainty principle, *Gravitational wave detectors, *Quantum mechanics, *Laser interferometers.

Several groups around the world are now developing interferometers to detect gravitational waves by measuring small relative position changes of suitably separated masses. The fundamental limitations on the sensitivity of such interferometers come from quantum-mechanical noise while the sensitivity of the present gravitational-wave detectors is mainly limited by the other noise sources. In this paper we address the problem of correlations of different sources of quantum-mechanical noise and investi- gate the use of squeezed-state technique in optimizing the power requirement.

**References**

PB86-1617
Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD, Metrology.

Siegert’s Theorem and Nuclear Electrodissintegration.
Final rept.,
W. R. Dodge, and E. Hayward. Apr 86, 7p
Sponsored by Lewis Physics Center, DE.

Pub. in Physical Review C 33, n4 p1251-1257 Apr 86.

Keywords: Electron scattering, Scattering cross section, Diffraction, Nuclear Electrodissintegration, Form factors, Virtual particles.

The connection between the electron scattering electric dipole coincidence section, (e,e)x, and the inclusive electric dipole (e,e) cross section, differential in the angle of the outgoing X particle, is derived. Unlike the (e,e)x inclusive cross section which contains contributions from only two of the four terms of the (e,e) cross section, the (e,e)x cross section contains contributions from all four terms of the (e,e)x cross section. Data from a previous experiment have been used to obtain the magnitudes and sign of the interfer- ence term between the transverse and Coulomb re- duced matrix elements (form factors) in the limit as q - > 0, from the relationship commonly referred to as Siegert’s theorem in the context of inclusive (e,e)x scattering.

**References**
A numerical technique is developed for computing the Laplace transform of the time-domain behavior of a dielectric breakdown in a frequency-domain behav-
ior. The method is based on using a cubic spline to the original data and using the spline to define the integra-
tion. Then it is investigated for dielectric, and its significance, data uniformly spaced on a logarithmic time scale. It is shown that the error is much smaller than with previous
methods, is computationally stable, and con-
verges as the fourth power of the sample density. For an error of 0.001 or less, only 10 points per decade are required for all frequencies that correspond to the time
window of the measurement. It is also shown
that it is possible to estimate those parts of the integrals that lie outside the measurement window, from the data inside the window, so that the errors from the unknown parts are kept small and affect only the extremes of the frequency range.


In addition to providing a probe of great power in con-
densed and high-energy neutron itself is the object of a considerable research effort. The study of the properties of the neutron can shed light on a variety of questions in nuclear astrophysics, and nuclear physics. A summary of the neutron properties is given, along with the methods used for their determination and their theoretical impli-
cations.


Keywords: "Electron beams, Cerenkov radiation, Air, Reprints, Beam profiles, Relativistic range."

The spatial charge distribution of an electron pulse, along with the beam interaction length, determines the Cerenkov radiation distribution as a function of fre-
quency and angle of the Cerenkov radiation can, in principle, measure its spatial charge distri-
bution. At a measurement angle of 90 degrees with respect to the beam direction, the form factor is unity, which allows a measurement of the total charge con-
tained in the pulse. At other angles, Fourier transforms of the charge distribution may be measured. Possible application to intense relativistic beams in air is dis-
cussed.


Keywords: "General relativity, Gravitational waves, Hipparcos satellite, Galileo project, Pulsars, Satellites."

A number of tests of gravitational physics using planned or proposed new space missions were dis-
cussed (these were the following: the Stanford Gyro Relativity Experiment, which would test the 'gravitational effects' predicted by general relativity; and, the first light; new calculations of small relativistic effects for accurately tracked earth satellites; light-bending observations by the HIPPAR-
COS satellite; continued low-frequency gravitational wave experiments during the Galileo and LSPM mis-
sions; and limits on very-low-frequency gravitational waves from pulsar timing measurements.


For in IEEE (Institute of Electrical and Electronics En-

Microtron. The NBS-Los Alamos 200 MeV Racetrack Microtron is being built under a program aimed at developing the technology needed for high-current intermediate-energy CW electron accelerators. The authors give an overview of the present status of the project. Recent progress is discussed.


For in IEEE (Institute of Electrical and Electronics En-

Microtron. Two end magnets have been designed and construct-
ed for the 185 MeV NBS-Los Alamos racetrack micro-
tron. The field has been measured in the first magnet and is uniform over a 0.62 sq m area to within +0 or
-0.0002 at 1 T. The magnet meets all performance specifications. Field measurements are underway on the second magnet. In this paper, design and con-
struction details which play an important role in mag-
netic performance are described, and the measured fields are compared with calculations.


Keywords: "Calorimeters, Heat measurement, Enthalpy, Specific heat, Thermodynamics, Reprints."

The field of calorimetry, and the method of mixtures, to measure relative enthalpy and heat capacity is sur-
meyed. The aim is to present for the non-specialist in the technique sufficient material concerning its areas of strength and its limitations to assist him in deciding either or not the technique is applicable to his measure-
ment problem. Following an introduction giving the basic thermodynamic theory of the calorimetric tech-
nique, specific calorimeter types are discussed. For each technique, basic operating principles, range of utility, strengths, weaknesses and special problems are cov-
ered. A comprehensive bibliography of references to applicable calorimetric instrumentation is presented together with brief commentary on salient features of the references.


Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div., Neutron Cross-Section Standards Evaluations for ENDF/B-VI.


Keywords: *Neutron cross sections, *Standards, Uranium 235, Hydrogen, Neutron reactions, R matrix, Lithium 6, Boron 10, Gold 197.

As a first step in the development of the new ENDF/B-VI file, the neutron cross section standard are being evaluated. These evaluated standards are following a different process compared with that used for earlier versions of ENDF. The primary effort is concentrated on a simultaneous evaluation using a generalized least squares program, R-matrix evaluations, and a procedure for combining the results of the evaluations. The ENDF/B-VI standard evaluation procedure is outlined, and preliminary simultaneous evaluation and R-matrix results are presented.


Keywords: *Reprints, *Strings model, *Quarkonium.

It is shown that heavy q qbar (color) systems can be described for r > (R sub c) by the square-root potential (K squared root of (r squared - (R sub c) squared)) + (V sub 0) characteristic of strings, (R sub c) approx. = 0.3 fm, a number consistent with Nambu-Goto strings.


Keywords: *Reprints, *X-ray sources, Wiggler magnet, Undulators.

For experiments using the energy region below 4 keV the LBL/EXXON insertion device on Beam Line VI-2 at the Stanford Synchrotron Radiation Laboratory (SSRL) can be used to work as a source of undulator radiation. For example, with a K of 0.94 rather than its normal value of 5.6 the fourth harmonic of the undulator coincides with the Ar K absorption edge at 3.2 keV. Because the total power is relatively low, carbon foils protecting the beryllium window can be used to reduce the background. Thus there is a net gain the flux at the edge over that obtainable in wigglers with carbon absorbers in place. In addition, the beam transmitted through the undulator is lower harmonic content and improved energy resolution.

Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards. High Energy Resolution X-ray Spectroscopy Synchrotron Radiation Beamline for the Energy Range 800-5000 eV.


Keywords: *Synchrotron radiation, X-ray spectroscopy, Monochromators, Mirrors, Reprints, *X-ray sources, NSLS, ev range 1000-10000, KeV range 01-10.

A beamline for X-ray spectroscopy of atomic and molecular gases and condensed matter has been designed and installed at the National Synchrotron Light Source. The beamline is UV compatible to allow windowless operation for improved flux at low photon energies. A double axis crystal monochromator is employed with a combination of a compound mirror and a postmirror. Pairs of beryllium, quartz, or silicon crystals define an energy band width of 0.4 ev at an arbitrary energy above 0.98 keV. The monochromator also acts as a tunnelable low-pass filter to minimize heat loading on the first monochromator crystal. At the present operating parameters of the NSLS a flux of 10 to 90 in the 13th power of the 13th power photons/s of high monochromatic X-rays can be focused onto a 1mm diameter spot. Initial experimental results are presented.


Keywords: Gravitation, Reprints, *Eotvos experiment.

Fischbach et al. (Phys. Rev. Lett. 56, 3 (1986)) present an analysis of the Eotvos, Pekar, and Fekete data from which the existence of a non-Newtonian-coupling to baryon number (i.e., hypercharge). The authors find two flaws: (a) they misinterpret or omit some of the Eotvos of data and (b) they reject the work of Janos Renner.


Keywords: Maxwell's equations, Reprints, *Radiative transfer, Wigner-function.

A derivation of the equation of transfer is obtained by working with the "slowly varying envelope" form. Particular attention is paid to characterizing the intensity that is "seen" by the atom (which is found to be related to the distribution of the electric field). The equation of transfer is found to be valid for "broadband" slowly varying radiation fields.

Not available NTIS National Bureau of Standards (NML), Boulder, CO. Ionizing Radiation Physics Div.


Keywords: *Uranium 235, *Neutron cross sections, *Fission cross sections, MeV range 01-10, KeV range 0.1-10.

Measurements of the (235U) neutron fission cross section have been made at the NBS linac neutron time-of-flight facility. The neutron flux was measured with a Black Neutron Detector located at the 200 m experimental station of the facility. The fission events were detected with a well-characterized (235U) fission ionization chamber located 69 m from the neutron producing target on the same beam line as the Black Detector. The data have been grouped to statistical precisions of about 1%. Total uncertainties are about 2%.

Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div., Neutron Cross-Section Standards Evaluations for ENDF/B-VII.


Keywords: *Neutron cross sections, *Standards, Uranium 235, Hydrogen, Neutron reactions, R matrix, Lithium 6, Boron 10, Gold 197.

As a first step in the development of the new ENDF/B-VII file, the neutron cross section standard are being evaluated. These evaluated standards are following a different process compared with that used for earlier versions of ENDF. The primary effort is concentrated on a simultaneous evaluation using a generalized least squares program, R-matrix evaluations, and a procedure for combining the results of the evaluations. The ENDF/B-VI standard evaluation procedure is outlined, and preliminary simultaneous evaluation and R-matrix results are presented.
The report deals with hysteresis losses at 4 K measured on a magnetization and complex magnetic susceptibility. The theoretical and experimental relationships between ac susceptibility and magnetization as functions of frequency and temperature were examined in terms of the critical-state model as developed by Carr and Clem. A theoretical method of calibrating ac susceptometers for cylindrical specimens, which is based on a mutual-inductance calculation, was developed.

601.629
PB87-102422
PC A99/MF E04
Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.

X-ray Photocurrent Coefficients (Total Cross Sections): Comparison of the Experimental Data Base with the Recommended Values of Henke and the Theoretical Values of Scofield for Energies between 0.1-1.0 GeV. E. B. Saloman, and J. H. Hubbell. Jul 86, 715p
Sponsored by Department of Energy, Washington, DC, and Department of the Navy, Washington, DC.

Keywords: X rays, Absorption cross sections, Tables(Data), Graphs, Charts, Comparison, Absorption constants, Total cross sections, eV range 100-1000, KeV range 1-10, KeV range 10-100, Photon-atom collisions.

A comparison is carried out, in both graphical and tabular forms, of the energy range 0.1-1.0 GeV between the National Bureau of Standards' database of experimental x-ray attenuation coefficients (total absorption cross sections) and cross sections obtained using two sets of photoionization cross section values; the empirical set of recommended values produced by Henke et al which covers the energy range 0.03-10 GeV, and a theoretical set calculated by Scofield which covered the range 1-1500 eV and was extended by Scofield, at our request, to also cover the 0.1-1 GeV range.

There has been some disagreement over whether Scofield's results should be subject to renormalization from a Hartree-Slater to a Hartree-Slater to a Hartree-Fock atomic model. Therefore, in the tables a comparison is made of Scofield's predictions both with and without the renormalization.

601.640
PB87-102901
Not available NTIS National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Coordinate Time in the Vicinity of the Earth.
Final rept.
D. W. Allan, and N. Ashley 1986, 15p

Keywords: Atomic clocks, General relativity, Accuracy, Comparison, Time standards, Frequency standards.

Atomic clock accuracies continue to improve rapidly, requiring the inclusion of general relativity for unambiguous time and frequency clock comparisons. Atomic clocks are now placed on space vehicles and there are many new applications of time and frequency metrology. The paper addresses theoretical and practical limitations in the accuracy of atomic clock comparisons arising from relativity, and demonstrates that accuracies of time and frequency comparison can approach a few picoseconds and a few parts in 10 to the 18th power, respectively.

601.641
PB87-104078
Not available NTIS National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Characterization, Optimum Estimation, and Time Prediction of Precision Clocks.
Final rept.
D. W. Allan. 1986, 23p

Keywords: Atomic clocks, Standard deviation, Performance, Reviews, Precision, Optimization.

The paper is a partial review of several other papers given in the reference per the guidelines of the title. A few additional calculations are added for completeness of some of the tables, which indicate the uselessness of the standard deviation for a measure of performance of atomic clocks. A proper characterization of both the low-frequency, divergent-power-law processes observed for the random deviations of precision oscillators as well as the environmental sensitivities and systematic characteristics opens the door to: a clear characterization of performance; optimum estimation procedures of systematic parameters; optimum estimation of the influence of environmental parameters; optimum prediction algorithms; and clear specifications which allow system designers and planners to estimate the influence of a given precision oscillator on their system.

601.642
PB87-104469
Not available NTIS National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.

Nonlinearity in Weak Magnetic Fields Induced by Neutron-Antineutron Oscillations in Neutron Interferometry and Spin Resonance.
Final rept., R. C. Cswel, 1984, 4p

Keywords: Magnetic fields, Baryons, Nuclear spin, Reprints, "Neutron oscillation, Grand unified theory, Nuclear resonance, Nonlinearity."

In principle these minute effects are observable if generation problems can be overcome, but general statistical arguments render this approach non-competitive with direct observation of the neutron.

601.643
PB87-105177
Not available NTIS National Bureau of Standards (NBL), Boulder, CO. Electromagnetic Technology Div.

Research on Practical Superconductors at National Bureau of Standards.
Final rept., F. R. Hickett, 1985, 7p

Keywords: Superconductors, Superconducting magnets, Critical field, Copper, Stability, Reprints, Critical current.

The National Bureau of Standards is engaged in a large number of research programs which have as their goals the evaluation of various properties of practical superconductors related to the application in large magnet systems. The NBS work has concentrated on measurement of critical current, critical field, ac losses, and properties of the copper normally used as a stabilizing material. Many parameters must be considered in these investigations. An overview of these research efforts and a selection of recent results are presented. Particular emphasis is given to work performed in cooperation with the International Copper Research Association (IN CRA) on properties of oxygen-free copper.

601.644
PB87-106415

Anomalous Vertical Magnetic Field for Electromagnetic Induction in a Laterally Varying Thin Conducitve Sheet.
Final rept., D. A. Hill, and J. R. Wait. 1986, 5p
Sponsored by Bureau of Mines, Washington, DC.
Pub. in Radio Science 21, n4 p617-621 Jul-Aug 86.

Keywords: "Electromagnetic induction, Magnetic fields, Surface resistivity, Electromagnetic fields, Reprints." The authors employ a simple model to show how the natural electromagnetic field on the surface of the earth, which has a strong horizontal magnetic field component along with a significant vertical magnetic field at the surface. Such a conversion mechanism will be caused by lateral variations of the subsurface conductivity structure. Our idealized model is a thin conducting sheet with a periodic variation of the conductivity-thickness product in one horizontal direction only.

601.645
PB87-106712
Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.

Implementation of CRCPD Accreditation Criteria in State Calibration Laboratories.
Final rept.
H. T. Heaton, 1985, 18p
Contract DE-AC04-76O1830

Keywords: *Laboratories, *Test facilities, *Calibrating, *Ionizing radiation, Quality control, Accreditation. The paper summarizes the unique aspects of the four state laboratories for calibrating ionizing radiation instruments, with which NBS is presently cooperating. The general requirements of the CRCPD accreditation criteria are reviewed, and the procedures by which the state labs meet the criteria are discussed.

601.646
PB87-110102
Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

Electron Scattering by Neon in Resonance Regions.

Keywords: Electron scattering, *Neon, Inelastic scattering, Atomic structure, Reprints.

The authors present cross sections for excitation and de-excitation of neon by electron impact at energies up to 100 eV above the ground state, calculated by the R-matrix method. Comparison with available experimental data is satisfactory, and a number of transitions between excited states are examined theoretically for the first time. The effect of resonances on the cross section is seen to be quite large in some instances. In addition, calculated values of the oscillator strength and transition probabilities for the 3s-3p transition array of neon are given, and are compared with other recent theoretical and experimental values.

601.647
PB87-110201
Not available NTIS National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Future Atomic Frequency and Time Standards.
Final rept., D. J. Wineland. 1981, 12p

Keywords: *Frequency standards, *Time standards, Atomic clocks, Atomic clocks, Cesium frequency standards, Rubidium frequency standards, *Ion storage.

Research towards making improved primary micro-wave frequency and time standards is reviewed. Two areas are highlighted (1) Advances in atomic beam research, and (2) Prospects for stored ion frequency standards.

601.648
PB87-110219
Not available NTIS National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Research on Field Usable Cs and Rb Frequency Standards.
Final rept.
D. J. Wineland. 1981, 17p

Keywords: *Cesium frequency standards, *Rubidium frequency standards, *Frequency standards, Atomic clocks, Time standards, Reviews, Ion storage.

Current research towards improving the "physics packages" in field-usable Cs and Cs clocks is reviewed. The paper is intended to update other similar reviews.

601.649
PB87-110227
Not available NTIS National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Optical Pumping of Stored Atomic Ions.


Keywords: *Optical pumping, Atomic spectroscopy, Reprints, *ion storage, Laser cooling, Laser spectroscopy, Ion traps.

Optical pumping experiments on atomic ions which are stored in electromagnetic <e, traps> are discussed. Weak relaxation and extremely small energy shifts of the stored ions lead to very high resolution and accuracy in optical pumping-double resonance experiments. The basic spirit of Kastler's proposal for <lumino refrigeration> (1950), the kinetic energy levels of stored ions can be optically pumped. This technique, which has been called laser cooling, significantly reduces Doppler frequency shifts in the spectra.

Limits for Spatial Anisotropy by Use of Nuclear-Spin-Polarized (9)Be(1+)-ions.


Keywords: Atomic clocks, Hyperfine structure, Nuclear spin, Polarization, Anisotropy, Reprints, *Beryllium ions, Beryllium 9, Hydrogen masers, Laser cooling, Hughes-Drewer experiment.

The frequency of a nuclear spin-flip (Delta m sub 1 = 1) transition has been compatible to the frequency of a hydrogen maser transition (Delta F = 1). Delta (m sub F = 0) to see if the relative frequencies depend on the orientation of the (9)Be(1+) ions in space. The present null result represents a decrease in the limits set by Hughes and Drever on a spatial anisotropy by a factor of about 300 space.

601,650
PB87-110235 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Frequency Standards Based on Stored Ions.


Keywords: *Frequency standards, Atomic spectroscopy, Atomic clocks, Reprints, *ion storage, Laser cooling, Laser spectroscopy.

The state of development of frequency standards based on stored ions is reviewed. Several preliminary demonstrations of the concept have already shown a level of performance approaching that of today's cesium-beam standards (accuracy of one part in 10 to the 13th power). The potential for accurately measuring or reducing all known systematic effects suggests that frequency standards based on stored ions with inaccuracies of one part in 10 to the 15th power are obtainable and eventually they could be orders of magnitude better than this. This performance is a result of extremely high-Q resonances (e.g., millihertz linewidths at microwave frequencies) and a very small second-order Doppler shift which follows with the addition of techniques for ion cooling.

601,651
PB87-111058 Not available NTIS National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.


Keywords: *Special relativity, *Lorentz transformations, Atomic beams, Precision, Tests, Laser interferometry.

Physicists have been unreasonably successful in tracing physical laws by idealization of rather crude experimental data and modern precision measurements at the 9, 12 or 15 digit precision level. This lecture considers some precision laser interferometer and atomic beam experiments which might be suitable for detecting very small departures from the perfect spatial isotropy postulated in special relativity, as well as for more sensitively testing the basic Lorentz transformations.

601,655


601,658


Keywords: *Acoustic velocity, Temperature measurement, Ideal gas law, Ratios, Reprints, "Light speed.

Measurements of the resonance frequencies of the acoustic modes and of the microwave modes of a single cavity can determine c/u, the ratio of the speed of sound of a gas to the speed of light. Such measurements with a monatomic gas would determine the thermodynamic temperature T with unprecedented accuracy. By judicious choices of cavity geometry and resonance modes, u/c can be measured to part-per-million accuracy using cavity whose geometry is known only to parts per thousand. These techniques can also be applied to measurements of the universal gas constant R. A measurement of R would also require an accurate determination of the average atomic mass of the monatomic gas.

601,658

Keywords: "Atomic beams, Reprints, "Laser cooling, Sodium atoms, Atom traps.

Successful modification of the velocity of atomic beam sodium atoms to zero or negative values are reported, by using counter-propagating laser radiation which has been counter-propagated, using precise optical modulation techniques. The resulting "gas cloud" had a temperature below 50 mK in the dense above a one million atoms/cm. Some near future possibilities are considered in atom slowing, deflection, and storage.

601.665
PB87-128377 Not available NTIS National Bureau of Standards (NLM), Boulder, CO. Electromagnetic Technology Div.
Effect of Aspect Ratio on Critical Current in Multilayered Superconductors.

Keywords: "Superconductors, Magnetic fields, Niobium intermetallics, Tin intermetallics, Titanium intermetallics, Reprints, "Critical current, Niobium titanium, Nichrome tin.

Experimental data and discussion are presented on the critical current of straight superconductors as a function of the thickness of a perpendicular applied magnetic field. Commercial, multilayered NbTi and Nb3Sn samples were measured in a radial access magnet that allowed an arbitrary angle setting. The change in critical current was measured at different magnetic fields to scale the effect for use in a standard test method. For a NbTi sample, the critical current with the magnetic field parallel to the wider face of the conductor is higher than that with the perpendicular magnetic field. For Nb3Sn, the critical current in a NbTi sample with an aspect ratio of six. The effect in Nb3Sn is opposite that in NbTi. A discussion of the likely cause of the effect, which accounts for the difference between NbTi and Nb3Sn, is given.

601.688
PB87-132221 Not available NTIS National Bureau of Standards (NLM), Boulder, CO. Nuclear Radiation Div.

...
Particle-Hole Symmetry In the Interacting-Boson Model: Fermion and Boson Aspects.

Final rept., A. B. Johnson, and C. M. Vincent. 1985, 6p
Grant NFG-11Y82-13597
Sponsored by National Research Council, Washington, DC.

Keywords: * Nuclear structure, Nuclear shell models, Bosons, Fermions, Reprints, Collective model.

It is shown that the S-D subspaces, which are used in the DDI microscopic derivation of the interacting boson model, form a particle-hole-symmetric family. Consequently there exist particle-hole-symmetric prescriptions for determining the structure of the S and D pairs. The result does not (as stated by Talmi) require the Hamiltonian to conserve generalized seniority. Nevertheless there are derivations from particle-hole symmetry when boson matrix elements involving more than two d bosons are calculated in lowest order using the boson mapping procedure of Otsuka, Arima, and lachello. These deviations are used to estimate the inaccuracies introduced by the lowest-order mapping.

601,689
PP87-134227 Not available NTIS National Bureau of Standards (NML), Boulder, CO.
Quantum Physics Div.
Final rept., R. Blatt, W. Ertmer, P. Zoller, and J. L. Hall. 1986, 12p
Grants N00014-77-A-0106, NSF-PHY-82-00805
Sponsored by Office of Naval Research, Arlington, VA., and National Science Foundation, Washington, DC.

Keywords: * Atomic beams, Mathematical models, Computerized simulation, Reprints, * Laser cooling.

Laser cooling of atoms in an atomic beam is studied theoretically by using a simulation approach derived from a pure-state analysis of resonant radiation pressure. Detailed numerical results are presented discussing the form of the atomic velocity distribution and many of the measured effects. The authors summarize research undertaken to develop time and frequency standards based on stored ions. The ion storage method for high resolution spectroscopy is also briefly compared to the methods for stored neutrals and slow atomic beams.

601,679
PP87-140315 PC A15/MF A01 National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
See also PB86-140043.

Keywords: * Research, * Standards, Metrology, Fundamental constants, Pressure, Vacuum, Electrical measurement, Temperature, Atomic physics, Frequency standards, Gravity, X rays, Gamma rays, Laser applications.

The report summarizes the research and technical activities of the Center for Basic Standards during the Fiscal Year 1986. These activities include work in the areas of electric, magnetic, pressure, mass, length, time and frequency, quantum metrology, and quantum physics.

SPACE TECHNOLOGY

Manned Spacecraft

601,674
PP87-103305 PC A03/MF A01 National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Sponsored by Department of Energy, Washington, DC.
Office of Health and Environmental Research, and Office of Naval Research, Arlington, VA.


Monte Carlo calculations have been made of the stopping of electrons and the penetration of secondary bremsstrahlung through layered aluminum-lead spacecraft walls. The results are presented in terms of the radiant dose to objects inside. Dose values for monoenergetic incident electrons are given as a function of the aluminum/lead thickness ratio. These data, integrated over a few typical earth-orbit electron spectra, demonstrate the substantial reduction in radiation dose that can be achieved by replacing a portion of an aluminum shield with an inner layer of lead. The main results were obtained by applying a complex-geometry code to spherical-shell configurations. It was found that these results could be reasonably well approximated by an alternative and more economical approach, involving the use of slab-geometry transport results.

Transportation Safety

601,676
PB86-163524 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Role of Structural Panel Materials in Cabin Fires and Their Properties.
Sponsored by National Aviation Facilities Experimental Center, Atlantic City, NJ.

Keywords: * Aircraft cabins, * Fires, Combustion, Flammability, Heat transfer, Ignition, Reprints.

The report examines the fire development in the FAA C 133 post crash fire experiments involving a fully furnished cabin section. In particular the rate and involvement of aircraft wall and ceiling panels are examined. For two full-scale experiments the energy release rate of the interior cabin furnishings were estimated and an estimate of ceiling ignition computed. Also flammability data on ignition, combustion, and heat transfer at various external irradiance, for one device at diminished ambient oxygen, were compiled from several test apparatus for five candidate aircraft panel materials.

601,676 179
National Bureau of Standards (NEL), Gaithersburg, MD. Law Enforcement Standards Lab.

Keywords: *Directories, *Law enforcement, *Laboratories, *Organizations, User needs, United States, Communication equipment, Security systems, Protective clothing, Criminal justice, Investigative aids.

The Law Enforcement Standards Laboratory (LESL) of the National Bureau of Standards (NBS) furnishes technical support to the National Institute of Justice (NIJ) program to strengthen law enforcement and criminal justice in the United States. LESL's function is to conduct research that will assist law enforcement and criminal justice agencies in the selection and procurement of quality equipment. The document is a law enforcement equipment report developed by LESL under the sponsorship of NIJ as part of the Technology Assessment Program, which is described on page iv. Additional reports as well as other documents are being issued under the LESL program in the areas of protective equipment, communications equipment, security systems, weapons, emergency equipment, investigative aids, vehicles, and clothing.
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<td>Water Bath Blackbody for the 5 to 60°C Temperature Range. Performance Goal, Design Concept, and Test Results</td>
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<td>PBB7-117941</td>
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<td>Water Vapor-Enhanced Electron-Avalanche Growth in SF6 for Nonuniform Fields</td>
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<td>PBB6-192770</td>
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<td>Vibration Standard for the Near Infrared Based on the Reflectance of Rare-Earth Oxides</td>
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**Note:** Table entries marked with an asterisk (*) are not available from NTIS.
### NTIS ORDER/REPORT NUMBER INDEX

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<td>Airborne Sound Transmission Loss Characteristics of Wood-Frame Construction</td>
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PB86-160597
Quantitative Evaluation of Blistering and Corrosion in Organosilicate Systems.
PB86-160983
Sawtooth Segmentation and Deformation Processes on the Southern San Andreas Fault.
PB86-160996
Infrared Cross-Section of Macalolite Green Dry in Organic Solvents.
PB86-161007
Kinetcs of the Early Hydration of Tricalcium Aluminate in Solutions Containing Calcium Sulfate.
PB86-161015
Free-Space Propagation of Ultrashort Light Pulse.
PB86-161030
Two-Photon Absorption from a Phase-Modulated Field.
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Thermophysical Processes.
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Static Propagation of Ultrashort Light Pulse.
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No thermal Radiation Emission and the H II Diagram.
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Structural Analysis of Polymer(V) Polymers by Solid-State 13C NMR Spectroscopy.
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Phase-Diagram of Zirconia. 

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Effect of Bevel Angle and Number of Points on Spreading Resistance Data Analysis. 

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Energy and Radiative Lifetime of the 5d(9)6s(2) doublet (5d/2) State in Hg II by Doppler-Free Two-Photon Laser Spectroscopy. 

PB86-238672 

Corrosion. Metallurgical Aspects. 

PB86-238441 

Corrosion of Magnesium. 

PB86-238110 

Corrosion of Lead. 

PB86-238128 

Degradation. Taxonomy. 

PB86-238136 


PB86-238144 

Database Development under the ASM/NBS Program on Alloy Phase Diagrams. 

PB86-238151 

Chemical and Electrochemical Aspects of SCC of Alpha-Brass in Aqueous Ammonia. 

PB86-238159 

Electrochemical Principles of Corrosion. 

PB86-238177 

Stress-Corrosion Cracking of Brass in Aqueous Ammonia in the Presence of Detectable Anodic-Dissolution. 

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Calcium Aluminate Cements. 

PB86-238268 

Portland Cements, Blended Cements and Mortars. 

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Cements, Specialty. 

PB86-238284 


PB86-238292 

Rovibrational Analysis of an Intermediary Hydrogen-Bonded Vibration: The n(u)(sub 6, sup 1) Band of HCN-\(\cdot\)HF. 

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Underground Corrosion. 

PB86-238334 

Vegard’s Law. 

PB86-238342 

Mossbauer Techniques in Nondestructive Evaluation. 

PB86-238359 

Orientation Relationship Between Precipitated Al\(\cdot\)Fe\(\cdot\)Ni\(\cdot\)Zn Phase and Alpha-Aluminum. 

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Corrosion of Metals: An Overview. 

PB86-238375 


PB86-238383 

Discinations. 

PB86-238391 

Effective Wave Speeds in an SiC-Particle-Reinforced AI Composite. 

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PB87-122693  Electron Detection Modes and Their Relation to Linewidth Measurement in the Scanning Electron Microscope. PB87-122693

PB87-122701  Water Mapping of Electrically Active Defects. PB87-122701

PB87-122719  Techniques for Characterizing Defects in Silicon Solar Cells Using TSM (Thermally Stimulated Current and Capacitance Measurements). PB87-122719

PB87-122727  Electric Field Effects in Rydberg Atoms. PB87-122727

PB87-122735  Asymmetry of Field-Induced Shape Resonances in Hydrogen. PB87-122735

PB87-122743  Use of Acoustic Emission as a Test Method for Electronic Interconnects and Joints. PB87-122743

PB87-122750  Enhancement of Luminolcence by Radiation Sensitization and Chemical Donors. PB87-122750

PB87-122767  Theoretical Studies of Potential Gas-Phase Charge-Transfer Complexes: NH3 + HX (X = Cl, Br, I). PB87-122767

PB87-122776  National Bureau of Standards Research Program for the Archival Lifetime Analysis of Optical Digital Data Disks (ODD sup 3). PB87-122776

PB87-122784  DATAPLOT as an Expert System for Interactive Data Analysis. PB87-122784

PB87-122792  NBS (National Bureau of Standards) Facilities for the Study of Radiation-Protection Instruments. PB87-122792

PB87-122800  Ignition and Combustion Temperatures Determined by Laser Heating. PB87-122800

PB87-122818  NBS (National Bureau of Standards) Standard Reference Materials for Improved Techniques for Luminescence Analysis. PB87-122818

PB87-122826  DATA: A Prototype Software for Engineering Data Evaluation and Decision Support. PB87-122826

PB87-122834  Engineering Databases: Software for On-Line Applications. PB87-122834

PB87-122842  Influence of Thermal Processing on Fatigue Crack Initiation and Propagation of Ti-6Al-4V. PB87-122842

PB87-122850  High Accuracy/High Precision Determination of (223)U in Nondestructive Assay Standards by Gamma-Ray Spectrometry. PB87-122850

PB87-122859  Ignitability Measurements with the Cone Calorimeter. PB87-122859

PB87-122938  Microscopy for Electromagnetic Technology: A Bibliography of NBS (National Bureau of Standards) Publications. PB87-122938

PB87-122946  Out-of-Band Response of Antenna Arrays. PB87-122946

PB87-122953  Electromechanical Properties of Superconductors for DCE (Department of Energy) Fusion Applications. PB87-122953

PB87-122736  Electromagnetic Radiation Test Facilities Evaluation of Rejection Chamber Located at NSWC (Naval Surface Weapons Center), Dahlgren, Virginia. PB87-122736

PB87-122738  Surface Roughness Studies for Wind Tunnel Models Used in High Reynolds Number Testing. PB87-122738

PB87-122739  Optical Measurement of the Roughness of Sinosoidal Surfaces. PB87-122739

PB87-122740  Use of Charge Pumping to Characterize Generation by Interface Traps. PB87-122740
# APPENDIX A
## List of Depository Libraries in the United States

### ALABAMA

| Location            | Library Name                                             | Year
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<td>Auburn</td>
<td>Auburn University Ralph Brown Draughon Library (1907)</td>
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<tr>
<td>Birmingham</td>
<td>Birmingham Public Library (1895)</td>
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<td>Birmingham-Southern College Library (1932)</td>
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<td></td>
<td>Miles College C. A. Kirkendoll Learning Resource Center (1960)</td>
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<td>Samford University Library (1884)</td>
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<td>Enterprise</td>
<td>Enterprise State Junior College Learning Resources Center Library (1967)</td>
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<td>Fayette</td>
<td>Brewer State Junior College Learning Resources Center Library (1979)</td>
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<td>Florence</td>
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<td>University of Alabama in Huntsville Library (1964)</td>
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<td>Jacksonville</td>
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<td>University of South Alabama Library (1966)</td>
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<td>Montgomery</td>
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<td>Normal</td>
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### ALASKA

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<td>Anchorage Municipal Libraries Z. J. Loussac Public Library (1978)</td>
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<td>University of Alaska at Anchorage Library (1961)</td>
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<td>U.S. Department of Interior Alaska Resources Library (1981)</td>
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<td>U.S. District Court Library (1983)</td>
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<td>Fairbanks</td>
<td>University of Alaska Elmer E. Rasmussen Library (1922)</td>
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<td>Juneau</td>
<td>Alaska State Library (1900)</td>
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<td>University of Alaska-Juneau Library (1961)</td>
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<td>Ketchikan</td>
<td>Ketchikan Community College Library (1970)</td>
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### AMERICAN SAMOA

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*Year designated.
### Arizona

**Coolidge**  
Central Arizona College (1973)

**Flagstaff**  
Northern Arizona University Library (1937)

**Holbrook**  
Northland Pioneer College (1985)

**Mesa**  
Mesa Public Library (1983)

**Prescott**  
Yavapai College Library (1976)

**Tempe**  
Arizona State University College of Law Library (1977)  
Arizona State University Library (1944)

**Tucson**  
Tucson Public Library (1970)  
University of Arizona Library (1907) REGIONAL

**Yuma**  
Yuma City-County Library (1963)

### Arkansas

**Arkadelphia**  
Ouachita Baptist University Riley Library (1963)

**Batesville**  
Arkansas College Library (1963)

**Clarksville**  
College of the Ozarks Dobson Memorial Library (1925)

**Conway**  
Hendrix College Olin C. Bailey Library (1903)

**Fayetteville**  
University of Arkansas Mullins Library (1907)  
University of Arkansas School of Law Library (1978)

**Little Rock**  
Arkansas State Library (1978) REGIONAL  
Arkansas Supreme Court Library (1962)  
Little Rock Public Library (1953)  
University of Arkansas at Little Rock Library (1973)  
University of Arkansas at Little Rock, School of Law Library (1979)

**Magnolia**  
Southern Arkansas University Magale Library (1956)

**Monticello**  
University of Arkansas at Monticello Library (1956)

**Pine Bluff**  
University of Arkansas at Pine Bluff Watson Memorial Library (1976)

**Russellville**  
Arkansas Tech University Tomlinson Library (1925)

**Searcy**  
Harding University Beaumont Memorial Library (1963)

**State University**  
Arkansas State University Dean B. Ellis Library (1913)

**Walnut Ridge**  
Southern Baptist College Felix Goodson Library (1967)

### California

**Anaheim**  
Anaheim Public Library (1963)

**Arcadia**  
Arcadia Public Library (1975)

**Arcata**  
Humboldt State University Library (1963)

**Bakersfield**  
California State College Bakersfield Library (1974)  
Kern County, Beale Memorial Library (1943)
Berkeley
University of California General Library (1907)
University of California Law Library (1963)

Carson
California State University Dominguez Hills Educational Resources Center (1973)
Carson Regional Library (1973)

Chico
California State University Merriam Library (1962)

Claremont
Claremont Colleges’ Libraries Honnold Library (1913)

Compton
Compton Public Library (1972)

Culver City
Culver City Library (1966)

Davis
University of California Shields Library (1953)
University of California at Davis Law Library (1972)

Downey
Downey City Library (1963)

Fresno
California State University, Fresno, Henry Madden Library (1962)
Fresno County Free Library (1920)

Fullerton
California State University at Fullerton Library (1963)
Western State University College of Law Library (1984)

Garden Grove
Garden Grove Regional Library (1963)

Gardena
Gardena Public Library (1966)

Hayward
California State University at Hayward Library (1963)

Huntington Park
Huntington Park Library (1970)

Inglewood
Inglewood Public Library (1963)

Irvine
University of California at Irvine General Library (1963)

La Jolla
University of California at San Diego Central University Library (1963)

Lakewood
Angelo Iacoboni Public Library (1970)

Lancaster
Lancaster Library (1967)

La Verne
University of La Verne College of Law Library (1979)

Long Beach
California State University at Long Beach Library (1962)
Long Beach Public Library (1933)

Los Angeles
California State University at Los Angeles John F. Kennedy Memorial Library (1956)
Los Angeles County Law Library (1963)
Los Angeles Public Library (1891)
Loyola Marymount University Charles Von der Ahe Library (1933)
Loyola Law School Library (1979)
Occidental College Library (1941)
Southwestern University School of Law Library (1975)
University of California, University Research Library (1983)
University of California, Los Angeles Law Library (1958)
University of Southern California Doheny Memorial Library (1933)
University of Southern California Law Library (1978)
U.S. Court of Appeals 9th Circuit Library (1981)
Whittier College School of Law Library (1978)

Malibu
Pepperdine University Payson Library (1963)

Menlo Park
Department of Interior Geological Survey Library (1962)

Montebello
Montebello Regional Library (1966)

Monterey
U.S. Naval Postgraduate School Dudley Knox Library (1963)

Monterey Park
Bruggemeyer Memorial Library (1964)

Northridge
California State University at Northridge, Oviatt Library (1958)
Norwalk
Norwalk Regional Library (1973)
San Diego County Library (1966)
San Diego Public Library (1895)
San Diego State University Library (1962)
University of San Diego Kratter Law Library (1967)

Oakland
Mills College Library (1966)
Oakland Public Library (1923)
Golden Gate University School of Law Library (1979)
Hastings College of Law Library (1972)
San Francisco Public Library (1869)
San Francisco State University J. Paul Leonard Library (1955)
Supreme Court of California Library (1979)
U.S. Court of Appeals Ninth Circuit Library (1971)
University of San Francisco Richard A. Gleeson Library (1963)

Ontario
Ontario City Library (1974)

Palm Springs
Palm Springs Public Library (1980)

Pasadena
California Institute of Technology Millikan Memorial Library (1933)
Pasadena Public Library (1963)

Pleasant Hill
Contra Costa County Library (1964)

Redding
Shasta County Library (1956)

Redlands
University of Redlands Armacost Library (1933)

Redwood City
Redwood City Public Library (1966)

Reseda
West Valley Regional Branch Library (1966)

Richmond
Richmond Public Library (1943)

Riverside
Riverside City and County Public Library (1947)
University of California at Riverside Library (1963)

Sacramento
California State Library (1895) REGIONAL
California State University at Sacramento Library (1963)
Sacramento County Law Library (1963)
Sacramento Public Library (1880)
University of the Pacific McGeorge School of Law Library (1978)

San Bernardino
San Bernardino County Law Library (1984)
San Bernardino County Library (1964)

San Diego
San Diego County Law Library (1973)

San Francisco
San Jose State University Library (1962)

San Leandro
San Leandro Community Library Center (1961)

San Luis Obispo
California Polytechnic State University Robert E. Kennedy Library (1969)

San Rafael
Marin County Free Library (1975)

Santa Ana
Orange County Law Library (1975)
Santa Ana Public Library (1959)

Santa Barbara
University of California at Santa Barbara Library (1960)

Santa Clara
University of Santa Clara Orradre Library (1963)

Santa Cruz
University of California at Santa Cruz McHenry Library (1963)

Santa Rosa
Sonoma County Library (1896)

Stanford
Stanford University Libraries (1895)
Stanford University Robert Crown Law Library (1978)

Stockton
Public Library of Stockton and San Joaquin County (1884)

Thousand Oaks
California Lutheran College Library (1964)
Torrance
Torrance Public Library (1969)

Turlock
California State College Stanislaus Library (1964)

Vallejo
Solano County Library, John F. Kennedy Library (1982)

Valencia
Valencia Regional Library (1972)

Ventura
Ventura County Library Services Agency (1975)

Visalia
Tulare County Free Library (1967)

Walnut
Mount San Antonio College Library (1966)

West Covina
West Covina Regional Library (1966)

Whittier
Whittier College Wardman Library (1963)

CANAL ZONE

Balboa Heights
Panama Canal Commission (1963)

COLORADO

Alamosa
Adams State College Library (1963)

Aurora
Aurora Public Library (1984)

Boulder
University of Colorado at Boulder Norlin Library (1879) REGIONAL

Colorado Springs
Colorado College Tutt Library (1880)
University of Colorado at Colorado Springs Library (1974)
U.S. Air Force Academy Academy Library (1956)

Denver
Auraria Library (1978)
Colorado State Library (unknown)
Colorado Supreme Court Library (1978)
Denver Public Library (1884) REGIONAL
Department of the Interior Bureau of Reclamation Library (1962)
Regis College Dayton Memorial Library (1915)
U.S. Court of Appeals Tenth Circuit Library (1973)
University of Denver Penrose Library (1909)
University of Denver College of Law Westminster Law Library (1978)

Fort Collins
Colorado State University Libraries (1907)

Golden
Colorado School Mines Arthur Lakes Library (1939)

Grand Junction
Mesa College Lowell Heiny Library (1978)

Greeley
University of Northern Colorado James A. Michener Library (1966)

Gunnison
Western State College Leslie J. Savage Library (1932)

La Junta
Otero Junior College Wheeler Library (1963)

Lakewood
Jefferson County Public Library Lakewood Library (1968)

Pueblo
Pueblo Library District (1893)
University of Southern Colorado Library (1965)

CONNECTICUT

Bridgeport
Bridgeport Public Library (1884)
University of Bridgeport School of Law Library Wahlstrom Library (1979)

Danbury
Western Connecticut State University Ruth A. Haas Library (1967)
Danielson
Quinebaug Valley Community College Audrey P. Beck Library (1975)

Enfield
Enfield Central Library (1967)

Hartford
Connecticut State Library (unknown) REGIONAL
Hartford Public Library (1945)
Trinity College Library (1895)
University of Connecticut School of Law Library (1978)

Middletown
Wesleyan University Olin Library (1906)

Mystic
Mystic Seaport Museum, Incorporated G. W. Blunt White Library
(1964)

New Britain
Central Connecticut State University Elihu Burritt Library (1973)

New Haven
Southern Connecticut State University Hilton C. Buley Library (1968)
Yale Law Library (1981)
Yale University Seeley G. Mudd Library (1859)

New London
Connecticut College C. E. Shain Library (1926)
U.S. Coast Guard Academy Library (1939)

Stamford
Ferguson Library (1973)

Storrs
University of Connecticut Homer Babbidge Library (1907)

Waterbury
Post College Traurig Library (1977)
Silas Bronson Public Library (1869)

West Haven
University of New Haven Peterson Library (1971)

DELWARE

Dover
Delaware State College William C. Jason Library (1962)
State Law Library in Kent County (unknown)

Georgetown
Delaware Technical and Community College Library (1968)
Sussex County Law Library (1976)

Newark
University of Delaware Library (1907)

Wilmington
Delaware Law School Library (1976)
New Castle County Law Library (1974)

DISTRICT OF COLUMBIA

Washington
Administrative Conference of the United States Library (1972)
Advisory Commission on Intergovernmental Relations Library (1977)
American University Washington College of Law Library (1983)
Antioch School of Law Library (1982)
Catholic University of America Robert J. White Law Library (1979)
Department of the Army Pentagon Library ANRAL(1969)
Department of Commerce Library (1955)
Department of Health and Human Services Library (1954)
Department of Housing and Urban Development Library (1969)
Department of the Interior Library Natural Resources Library (1895)
Department of Justice Main Library (1895)
Department of Labor Library (1978)
Department of the Navy Library (1895)
Department of State Library (1895)
Department of State Law Library (1966)
Department of Transportation Main Library (1982)
Department of Transportation, U.S. Coast Guard Law Library (1982)
Department of the Treasury Library (1895)
District of Columbia Court of Appeals Library Library (1981)
District of Columbia Public Library (1943)
Executive Office of the President, Office of Administration, Library &
Information Service Division (1965)
Federal Deposit Insurance Corporation Library (1972)
Federal Election Commission Library (1975)
Federal Labor Relations Authority Law Library (1982)
Federal Mine Safety & Health Review Commission Library (1979)
Federal Reserve System Board of Governors Research Library
(1978)
Federal Reserve System Law Library (1976)
General Accounting Office Library (1974)
General Services Administration Library (1975)
Georgetown University Library (1969)
Georgetown University Law Center Fred O. Dennis Law Library
(1978)
George Washington University Melvin Gelman Library (1983)
George Washington University National Law Center Jacob Burns Law
Library (1978)
Library of Congress Congressional Research Service (1978)
Merit Systems Protection Board Library (1979)
National Defense University Library (1895)
U.S. Court of Appeals Judges' Library (1975)
U.S. Information Agency Library (1964)
U.S. Office of Personnel Management Library (1963)
U.S. Postal Service Library (1995)
U.S. Senate Library (1979)
U.S. Supreme Court Library (1978)
University of the District of Columbia Library (1970)
Veterans' Administration Central Office Library (1967)
# Florida Library Listings

**FLORIDA**

**Boca Raton**
Florida Atlantic University S. E. Wimberly Library (1963)

**Clearwater**
Clearwater Public Library (1972)

**Coral Gables**
University of Miami Library Otto G. Richter Library (1939)

**Daytona Beach**
Volusia County Library Center (1963)

**De Land**
Stetson University duPont-Ball Library (1887)

**Fort Lauderdale**
Broward County Main Library (1967)
Nova University, Center for Study of Law/Law Library (1967)

**Fort Pierce**
Indian River Comunity College Library (1975)

**Gainesville**
University of Florida College of Law Library (1978)
University of Florida Libraries (1907) REGIONAL

**Jacksonville**
Haydon Burns Public Library (1914)
Jacksonville University Swisher Library (1962)
University of North Florida Thomas G. Carpenter Library (1972)

**Lakeland**
Lakeland Public Library (1928)

**Leesburg**
Lake-Sumter Community College Library (1963)

**Melbourne**
Florida Institute of Technology Library (1963)

**Miami**
Florida International University Library (1970)
Miami-Dade Public Library (1952)

**North Miami**
Florida International University North Miami Campus Library (1977)

**Opa Locka**
St. Thomas University Library (1977)

**Orlando**
University of Central Florida Library (1966)

**Palatka**
Saint Johns River Community College Library (1963)

**Panama City**
Bay County Public Library (1983)

**Pensacola**
University of West Florida John C. Pace Library (1966)

**Port Charlotte**
Charlotte County Library System (1973)

**Saint Petersburg**
Saint Petersburg Public Library (1965)
Stetson University College of Law Charles A. Dana Library (1975)

**Sarasota**
Selby Public Library (1970)

**Tallahassee**
Florida Agricultural and Mechanical University Coleman Memorial Library (1936)
Florida State University College of Law Library (1978)
Florida State University Strozier Library (1941)
Florida Supreme Court Library (1974)
State Library of Florida (1929)

**Tampa**
Tampa-Hillsborough County Public Library (1965)
University of South Florida Library (1962)
University of Tampa Merl Kelce Library (1953)

**Winter Park**
Rollins College Mills Memorial Library (1909)

# Georgia Library Listings

**GEORGIA**

**Albany**
Dougherty County Public Library (1964)
<table>
<thead>
<tr>
<th>Americus</th>
<th>Statesboro</th>
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<tr>
<td>Georgia Southwestern College James Earl Carter Library (1966)</td>
<td>Georgia Southern College Liberty (1939)</td>
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<tr>
<th>Athens</th>
<th>Valdosta</th>
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<tr>
<td>University of Georgia Libraries (1970) REGIONAL</td>
<td>Valdosta State College Library (1956)</td>
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<tr>
<td>University of Georgia School of Law Library (1979)</td>
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<tr>
<th>Atlanta</th>
<th>GUAM</th>
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<tbody>
<tr>
<td>Atlanta-Fulton Public Library (1880)</td>
<td>Agana</td>
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<tr>
<td>Emory University School of Law Library (1968)</td>
<td>Mangilao</td>
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<tr>
<td>Emory University Woodruff Library (1928)</td>
<td>University of Guam Robert F. Kennedy Memorial Library (1978)</td>
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<tr>
<td>Georgia Institute of Technology Price Gilbert Memorial Library (1963)</td>
<td></td>
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<tr>
<td>Georgia State Library (unknown)</td>
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<tr>
<td>Georgia State University William Russell Pullen Library (1970)</td>
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<td>Georgia State University College of Law Library (1983)</td>
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<tr>
<td>U.S. Court of Appeals 11th Circuit Library (1980)</td>
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<tr>
<th>Augusta</th>
<th>HAWAII</th>
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<tr>
<td>Augusta College Reese Library (1962)</td>
<td>Hilo</td>
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<td></td>
<td>University of Hawaii at Hilo Edwin H. Mookini Library (1962)</td>
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<tr>
<th>Brunswick</th>
<th>Honolulu</th>
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<tr>
<td>Brunswick-Glynn County Regional Library (1965)</td>
<td>Hawaii Medical Library Incorporated (1968)</td>
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<td>Hawaii State Library (1929)</td>
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<tr>
<td></td>
<td>Municipal Reference &amp; Records Center (1965)</td>
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<tr>
<td></td>
<td>Supreme Court Law Library (1973)</td>
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<tr>
<td></td>
<td>University of Hawaii Hamilton Library (1907) REGIONAL</td>
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<td></td>
<td>University of Hawaii William S. Richardson School of Law Library (1978)</td>
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<table>
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<tr>
<th>Carrollton</th>
<th>LAIE</th>
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<tr>
<td>West Georgia College Irvine Sullivan Ingram Library (1962)</td>
<td>Brigham Young University Hawaii Campus, Joseph F. Smith Library (1964)</td>
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<tr>
<th>Columbus</th>
<th>Lihue</th>
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<tr>
<td>Columbus College Simon Schwob Memorial Library (1975)</td>
<td>Kauai Regional Library (1967)</td>
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<tr>
<th>Dahlonega</th>
<th>Pearl City</th>
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<tr>
<td>North Georgia College Stewart Library (1939)</td>
<td>Leeward Community College Library (1967)</td>
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<th>Dalton</th>
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<tr>
<td>Dalton Junior College Library Resource Center (1978)</td>
<td>Maui Public Library (1962)</td>
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<tr>
<th>Macon</th>
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<tr>
<td>Mercer University Stetson Memorial Library (1964)</td>
<td>Boise</td>
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<td>Mercer University Walter F. George School of Law Library (1978)</td>
<td>Boise Public Library and Information Center (1929)</td>
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<th>Marietta</th>
<th>Cadwell</th>
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<td>Kennesaw College Library (1968)</td>
<td>College of Idaho Terteling Library (1930)</td>
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<th>Milledgeville</th>
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<tr>
<td>Georgia College at Milledgeville Ina Dillard Russell Library (1950)</td>
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<tr>
<th>Mount Berry</th>
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<tr>
<td>Berry College Memorial Library (1970)</td>
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<tr>
<th>Savannah</th>
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<tbody>
<tr>
<td>Chatham-Effingham Liberty Regional Library (1857)</td>
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</table>
Moscow
University of Idaho College of Law Library (1978)
University of Idaho Library (1907) REGIONAL

Nampa

Pocatello
Idaho State University Eli Oboler Library (1908)

Rexburg
Ricks College Davis O. McKay Learning Resources Center (1946)

Twin Falls
College of Southern Idaho Library (1970)

ILLINOIS

Bloomington
Illinois Wesleyan University Sheean Library (1964)

Carbondale
Southern Illinois University at Carbondale Morris Library (1932)
Southern Illinois University School of Law Library (1976)

Carlinville
Blackburn College Lumpkin Library (1954)

Carterville
Shawnee Library System (1971)

Champaign
University of Illinois Law Library (1965)

Charleston
Eastern Illinois University Booth Library (1962)

Chicago
Chicago Public Library (1876)
Chicago State University Paul and Emily Douglas Library (1954)
DePaul University Law Library (1979)
Field Museum of Natural History Library (1963)
Illinois Institute of Technology Chicago-Kent College of Law Library (1978)
Illinois Institute of Technology Paul V. Galvin Library (1982)
Loyola University of Chicago E. M. Cudahy Memorial Library (1966)
Loyola University School of Law Library (1979)
Northeastern Illinois University Library (1961)
Northwestern University School of Law Library (1978)
University of Chicago Law Library (1964)
University of Chicago Library (1897)
University of Illinois at Chicago Library (1957)
William J. Campbell Library of the U.S. Courts (1979)

Decatur
Decatur Public Library (1954)

De Kalb
Northern Illinois University Founders' Memorial Library (1960)
Northern Illinois University College of Law Library (1978)

Des Plaines
Oakton Community College Library (1976)

Edwardsville
Southern Illinois University Lovejoy Memorial Library (1959)

Elsah
Principia College Marshall Brooks Library (1957)

Evanston
Northwestern University Library (1876)

Freeport
Freeport Public Library (1905)

Galesburg
Galesburg Public Library (1896)

Jacksonville
MacMurray College Henry Pfeiffer Library (1929)

Kankakee
Olivet Nazarene College Benner Library and Learning Resource Center (1946)

Lake Forest
Lake Forest College Donnelley Library (1962)

Lebanon
McKendree College Holman Library (1968)

Lisle
Illinois Benedictine College Theodore F. Lownik Library (1911)

Macomb
Western Illinois University Government Publications & Legal Reference Library (1962)

Moline
Black Hawk College Learning Resources Center (1970)
<table>
<thead>
<tr>
<th>Town</th>
<th>Library Name</th>
<th>Year</th>
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<tr>
<td>Monmouth</td>
<td>Monmouth College Hewes Library</td>
<td>1860</td>
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<tr>
<td>Mount Carmel</td>
<td>Wabash Valley College Bauer Media Center</td>
<td>1975</td>
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<tr>
<td>Mount Prospect</td>
<td>Mount Prospect Public Library</td>
<td>1977</td>
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<tr>
<td>Normal</td>
<td>Illinois State University Milner Library</td>
<td>1877</td>
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<tr>
<td>Oak Park</td>
<td>Oak Park Public Library</td>
<td>1963</td>
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<tr>
<td>Oglesby</td>
<td>Illinois Valley Community College Jacobs Memorial Library</td>
<td>1976</td>
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<td>Palos Hills</td>
<td>Moraine Valley Community College Library</td>
<td>1972</td>
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<td>Peoria</td>
<td>Bradley University Cullom-Davis Library</td>
<td>1963</td>
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<td>Peoria Public Library</td>
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<tr>
<td>River Forest</td>
<td>Rosary College Library Rebecca Crown Library</td>
<td>1966</td>
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<td>Rockford</td>
<td>Rockford Public Library</td>
<td>1895</td>
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<td>Romeoville</td>
<td>Lewis University Library</td>
<td>1952</td>
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<tr>
<td>Springfield</td>
<td>Illinois State Library (unknown) REGIONAL</td>
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<td>Streamwood</td>
<td>Poplar Creek Public Library</td>
<td>1980</td>
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<tr>
<td>University Park</td>
<td>Governors' State University Library</td>
<td>1974</td>
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<tr>
<td>Urbana</td>
<td>University of Illinois Documents Library</td>
<td>1907</td>
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<tr>
<td>Wheaton</td>
<td>Wheaton College Buswell Memorial Library</td>
<td>1964</td>
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<tr>
<td>Woodstock</td>
<td>Woodstock Public Library</td>
<td>1963</td>
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**INDIANA**

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<tr>
<th>Town</th>
<th>Library Name</th>
<th>Year</th>
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<tbody>
<tr>
<td>Anderson</td>
<td>Anderson College Charles E. Wilson Library</td>
<td>1959</td>
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<td>Anderson Public Library</td>
<td>1983</td>
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<tr>
<td>Bloomingtron</td>
<td>Indiana University Library</td>
<td>1881</td>
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<td></td>
<td>Indiana University Law Library</td>
<td>1978</td>
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<tr>
<td>Crawfordsville</td>
<td>Wabash College Lilly Library</td>
<td>1906</td>
</tr>
<tr>
<td>Evansville</td>
<td>Evansville and Vanderburgh County Public Library</td>
<td>1928</td>
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<td>Indiana State University at Evansville Evansville Campus Library</td>
<td>1969</td>
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<tr>
<td>Fort Wayne</td>
<td>Allen County Public Library</td>
<td>1896</td>
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<td></td>
<td>Indiana University-Purdue University at Fort Wayne Helmke Library</td>
<td>1965</td>
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<tr>
<td>Franklin</td>
<td>Franklin College Library</td>
<td>1976</td>
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<tr>
<td>Gary</td>
<td>Gary Public Library</td>
<td>1943</td>
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<td></td>
<td>Indiana University Northwest Library</td>
<td>1966</td>
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<tr>
<td>Greencastle</td>
<td>De Pauw University Roy O. West Library</td>
<td>1879</td>
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<td>Hammond</td>
<td>Hammond Public Library</td>
<td>1964</td>
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<td>Hanover</td>
<td>Hanover College Duggan Library</td>
<td>1892</td>
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<tr>
<td>Huntington</td>
<td>Huntington College Loew Alumni Library</td>
<td>1964</td>
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<tr>
<td>Indianapolis</td>
<td>Butler University Irwin Library</td>
<td>1965</td>
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<td>Indianapolis-Marion County Public Library</td>
<td>1906</td>
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<td>Indiana State Library (unknown) REGIONAL</td>
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<td>Indiana Supreme Court Law Library</td>
<td>1975</td>
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<td></td>
<td>Indiana University School of Law Library</td>
<td>1967</td>
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<td>Indiana University-Purdue University Library</td>
<td>1979</td>
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Kokomo
Indiana University at Kokomo Learning Resource Center (1969)

Muncie
Ball State University Alexander M. Bracken Library (1959)
Muncie Public Library (1906)

New Albany
Indiana University Southeastern Library (1965)

Notre Dame
University of Notre Dame Memorial Library (1883)

Rensselaer
Saint Joseph's College Library (1964)

Richmond
Earlham College Lilly Library (1964)
Morrison-Reeves Library (1906)

South Bend
Indiana University at South Bend Library (1965)

Terre Haute
Indiana State University Cunningham Memorial Library (1906)

Valparaiso
Valparaiso University Moeller Memorial Library (1930)
Valparaiso University Law Library (1978)

West Lafayette
Purdue University Libraries (1907)

IOWA

Ames
Iowa State University Library (1907)

Cedar Falls
University of Northern Iowa Library (1946)

Council Bluffs
Free Public Library (1885)
Iowa Western Community College Herbert Hoover Library (1972)

Davenport
Davenport Public Library (1973)

Des Moines
Drake University Cowles Library (1966)
Drake University Law Library (1972)
Public Library of Des Moines (1868)
State Library of Iowa (unknown)

Dubuque
Carnegie-Stout Public Library (unknown)
Loras College Wahlert Memorial Library (1967)

Fayette
Upper Iowa University Henderson-Wilder Library (1974)

Grinnell
Grinnell College Burling Library (1874)

Iowa City
University of Iowa College of Law Law Library (1968)
University of Iowa Libraries (1884) REGIONAL

Land
Graceland College Frederick Madison Smith Library (1927)

Mason City
North Iowa Area Community College Library (1976)

Mount Vernon
Cornell College Russell D. Cole Library (1896)

Orange City
Northwestern College Ramaker Library (1970)

Sioux City
Sioux City Public Library (1894)

KANSAS

Atchison
Benedictine College Library (1965)

Baldwin City
Baker University Collins Library (1908)

Colby
Colby Community College H. F. Davis Memorial Library (1968)

Emporia
Emporia State University William Allen White Library (1909)
Hays
Fort Hays State University Forsyth Library (1926)

Hutchinson
Hutchinson Public Library (1963)

Fort Scott
Fort Scott Community College Learning Resources Center Library (1979)

Lawrence
University of Kansas Law Library (1971)
University of Kansas Spencer Research Library (1869) REGIONAL

Manhattan
Kansas State University Farrell Library (1907)

Pittsburg
Pittsburg State University Leonard H. Axe Library (1952)

Salina
Kansas Wesleyan University Memorial Library (1930)

Shawnee Mission
Johnson County Library (1979)

Topeka
Kansas State Historical Society Library (1877)
Kansas State Library (unknown)
Kansas Supreme Court Law Library (1975)
Washburn University of Topeka Law Library (1971)

Wichita
Wichita State University Ablah Library (1901)

KENTUCKY

Ashland
Boyd County Public Library (1964)

Barbourville
Union College Abigail E. Weeks Memorial Library (1958)

Bowling Green
Western Kentucky University Helm-Cravens Library (1934)

Crestview Hills
Thomas More College Library (1970)

Danville
Centre College Grace Doherty Library (1884)

Frankfort
Kentucky Department of Libraries and Archives (1967)
Kentucky State Law Library (unknown)
Kentucky State University Blazer Library (1972)

Highland Heights
Northern Kentucky University W. Frank Steely Library (1973)

Lexington
University of Kentucky Law Library (1968)
University of Kentucky Libraries (1907) REGIONAL

Louisville
Louisville Free Public Library (1904)
University of Louisville Ekstrom Library (1925)
University of Louisville Law Library (1975)

Morehead
Morehead State University Camden-Carroll Library (1955)

Murray
Murray State University Waterfield Library (1924)

Owensboro
Kentucky-Wesleyan College Library Learning Center (1966)

Richmond
Eastern Kentucky University John Grant Crabbe Library (1966)

Williamsburg

LOUISIANA

Baton Rouge
Louisiana State Library (1976)
Louisiana State University Middleton Library (1907) REGIONAL
Louisiana State University Paul M. Hebert Law Center Library (1929)
Southern University Law School Library (1979)
Southern University Library (1952)

Eunice
Louisiana State University at Eunice LeDoux Library (1969)

Hammond
Southeastern Louisiana University Sims Memorial Library (1966)
Lafayette
University of Southwestern Louisiana Library (1938)

Lake Charles
McNeese State University Lether E. Frazar Memorial Library (1941)

Monroe
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Natchitoches
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Southern University in New Orleans Leonard S. Washington Memorial Library (1962)
Tulane University Law Library (1942)
Tulane University Howard-Tilton Memorial Library (1884)
U.S. Court of Appeals Fifth Circuit Library (1973)
University of New Orleans Earl K. Long Library (1963)

Pineville
Louisiana College Richard W. Norton Memorial Library (1969)

Ruston
Louisiana Technical University Prescott Memorial Library (1996)
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Shreve Memorial Library (1923)

Thibodaux
Nicholls State University Ellender Memorial Library (1962)

MAINE

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Maine State Library (unknown)

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Brunswick
Bowdoin College Library (1884)

Castine
Maine Maritime Academy Nutting Memorial Library (1969)

Lewiston
Bates College George and Helen Ladd Library (1883)

Oroko
University of Maine Raymond H. Fogler Library (1907) REGIONAL

Portland
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Presque Isle
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Sanford

Waterville
Colby College Miller Library (1884)

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Annapolis
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Johns Hopkins University Milton S. Eisenhower Library (1882)
Morgan State University Soper Library (1940)
University of Baltimore Langsdale Library (1973)
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Uniformed Services University of Health Sciences Learning Resource Center (1983)
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Patuxent River
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Rockville
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Salisbury
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Towson State University Cook Library (1979)

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U.S. Court of Appeals First Circuit Library (1978)

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Tufts University Wessels Library (1899)

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Stonehill College Cushing-Martin Library (1962)

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Wenham
Gordon College Winn Library (1963)
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MISSISSIPPI

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Columbus
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Hattiesburg
University of Southern Mississippi Joseph A. Cook Memorial Library (1935)

Jackson
Jackson State University Henry Thomas Sampson Library (1968)
Millsaps College Millsaps-Wilson Library (1963)
Mississippi College School of Law Library (1977)
Mississippi Library Commission (1947)
Mississippi State Law Library (unknown)

Lorman
Alcorn State University Library (1970)

Mississippi State
Mississippi State University Mitchell Memorial Library (1907)

Pascagoula
Jackson-George Regional Library (1985)

University
University of Mississippi J. D. Williams Library (1883) REGIONAL
University of Mississippi James O. Eastland Law Library (1967)

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Columbia
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Fayette
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Westminster College Reeves Library (1875)

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Lincoln University Inman E. Page Library (1944)
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Missouri Supreme Court Library (unknown)

Joplin
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Kansas City
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Rockhurst College Greenlease Library (1917)
University of Missouri at Kansas City General Library (1938)
University of Missouri-Kansas City Leon E. Bloch Law Library (1978)

Kirksville
Northeast Missouri State University Pickler Memorial Library (1966)

Liberty
William Jewell College Charles F. Curry Library (1900)

Maryville
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Rolla
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Saint Charles
Lindenwood College Margaret Leggat Butler Library (1973)

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Saint Louis Public Library (1866)
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University of Missouri at Saint Louis Thomas Jefferson Library (1966)
Washington University John M. Olin Library (1906)
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Springfield
Drury College, Walker Library (1874)
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Douglas
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Adelphi University Swirbul Library (1966)

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Hofstra University School of Law Library (1979)

Huntington
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Cornell Law Library (1978)
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Yeshiva University Pollack Library (1979)

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Newburgh Free Library (1909)

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Fayetteville
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Greensboro
North Carolina Agricultural and Technical State University F. D. Bluford Library (1937)
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Greenville
East Carolina University J. Y. Joyner Library (1951)

Laurinburg
Saint Andrews Presbyterian College DeTamble Library (1969)

Lexington
Davidson County Public Library (1971)

Mount Olive
Mount Olive College Moye Library (1971)

Murfreesboro
Chowan College Whitaker Library (1963)

Pembroke
Pembroke State University Mary H. Livermore Library (1956)

Wilson
Atlantic Cristian College Hackney Library (1930)

Winston-Salem
Forsyth County Public Library (1954)
Wake Forest University Z. Smith Reynolds Library (1902)

NORTH DAKOTA

Bismarck
North Dakota State Library (1971)
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Veteran's Memorial Public Library (1967)

Dickinson
Dickinson State College Stoxen Library (1968)

Fargo
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Grand Forks
University of North Dakota Chester Fritz Library (1890)

Minot
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Valley City
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OHIO

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Akron
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University of Akron Bierce Library (1963)
University of Akron School of Law Library (1978)

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Mount Union College Library (1888)

Ashland
Ashland College Library (1936)
Athens
Ohio University Alden Library (1886)

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Bowling Green
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Canton
Malone College Everett L. Cattell Library (1970)

Chardon
Geauga County Public Library (1971)

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Columbus
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Gambier
Kenyon College Library (1873)

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Kent
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Marietta
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Marion
Marion Public Library (1979)

Middletown
Miami University-Middletown Gardner-Harvey Library (1970)

New Concord
Muskingum College Library (1966)

Oberlin
Oberlin College Library (1858)

Oxford
Miami University Library King Library (1909)

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| Toledo         | Toledo-Lucus County Public Library (1884)                
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University of Toledo Library (1963)                        |
| University Heights | John Carroll University Grasselli Library (1963)       |
| Worthington    | Worthington Public Library (1984)                        |
| Youngstown     | Public Library of Youngstown and Mahoning County (1923)  
Youngstown State University William F. Maag Library (1971) |
| Ada            | East Central Oklahoma State University Linscheid Library (1914) |
| Alva           | Northwestern Oklahoma State University J. W. Martin Library (1907) |
| Bethany        | Bethany Nazarene College R. T. Williams Learning Resources Center (1971) |
| Durant         | Southeastern Oklahoma State University Henry G. Bennett Memorial Library (1929) |
| Edmond         | Central State University Library (1934)                  |
| Enid           | Public Library of Enid and Garfield County (1908)        |
| Langston       | Langston University G. Lamar Harrison Library (1941)      |
| Muskogee       | Muskogee Public Library (1971)                           |
| Norman         | University of Oklahoma Libraries Bizzell Memorial Library (1893)  
University of Oklahoma Law Library (1978)                |
| Oklahoma City  | Metropolitan Library System Main Library (1974)            
Oklahoma City University Dulaney Browne Library (1963)  
Oklahoma Department of Libraries (1893) REGIONAL          |
| Shawnee        | Oklahoma Baptist University Library (1933)                |
| Stillwater     | Oklahoma State University Library (1907) REGIONAL         |
| Tahlequah      | Northeastern Oklahoma State University John Vaughan Library (1923) |
| Tulsa          | Tulsa City-County Library System (1963)                   
University of Tulsa College of Law Library (1979)  
University of Tulsa McFarlin Library (1929)                |
| Weatherford    | Southwestern Oklahoma State University Al Harris Library (1958) |
| OREGON         |                                                        |
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| Corvallis      | Oregon State University Library (1907)                    |
| Eugene         | University of Oregon Law Library (1979)                   
University of Oregon Library (1863)                         |
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RHODE ISLAND

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Providence
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Providence Public Library (1884)
Rhode Island College James P. Adams Library (1965)
Rhode Island State Law Library (1979)
Rhode Island State Library (1895)

Warwick
Warwick Public Library (1966)

Westerly
Westerly Public Library (1909)

Woonsocket
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SOUTH CAROLINA

Charleston
Baptist College at Charleston L. Mendel Rivers Library (1967)
The Citadel Military College Daniel Library (1962)
College of Charleston Robert Scott Small Library (1869)

Clemson
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Columbia
Benedict College Payton Learning Resources Center (1969)
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University of South Carolina Thomas Cooper Library (1884)

Conway
University of South Carolina Coastal Carolina College Kimbel Library (1974)

Due West
Erskine College McCain Library (1968)

Florence
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Francis Marion College James A. Rogers Library (1970)

Greenville
Furman University Library (1962)
Greenville County Library (1966)

Greenwood
Lander College Larry A. Jackson Library (1967)

Orangeburg
South Carolina State College Miller F. Whittaker Library (1953)

Rock Hill
Winthrop College Dacus Library (1896)

Spartansburg
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SOUTH DAKOTA

Aberdeen
Northern State College Beulah Williams Library (1963)

Brookings
South Dakota State University H. M. Briggs Library (1889)

Pierre
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Dallas Baptist University Vance Memorial Library (1967)
Dallas Public Library (1900)
Southern Methodist University Fondren Library (1925)
University of Texas Health Science Center-Dallas Library (1975)

Denton
North Texas State University Library (1948)

Edinburg
Pan American University Library (1959)

El Paso
El Paso Public Library (1906)
University of Texas at El Paso Library Documents & Maps Library (1966)

Fort Worth
Fort Worth Public Library (1905)
Texas Christian University Mary Couts Burnett Library (1916)

Galveston
Rosenberg Library (1909)

Houston
Houston Public Library (1884)
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Rice University Fondren Library (1967)
South Texas College of Law Library (1981)
Texas Southern University Thurgood Marshall School of Law Library (1982)
University of Houston-Clear Lake Alfred R. Neumann Library (1980)
University of Houston Library (1957)
University of Houston School of Law Library (1979)

Huntsville
Sam Houston State University Newton Gresham Library (1949)

Irving
Irving Public Library System (1974)

Kingsville
Texas Arts and Industries University Jernigan Library (1944)

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Longview
Nicholson Memorial Public Library (1961)

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Texas Tech University Library (1935) REGIONAL
Texas Tech University School of Law Library (1978)

Marshall
Wiley College Thomas Winston Cole Sr. Library (1962)

Nacogdoches
Stephen F. Austin State University Steen Library (1965)

Plainview
Wayland Baptist University Van Howeling Memorial Library (1963)

Richardson
University of Texas at Dallas McDermott Library (1972)

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Angelo State University Port Henderson Library (1964)

San Antonio
Saint Mary's University Academic Library (1964)
Saint Mary's University Law Library (1982)
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Sherman
Austin College Arthur Hopkins Library (1963)

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Martinsville
Patrick Henry Community College Library (1971)

Norfolk
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Quantico
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Marine Corps Education Center MCDEC James Carson Breckinridge Library (1967)

Reston
Department of the Interior Geological Survey Library (1963)

Richmond
U.S. Court of Appeals Fourth Circuit Library (1973)
University of Richmond Boatwright Memorial Library (1900)
University of Richmond Law School Library (1982)
Virginia Commonwealth University James Branch Cabell Library (1971)
Virginia State Law Library (1973)
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Salem
Roanoke College Library (1886)

Williamsburg
College of William and Mary Marshall-Wythe Law Library (1978)
College of William and Mary Swem Library (1936)

Wise
Clinch Valley College John Cook Wyllie Library (1971)

WASHINGTON

Bellingham
Western Washington University Mable Zoe Wilson Library (1963)

Cheney
Eastern Washington University JFK Library (1966)

Ellensburg
Central Washington University Library (1962)

Everett
Everett Public Library (1914)

Midway
Highline Community College Library (1983)

Olympia
Evergreen State College Daniel J. Evans Library (1972)
Washington State Law Library (1979)
Washington State Library (unknown) REGIONAL

Port Angeles
North Olympic Library System (1965)

Pullman
Washington State University Holland Library

Seattle
Seattle Public Library (1908)
University of Washington Suzzallo Library (1890)
University of Washington Marian Gould Gallagher Law Library (1969)
U.S. Court of Appeals 9th Circuit Library (1981)

Spokane
Gonzaga University School of Law Library (1979)
Spokane Public Library (1910)

Tacoma
Tacoma Public Library (1894)
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University of Puget Sound School of Law Library (1978)
**Vancouver**
Fort Vancouver Regional Library (1962)

**Walla Walla**
Whitman College Penrose Memorial Library (1890)

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**WEST VIRGINIA**

**Athens**
Concord College Library (1924)

**Bluefield**
Bluefield State College Hardway Library (1972)

**Charleston**
Kanawha County Public Library (1952)
West Virginia Library Commission (1975)
West Virginia Supreme Court Law Library (1977)

**Elkins**
Davis and Elkins College Library (1913)

**Fairmont**
Fairmont State College Library (1884)

**Glenville**
Glenville State College Robert F. Kidd Library (1966)

**Huntington**
Marshall University James E. Morrow Library (1925)

**Institute**
West Virginia State College Drain-Jordon Library (1907)

**Montgomery**
West Virginia Institute of Technology Vining Library (1985)

**Morgantown**
West Virginia University Library (1907) REGIONAL

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Salem College Library (1921)

**Shepherdstown**
Shepherd College Ruth Scarborough Library (1971)

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**Weirton**
Mary H. Weir Public Library (1963)

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**WISCONSIN**

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Lawrence University Seeley G. Mudd Library (1869)

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Beloit College Col. Robert H. Morse Library (1888)

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University of Wisconsin-Eau Claire William D. McIntyre Library (1951)

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Rebecca J. Pardee, Editor

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