Publications of the National Institute of Standards and Technology
1992 Catalog
The National Institute of Standards and Technology was established in 1988 by Congress to “assist industry in the development of technology . . . needed to improve product quality, to modernize manufacturing processes, to ensure product reliability . . . and to facilitate rapid commercialization . . . of products based on new scientific discoveries.”

NIST, originally founded as the National Bureau of Standards in 1901, works to strengthen U.S. industry’s competitiveness; advance science and engineering; and improve public health, safety, and the environment. One of the agency’s basic functions is to develop, maintain, and retain custody of the national standards of measurement, and provide the means and methods for comparing standards used in science, engineering, manufacturing, commerce, industry, and education with the standards adopted or recognized by the Federal Government.

As an agency of the U.S. Commerce Department’s Technology Administration, NIST conducts basic and applied research in the physical sciences and engineering, and develops measurement techniques, test methods, standards, and related services. The Institute does generic and precompetitive work on new and advanced technologies. NIST’s research facilities are located at Gaithersburg, MD 20899, and at Boulder, CO 80303. Major technical operating units and their principal activities are listed below. For more information contact the Public Inquiries Desk, 301-975-3058.

**Office of the Director**
- Advanced Technology Program
- Quality Programs
- International and Academic Affairs

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- Standards Services
- Technology Commercialization
- Measurement Services
- Technology Evaluation and Assessment
- Information Services

**Materials Science and Engineering Laboratory**
- Intelligent Processing of Materials
- Ceramics
- Materials Reliability
- Polymers
- Metallurgy
- Reactor Radiation

**Chemical Science and Technology Laboratory**
- Biotechnology
- Chemical Kinetics and Thermodynamics
- Analytical Chemical Research
- Process Measurements
- Surface and Microanalysis Science
- Thermophysics

**Physics Laboratory**
- Electron and Optical Physics
- Atomic Physics
- Molecular Physics
- Radiometric Physics
- Quantum Metrology
- Ionizing Radiation
- Time and Frequency
- Quantum Physics

**Manufacturing Engineering Laboratory**
- Precision Engineering
- Automated Production Technology
- Intelligent Systems
- Manufacturing Systems Integration
- Fabrication Technology

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- Law Enforcement Standards
- Electricity
- Semiconductor Electronics
- Electromagnetic Fields
- Electromagnetic Technology
- Optoelectronics

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- Building Materials
- Building Environment
- Fire Safety
- Fire Science

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

**Computing and Applied Mathematics Laboratory**
- Applied and Computational Mathematics
- Statistical Engineering
- Scientific Computing Environments
- Computer Services
- Computer Systems and Communications
- Information Systems

1 At Boulder, CO 80303.
2 Some elements at Boulder, CO 80303.
Publications of the National Institute of Standards and Technology
1992 Catalog

Debby King, Editor

Office of Information Services
National Institute of Standards and Technology
Gaithersburg, MD 20899

Issued March 1995

U.S. Department of Commerce
Ronald H. Brown, Secretary

Technology Administration
Mary L. Good, Under Secretary for Technology

National Institute of Standards and Technology
Arati Prabhakar, Director
## CONTENTS

About the National Institute of Standards and Technology .......................................................... inside front cover

Catalog structure and use .................................................................................................................. iv

Availability and ordering information ............................................................................................. iv

NIST publications announcements ............................................................................................... 1

Indexes
   Personal author ............................................................................................................................... PA-1
   Keyword ........................................................................................................................................ KW-1
   Title ............................................................................................................................................. TI-1
   NTIS order/report number ............................................................................................................ OR-1

Appendixes
   A  List of depository libraries in the United States ........................................................................ A-1
   B  List of district offices of the U.S. Department of Commerce .................................................. B-1

Order forms ........................................................................................................................................ F-1

NIST technical publications program ............................................................................................ inside back cover

NTIS subject categories ................................................................................................................... back cover
CATALOG STRUCTURE AND USE

Full bibliographic citations including keywords and abstracts for National Institute of Standards and Technology (NIST) papers published and entered into the National Technical Information Service (NTIS) collection are cited in the “NIST Publications Announcements” section of this catalog. (Also included are papers published prior to 1992 but not reported in previous supplements of this annual catalog.) Entries are arranged by NTIS subject classifications which consist of 34 broad subject categories (see back cover) and over 350 subcategories. Within a subcategory, entries are listed alphanumerically by NTIS order number.

Four indexes are included to allow the user to identify 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.

Papers may also be identified by searching the NTIS database either online via commercially available systems such as DIALOG, 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 NIST 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) should be ordered by these numbers. GPO will accept payment by check, money order, VISA, MasterCard, or deposit account. For availability and price, write to the GPO or telephone (202) 783-3238. Should a NIST 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, MasterCard, or deposit account. NTIS is the sole source of Federal Information Processing Standards (FIPS), Interagency Reports (IRs), and Grant/Contract Reports (GCRs). For more information call (703) 487-4650.

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 NIST 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 NIST publications (see inside back cover for a description of the various NIST 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

MANUFACTURING TECHNOLOGY

Computer Aided Design (CAD) 200,822
PB92-205434 PC A03/MF A01
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Automated Production Technology Div.
Automated Compensation of Part Errors Determined by In-Process Gauging.
K. W. Yee, H. T. Bandy, J. Boudreaux, and N. D. Wilkin. Jun 92, 22p
NISTIR-4854

Keywords: *Computer aided design, *Components, *Error correcting devices, Machine tools, Real time, Controllers, Automation, Quality control, Cutting.

An automated method for compensation of part errors determined by in-process gauging using a real-time error corrector (RTEC) is demonstrated. Fast-probing using a touch-trigger probe is used for the on machine gauging. Probing points are interactively selected on a computer-aided design (CAD) program display of the part outline. The numerical control (NC) program to probe the part is automatically generated and downloaded to the machine-tool controller. Errors, deviation from nominal dimensions, in a semifinish cut are determined and displayed using the CAD program. These errors are used to determine corrections, implemented by the RTEC, which modify the tool path during the finish cut. The system has the capability of reducing errors in the finished part less than to the correction resolution which for the machine used is 4 micrometers.

NTIS Subject Category
NTIS Subcategory
NTIS order number Availability Price Codes
Corporate or performing organization

Report Title
Personal authors Report date Page count

Report Number
Contract or grant number

Keywords: * indicates keyword index entry

Abstract

PROJECTS & PROGRAMS

Management Information Systems
200,001 PB92-144992 Not available NTIS
National Inst. of Standards and Technology (CISL), Gaithersburg, MD. Systems and Software Technology Div.
Designing Multimedia Systems for Museum Objects and Their Documentation.
Keywords: *Museums, *Management information systems, Records management, Humanities, Research

Public Administration & Government
200,002 PB92-205467 PC A03/MF A01
National Inst. of Standards and Technology (TS), Gaithersburg, MD. Metric Program.
Recommended Agency Procedures for Implementing Federal Metric Policy.
Final rept. J. B. McCracken, and G. P. Carver. May 92, 18p
NISTIR-4855

Keywords: *Metric system, *Metrication, Government policies, Federal law, State government, Local government, Recommendations, Federal agencies.

Recommendations to assist Federal Agencies in the transition to use of metric units in regulations, data requests, recordkeeping and reporting requirements are presented. Although intended for Federal Agency use, the recommendations may be useful to state and local government agencies and other organizations.

200,003 PB92-217611 PC A05/MF A01
National Inst. of Standards and Technology (TS), Gaithersburg, MD. Office of Information Services.
Special pub. (Final).
K. A. Beal. Apr 92, 80p NIST/SP-825 Also available from Supt. of Docs. as SN003-003-03152-6.


The publication contains the proceedings of NBS/NIST, A Historical Perspective: A Symposium in Celebration of NIST'S Ninetieth Anniversary, held March 4, 1991, at the National Institute of Standards and Tech-
ADDITIONAL INFORMATION & MANAGEMENT
Public Administration & Government

nology. The symposium, co-sponsored by the Standards Alumni Association and NIST, highlighted the NBS/NIST contributions to industry over its 90-year history. The nine papers provide now and interesting insights on significant historical events and personal.


200,004
PB92-222249
PC A06/MF A02

Prepared in cooperation with Internal Revenue Service, Washington, DC. Sponsored by Department of Transportation, Washington, DC.

Keywords: "Metric system, *Metrical, Unit of measurement, Government policies, Planning, "Federal history, Italic, A06"

The report presents an overview of the metric transition planning efforts of federal agencies. It contains summaries of the individual federal agencies' metric transition plans. It includes a set of criteria for evaluating the quality of an agency metric transition plan. Also included is a description of an overall, "aggregated," approach that results when the criteria are applied to the entire federal agency planning effort as though it were a single comprehensive plan. The report is intended for use by federal agencies, as well as by any organizations and individuals whose business-related activities are affected by federal agency programs.

200,005
PB92-238609
PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD. Technology Administration.
Research Considerations Regarding FBI-IAFIS Tasks and Requirements.

R. McCabe, C. Wilson, and D. Grubb. Aug 92, 24p NISTIR-4892

Contract F81-AS1 10-FBI-0001
Sponsored by Federal Bureau of Investigation, Washington, DC.

Keywords: "Identification systems, Identifying, Classifying, Image processing, Neural nets, Artificial, Data bases, Research and development, "FBI(Federal Bureau of Investigation), *Fingerprint"

The FBI is engaged in a revitalization effort of its Identification Division which will include a state-of-the-art Integrated Automated Fingerprint Identification System (IAFIS). To provide the users with the best possible IAFIS system, the FBI has solicited input from various sources. The report is primarily intended to provide a review of the programmatic needs and the directions of technical efforts that the Identification Division should consider. Alternative methods for solving current workload problems are presented. Candidate areas for IAFIS research are examined. Both long and short term suggestions are offered.

Research Program Administration & Technology Transfer

200,006
PB92-166297
Not available NTIS

Final rep. 1991, 80p


The federal government with nearly four hundred laboratories spends about $60 billion dollars each year on research and development. While this research and development is devoted to the missions of government agencies, examples from dozens of these laboratories show the impressive impact of successful technology transfer efforts when industry and laboratories work together. The mechanisms for this transfer vary widely from informal personal and direct interac-

tion to publications, patents, professional societies, and conferences. The National Bureau of Standards finds early and sustained collaborative work with industry to be one of the most successful forms. Some laboratory innovations lead almost directly to prototypes for commercial products, but by far the majority of transfers of technology are imbedded in the know-how or information transfers that enable industry to solve a problem in a timely and cost-effective manner. "The market is an important influence on both the pace and direction of these transfers. Successful technology innovation in industry is fostered by knowledgeable technical personnel who understand the potential of technological change; by a 'friendly' environment that can provide encouragement; by government/industry relations, Development, overlooking, United States, Government/industry relations, Materials, Manufacturing, in-

novation, NSF (National Institute of Standards and Technology). The report presents a brief summary of NIST's strategic outlook for the 1990s. The goal is to make NIST not only the nation's premier measurement laboratory, but also a "user friendly" resource of expertise on the latest technologies-supercconductors, lightwave electronics, high-speed digital communications, biosensors, and artificial intelligence.

200,007
PB92-172154
PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD. Science and Technology: NIST in the 1990s. Special pub. Dec 91, 24p NSTP/SP-828

Color illustrations reproduced in black and white.

Keywords: "Research and development, Technology transfer, Laboratory instrumentation, Technology innovation, NIST (National Institute of Standards and Technology).

The federal government has provided unique opportuni-

ties to bring about changes in US technology research and development. Implementation of its policies, through programs such as the Advanced Technology Program and Cooperative Research and Development Program at the National Institute of Standards and Technology (NIST), is expected to help speed the transfer of technology through innovative programs available to the US business and research community.

Advanced Materials and Processing: The Federal Program in Materials Science and Technology. A Report by the FCCSET Committee on Industry and Technology to Supplement the President's Fiscal Year 1993 Budget. 1992, 69p

Keywords: Federal budgets, Ceramic materials, Composite materials, Magnetic materials, Optical materials, Polymers, Superconductors, Metals, Photonics, *Advanced materials, *AMPP program, Federal agencies.

The goal of the advanced materials and processing program (AMPP) is to improve the manufacture and performance of materials to enhance the nation's quality of life, security, industrial productivity, and economic growth. The AMPP will focus special attention on the interfaces between universities, government laboratories and industry, and on the process of tech-

nology transfer from basic research to application. Continuing input from all parties will be sought and collab-

oration will be fostered through mechanisms such as consortia and cooperative research and develop-

ment agreements. The President's FY 1993 budget in
cudes $182,14 million for materials R&D representing an increase of 10 percent over the FY 1992 base. Spe-

cial emphasis is placed on synthesis and processing, those areas critical to the development of new materi-
als and to the improvement of reliability, cost, and quality of current materials. The budget also increases emphasis on those programs which are aimed at bridging the gap between the innovation of new materials and their application.

200,010
PB92-217579
PC A19/MF A04
National Inst. of Standards and Technology (TS), Gaithersburg, MD. Office of Information Services.


Also available from Supt. of Docs. as SN003-003-03170-4. See also PB91-216531.

Keywords: *Catalogs(Publications), *Bibliographies, Science, Technology, Research, *National Institute of Standards and Technology, US NIST.

The 23rd Supplement to Special Publication 305 contains full bibliographic citations including keywords and abstracts for National Institute of Standards and Technology (NIST) 1991 papers published and entered into the National Technical Information Service (NTIS) data collection. (Also included are NBS/NIST papers published prior to 1991 but not reported in previous supplements.) Four indexes are included to allow the user to identify NBS/NIST papers by personal author, keywords, title, or NTIS/order report number.

General

200,011
PB92-205459
PC A03/MF A01
National Inst. of Standards and Technology (TS), Gaithersburg, MD. Metric Program.

Metric America: A Decision Whose Time Has Come - for Real. 1991, 15p

G. P. Carver. Jun 92, 14p NISTIR-4585
See also COM-71-50329.

Keywords: *Metric system, *Metrical, Government policies, Federal law, Government/industry relations, Competition, Economic factors, Marketing, Reviews.

The Metric Conversion Act of 1975 (amended in 1988) and a 1991 Presidential Executive Order provide both the rationale and the mandate for transition to the use of the metric system. Federal agencies are developing and implementing metric transition plans, cooperating on mutual concerns, and working with industry and user groups to establish realistic schedules for change.
ASTRONOMY & AEROSPACE PHYSICS
Test Facilities & Equipment

Astronomy & Celestial Mechanics

200.014
PB92-144526  Not available NTIS
National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Applied Computational Mathematics.
Final rept.

Keywords: Partial differential equations, Canonical transformations, Hamiltonian functions, Harmonic oscillators. Perturbation theory, Dynamics, Isolopy, Reprints, Lissajous transformation, Elliptic oscillators.

A new canonical transformation is proposed to handle elliptic oscillators, that is, Hamiltonian systems made of two harmonic oscillators in a 1-1 resonance. Lissajous variables pertain to the ellipse drawn with a light pen whose coordinates oscillate at the same frequency, hence their name. They consist of two pairs of angle-action variables of which the actions and one angle refer to basic integrals admitted by an elliptic oscillator, namely, its energy, its angular momentum and its Runge-Lenz vector. The Lissajous transformation is defined in two ways: explicitly in terms of Cartesian variables, and implicitly by resolution of a partial differential equation separable in polar variables. Relations between the Lissajous variables, the common harmonic variables, and other sets of variables are discussed in detail.

200.015
PB92-144524  Not available NTIS
National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Lissajous Transformation, 2. Normalization.
Final rept.
A. Deprit, and A. Elpie. 1991, 24p
See also Part 1, PB92-144526 and Part 4, PB92-144542.

Keywords: Hamiltonian functions, Perturbation theory. Dynamics, Isolopy, Reprints, Lissajous transformation, Elliptic oscillators.

Normalization of a perturbed elliptic oscillator, when executed in Lissajous variables, amounts to averaging over the elliptic anomaly. The reduced Lissajous variables constitute a system of cylindrical coordinates over the orbital spheres of constant energy, but the polelike singularities are removed by reverting to the subjacent Hopf coordinates. The two-parameter coupling that is a polynomial of degree four admitting the symmetries of the square is studied in detail. It is shown that the normalized elliptic oscillator in that case behaves everywhere in the parameter plane like a rigid body in free rotation about a fixed point, and that it passes through butterfly bifurcations wherever its phase flow admits non-isolated equilibria.

Food Technology

200.013
PB92-144740  Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Div.
Detecting Irradiated Foods: Use of Hydroxyl Radical Biomarkers.
Final rept.
L. P. Karam, and M. G. Simic. 1988, 3p

Keywords: *Biological indicators, *Hydroxyl radicals, *Irradiated food, Chemical reactions, Water, Gas chromatography, Mass spectrometry, Selectivity, Organic solvents, Oxygen, Tyrosine, Amino acids, Radiation dosage, Reprints.

In the review article of work which has already been published out of the lab, the authors show the use of o-Tyr as a marker for OH radicals, ortho-Tyr, o-Tyro, Typical o-Tyr is produced in biological systems through the interaction of OH with the amino acid phenylalanine. Such OH may be formed through interaction of ionizing radiations with water or via a Haber-Weiss reaction involving organic solvents and O2 metabolism. They have described how several analytical problems were solved in the detection of o-Tyr in chicken meat.

AERONAUTICS & AERODYNAMICS

Test Facilities & Equipment

Agriculture & Food

Food Technology

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Astronomy & Astrophysics

The current evidence for the existence of hot (= \( \sim 10^4 \) K) pre-main-sequence luminous objects is examined. EXOSAT observations of the hybrid star alpha Tauri provide the first X-ray detection of such a system. An X-ray thermal emission measure factor is derived and used to demonstrate that the temperature of the X-ray-emitting plasma is unlikely to be lower than the million degree temperatures made of the interstellar hydrogen column densities toward hybrid stars by using a variety of methods in order to allow interpretation of X-ray observations. The X-ray luminosity of alpha Tauri is calculated. X-ray non-detections of other hybrid stars from EXOSAT and Einstein satellite observations are consistent with their interstellar hydrogen column densities, if the ratio of their intrinsic X-ray to transition region emission line surface fluxes are the same as for alpha Tauri. It now seems that the conceptual model of Linky, in which the higher temperature X-ray plasma is magnetically confined and separated from the outflowing stellar wind, is most likely to correctly represent the physical structure of hybrid star outer atmospheres.

Keywords: *carbon stars, *stellar evolution, *stellar envelopes, *stellar mass ejection, *reprints, *mass loss.

The authors present an integrated model of asymptotic giant branch carbon stars using empirical formulae to allow for nuclear shell burning in the core, dredge-up of heavy elements to the envelope, and mass loss from the surface. The authors emphasize the role of mass loss in the formation of carbon stars. The formation rate of carbon stars, for an assumed constant dredge-up every thermal pulse, is critically dependent on the mass-loss formula. The observed luminosity distribution of AGB stars, the initial-final mass relationship, and carbon-star mass distribution, and the total population of carbon stars can be reproduced by a new proposed mass-loss formula based upon the Reimers formula but with an initial mass dependent etal. For initial masses between 1.25 and 8 solar masses, the best fit is obtained with a carbon dredge-up of about 6% by mass each thermal pulse. The observed data are, however, not consistent with any of the 'supernovae' mass-loss formulae where most of the envelope mass is removed near the end of the AGB. The authors also find that carbon stars primarily descend from a low-mass (< 3 solar masses) population, and hence carbon stars remain oxygen-rich for most of their AGB lifetime.


We report the discovery of another IRAS source (2257+0509) showing the undetected 212 micron emission feature. Its overall energy distribution is similar to the well-known edge-on bipolar nebulae NGC 2264 and AFGL 2591. We used balloon based optical and infrared observations of this object and two other 212 micron sources show that while all three have very similar infrared properties, they differ greatly in the visual region. We suggest that all of these three 212 micron sources are intrinsically similar bipolar nebulae viewed at different orientations.

Keywords: *infrared stars, *optically thin thermal emission.
Meteorological Data Collection, Analysis, & Weather Forecasting

200.023
PB92-221308
National Inst. of Standards and Technology, Gaithersburg, MD. Office of Quality Programs. \(\text{PC A06/MF} \ A02\)

200.032
PB92-170579
Not available NTIS \text{National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Polymers Div.}

200.04
PB92-144443
Not available NTIS \text{National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Polymers Div.}

Physical Meteorology

200.032
PB92-170579
Not available NTIS \text{National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Polymers Div.}

Towards a Quantitative Understanding of Atmospheric Ozone

200.04
PB92-144443
Not available NTIS \text{National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Polymers Div.}

Biomedical Instrumentation & Bioengineering

200.034
PB92-117145
Not available NTIS \text{National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Systems and Software Technology Div.}

User Interface: A Hypertext Model Linking Art Objects and Related Information.

Final rep.
J. Moline, 1991, 16p


Keywords: *information retrieval, *Models, Expert systems, Museums, Databases, Data sources, Prototypes, Knowledge bases(Artificial intelligence), *Nuisimatics, *Art history, Hypertext.

The chapter presents a model combining the emerging technologies of hypertext and expert systems. The information sources used in the model are limited to databases of images (object surrogates and maps), object descriptions, document surrogates (abstracts, references, excerpts), genealogical trees, and time lines of historical events. In addition to hypertext, the model uses an expert system shell to generate new information from data entered at a terminal or imported from a database. Sample uses of the prototype based on the model are studied to determine the range of activities that can be performed. A knowledge base created by the author is limited to Arab numeristics. Nuisimastics work with coins and coin surrogates. These objects contain information that is significant in isolation but that is even more important when aggregated. Further, a wealth of information related to each coin ranging from historical references to analyses by art historians needs to be linked to the specific objects. The prototype developed from the model is used to show how hypertext facilitated the resolution of some specific information needs.
BIOMEDICAL TECHNOLOGY & HUMAN FACTORS ENGINEERING

Biomedical Instrumentation & Bioengineering

The paper reviews recent studies on self-setting calcium phosphate cements (CPC). Discussions are focused on the cement setting reactions, the products formed, the effects of the products on properties of the cement, and in vivo characteristics of CPC. Although cementation can occur in systems based on different pH and ion diffusion data in the literature at present indicate that mixes of tetracalcium phosphate and di-calcium phosphate (or di-calcium phosphate hydrate) may be most desirable because they produce materials that have greater strength and contain nearly pure hydroxypatite. The combination of self-setting capability and high bond strength produces CPC, a unique biomaterial. In its present state CPC appears to be suitable for a number of applications. Much remains to be done to further improve its properties to meet the requirements for different applications.

Keywords: "Dental materials, Composite materials, Dental cements, Sealants, Resins, Reprints, Glass ionomer cements."
The article outlines the authors' perceptions of the future and synthetic scaffold materials such as composites, glass ionomer cements, pit and fissure sealants and laboratory fabricated resin.

200,025
PB92-144906 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Adsortion of Low Molecular Weight Poly(acrylic acid) on Hydroxyapatite: Role of Molecular Association and Apatite Dissolution.
Final rep.
D. N. Misra. 1991, 3p Sponsored by American Dental Association Health Foundation, Chicago, IL.
Keywords: "Dental materials, Surface chemistry, Polyacrylates, Hydrogen bonds, Polymer chemistry, Adsorption, Isolomers, Phosphorus, Calcium, Dissolving, Langmuir frequency, Reprints, Apatite/hydroxyapatite."
Adsorption of low molecular weight poly(acrylic acid) from aqueous solution on hydroxyapatite shows that the initial sorbates reaches, a maximum then decreases, and is irreversible. This is qualitatively explained on the basis of the increasing self-aggregation of polymeric molecules with concentration and the inability of associated molecules to adsorb as their hydrogen-bonding capability is used up. As surface effects decrease with the increase in initial concentration of the acid, the Ca to P ratio in solution rises and eventually reaches the experimental ratio in the apatite. The initial part of the isotherm satisfies the Langmuir plot. The ratio of the geometrical area of the molecule to the area derived from the Langmuir plot is about the same as that obtained by DMarr on the basis of theoretical considerations.

200,026
PB92-165455 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Conservative Residue of the Interface Tissue to Dental Implants.
Final rep.
A. C. Fraker, P. Sung, A. C. Van Orden, and H. Hahn. 1990, 12p See also PB91-194787.
Keywords: "Dental implants, Corrosion, Tissues(Biology), Surface tension, Metals, Cations, Residuals."
The tissue response to a dental implant at the interface depends on many factors, including the implant's surface chemistry, the degree of contamination, the thickness and stability of the passive film, and the surface tension. The implant is a foreign body which must be stable in and tolerated by the host environment. Chemical interactions between the implant and the host environment at the interface, such as metal ion dissolution,  must be kept at a minimum.

200,027
PB92-129450 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Grafting into the Future of Elastic Restorative Materials.
Final rep.
R. A. Stover, F. C. Eichmiller, and W. A. Marenjohn. 1992, 7p Sponsored by American Dental Association, Chicago, IL.
Pub. in Jnl. of the American Dental Association 123, p33-39 May 92.
Keywords: "Computer vision, Visual perception, Motion, Representations, Images, Three dimensional bodies, Invariance, Robotics, Image processing, Coordinates, Cameras, Degrees of freedom."
The paper deals with motion-based image transformations that lead to new representations of 3-D objects for a reclining motion of an observer. In the new representations a stationary environment is kept invariant, or "frozen" in spite of the fact that the images on the retina are continuously changing. Since the 3-D stationary environment is also represented as stationary environment, moving objects can be easily detected and a good estimation of the scene from a long sequence of noisy images can be obtained. Three basic observations which are related to translational motion of an observer led to the new representations. One is that the information about position of space from the camera translational path is kept constant at any instant of time. The second observation is that the relative distance along the translational path between two points is the same at any point in time. The third observation is that points in the image plane move away from the Focus of Expansion (FOE) and towards the Focus of Contraction (FOC). The new representations are basic. All measurements for these representations are available in camera coordinates, only one camera is necessary, and the magnitude of the camera velocity vector need not be known. The mathematics involved is simple, and thus it may be suitable for real time applications.

200,043
PB92-183656 PC A05/MF A01 National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Robot Systems Div.
Quantitative Approach to Looming.
J. D. Raviv. April 1990, 8p See also PB92-183649. Prepared in cooperation with Florida Atlantic Univ., Boca Raton.
Keywords: "Computer vision, Behavior, Mathematical models, Image processing, Motion, Computation, Measurement, Looming, Optical flow, Estimation.
The visual looming effect has been shown to be very important when action is taken. Most existing work on "looming" is qualitative or limited-quantitative. In the paper, the author takes a quantitative approach to understanding "looming." He defines looming mathematically, shows geometrical properties of objects that produce the same value of looming, explains how to measure looming in the general case of motion, how a multiresolution logarithmic retina simplifies the measurement of looming, and how the results can be combined with previous work on visual fields. He suggests a new representation of space based on looming and the so-called Equal Flow Cycles (EFCs).

Human Factors Engineering

200,042
PB92-171024 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Gas and Particulate Science and Technology Division.
Mass Ingestion and Fit Monitoring: Present and Future.
Final rept.
R. A. Fletcher, R. M. Verkouteren, and J. R. Miller. 1989, 5p Sponsored by Department of the Army, Washington, DC.
Keywords: "Protective masks, "Chemical warfare, Acrosol, Reprints, "Fit testing.
A summary of and projected needs for future work in gas mask fit testing and fit monitoring is presented.

BIODATA TECHNOLOGY & HUMAN FACTORS ENGINEERING

Building Industry Technology

Architectural Design & Environmental Engineering

200,043
PB92-154533 Not available NTIS

6
National Inst. of Standards and Technology (CAML), Gaithersburg, MD.

ZIP 2.0: The Enhanced Zip Code Insulation Program.
Final rept.


ZIP 2.0, the enhanced Zip Code Insulation Program, determines economic levels of thermal insulation for new and existing houses in any location in the United States, given the first three digits of its zip code. Economic insulation levels are calculated for attics, cathedral ceilings, exterior walls, floors over unheated areas, slab floors, basement and crawlspace walls, ductwork in unconditioned spaces (attics and crawlspace), and water heaters. Local climate data and default insulation costs and energy prices are retrieved from data files on the ZIP disk. The user can enter site-specific data, such as energy prices, heating and cooling system types and approximate efficiencies, and other parameters to customize the calculations for a specific house.

200,044
PB92-159532 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Building Environment Div.
Numerical Simulation of the Performance of Building Ventilation Systems.
Final rept.
J. B. Fang, and R. A. Grot. 1990, 6p.


Mathematical modeling is performed for three-dimensional turbulent buoyant flows emerging from an air diffuser in an air-conditioned, ventilated room subject to diverse supply air velocities. The velocity and temperature distributions of air in the room are calculated, and the calculated results are found to be in reasonable agreement with published experimental observations.

Calculations show that the predicted ADPI values generally are found to be consistent with the calculated experimental values. It is reasonable to apply the numerical modeling techniques and practical use in the prediction of various air-conditioned room environments and the design of building ventilation systems.

200,045
PB92-160043 Not available NTIS National Inst. of Standards and Technology (NREL), Gaithersburg, MD. Building Environment Div.
Effect of Building Envelopes on Cooling Loads Due to Lighting.
Final rept.
Sponsored by Department of Energy, Washington, DC.


The interaction between the building envelope and lighting and HVAC systems is examined based on full-scale measurements and computer modeling of a lighting system. Testing of cooling loads due to lighting, in particular peak cooling loads during transient operation of the lighting system, are influenced by the nature of the external environment and heat storage characteristics. Variations in building envelope performance and exterior conditions can affect both lighting system performance and cooling load due to lighting.

200,046
PB92-170851 Not available NTIS National Inst. of Standards and Technology (BFRIL), Gaithersburg, MD. Building Environment Div.
Thermophysical Properties of Building Insulation Using an Encapsulated Bead Thermistor: Applications to Liquids and Insulation Materials.
Final rept.


A technique for simultaneously measuring thermal conductivity and thermal diffusivity was evaluated for applications with insulation materials and liquids. The thermophysical properties are determined from a single, transient measurement. The measurement apparatus employs an encapsulated bead thermistor as the sensing probe. The results from using a glass-encapsulated and a teflon-encapsulated bead thermistor are described.

200,047
PB92-170992 Not available NTIS National Inst. of Standards and Technology (NREL), Gaithersburg, MD. Building Environment Div.
Final rept.

Keywords: *Ventilation, *Mathematical models, *Turbulent flow, Diffusers, Air flow. Three dimensional flow, Temperature distribution, Numerical analysis, Environmental effects, Reprints.

Numerical modeling is performed for three-dimensional turbulent buoyant flows emerging from an air diffuser in an air-conditioned, ventilated room. The velocity and temperature distributions of air in the room are calculated, and the calculated results are found to be in reasonable agreement with published experimental observations. Calculations of Air Diffusion Performance Index (ADPI) for a sidewall grille and a return air grille in a room with specified heating loads are carried out for different flow rates of air supply. The predicted ADPI values are found generally to be consistent with the corresponding experimental values. It is reasonable to apply the numerical modeling technique for practical use in the prediction of various air-conditioned room environments and the design of building ventilation systems.

200,048
See also PB91-506586, PB91-507194, and PB91-167268. Sponsored by Public Buildings Service, Washington, DC.

Keywords: *Buildings, *Design criteria, *Human factors engineering, Productivity, Personnel, Workplace layout, Economic analysis, Life cycle costs.

Since employee salaries far exceed building costs, higher employee office tasks that enhance productivity may make economic sense. A method for including productivity benefits in building economic analysis could provide greater policy decision support, by reducing the uncertainty of design alternatives. Two suitable economic methodologies are the net benefits method and the multi-attribute decision analysis method. The methods and their data requirements are described. Each is illustrated with a hypothetical case application. The methods are compared to other methods to set a evaluation criteria, including with life-cycle cost analysis, ease of use, data requirements, and form of results. Based on these analyses, the net benefits method is recommended as most appropriate for including employee productivity in building economic analysis.

200,049


This is the student's Manual for an intensive two-day course on how to use life-cycle costing and related economic methods to make cost-effective decisions in designing and retrofitting Federal buildings for energy conservation. The manual is designed to serve as an in-class workbook and as a source for later reference and review. It contains 10 learning modules the mastery of which will satisfy the course's goal of enabling national, institutional building professionals to take into account long-run economic consequences of their decisions. The course has three main goals: (1) to instruct Federal designers, Office of Design and Construction Engineers, who are using life-cycle cost analysis for making decisions affecting energy consumption in Federal buildings; (2) to instruct Federal project managers, and others who are involved in Federal projects in evaluating projects according to Federal requirements, and (3) to provide members of the building community, large and small, with tools, and data for evaluating energy conservation and renewable energy projects in residential, commercial, and institutional buildings.

200,050
PB92-181221 PC A03/MF A01 National Inst. of Standards and Technology (BFRIL), Gaithersburg, MD. Building Environment Div.
Formal Analysis of the BACnet MS/TP Medium Access Control Protocol.

Keywords: *Buildings, *Automation, *Control systems, *Protocols, *Computer communications, Computer networks, Models, **CMSV(Multiplexing Machines with Shared Variables), MAC(Medium Access Control).

BACnet, a draft standard communication protocol for building automation and control systems, contains provisions for physical and data link layer protocols. One option is to use an EIA-485 physical layer combined with an RS-485 data link layer. The BACnet MS/TP medium access control protocol which was specifically designed for BACnet. The paper presents a formal model of the MS/TP protocol using the technique of communicating machines with shared variables. Using the model, the protocol is analyzed and shown to be dead-lock free. It is also shown that if a controller has a message to send it will eventually be transmitted.

200,051
PB92-187079 PC A06/MF A02 National Inst. of Standards and Technology (BFRIL), Gaithersburg, MD. Building Environment Div.
See also PB88-170006 and PB89-136295.


The interaction of building lighting and HVAC systems, and the effects on cooling load and lighting system performance, are being evaluated using a full-scale test facility at the National Institute of Standards and Technology. The results from a number of test configurations are described, including lighting system efficiency and cooling load due to lighting. The effect of lighting and HVAC system design and operation on performance is evaluated. Design considerations are discussed.
BUILDING INDUSTRY TECHNOLOGY
Architectural Design & Environmental Engineering

200.052
PB92-213321 PC A03/MF A01
National Inst. of Standards and Technology (BFRIL)
Gaithersburg, MD
Prototype Simulated Daylighting Design Tool.
S. J. Triado, and P. J. Goodin.
Jul 92, 23p NISTIR-4295.
See also PB83-240481 and PB90-149253.

Keywords: **Daylighting, Energy conservation, Cooling load, Energy consumption.**

The report describes a prototype simulated design tool which has been developed to provide information for developing effective building fenestration systems. A computer software prototype was developed to search through and select the best available fenestration designs from a large database of previously simulated buildings. Fenestration designs can be selected based on energy usage, energy cost or peak loads. The determination of fenestration energy costs is discussed. The design tool is primarily intended for commercial, industrial or institutional buildings of any type.

200.053
PB92-236728 Not available NTIS
National Inst. of Standards and Technology (BFRIL)
Gaithersburg, MD. Building Environment Div.
Thermal Performance of Residential Electric Water Heaters Subjected to Various Off-Peak Schedules.
Final rep.
A. L. Fanney, and B. P. Dougherty.
Sep 92, 10p
Sponsored by Department of Energy, Washington, DC.

Keywords: **Water heaters, Electric appliances, Electric power demand, Thermal efficiency, Residential buildings, Tests, Reprints.**

A number of electric devices use residential water heaters for reducing electrical demand. A water heater used in this manner is typically called an off-peak water heater because resistive heating is unrestricted during utility off-peak periods. During on-peak periods, by comparison, the utility seeks to limit and delay resistive water heating. Laboratory tests, where the off-peak and on-peak water draw schedule were varied, were conducted on two residential storage water heaters. A computer model of an electric water heater was developed and validated. The laboratory tests and the model were used to quantify the effect that various off- and on-peak and hot water draw schedules have on water heater thermal efficiency. Thermal efficiency was found to vary up to 7% for water heaters which met the 1991 minimum efficiency standards as specified within the National Appliance Energy Conservation Act. The energy factor, as measured in the Department of Energy Test Procedure for Water Heaters, was found to be independent of the off-peak schedule because of a "normalizing" that occurs as part of the calculation procedure.

200.054
PB93-113595 PC A03/MF A01
National Inst. of Standards and Technology (BFRIL)
Gaithersburg, MD
Study of Ventilation Measurement in an Office Building.
W. S. Dols, and A. K. Persily.
Oct 92, 43p NISTIR-4035.
Sponsored by Bonneville Power Administration, Portland, OR.

Keywords: **Office buildings, Ventilation, Air infiltration, Air exchange, Air flow measurement techniques, Tests, Graphs (Charts), Carbon dioxide.**

The major findings of the study are as follows. Airlow rates were measured in the air handling system ductwork using pilot tube, hotwire anemometer, and vane anemometer airflow measurement techniques. The use of CO2 detector tubes yielded unreliable results. Reliable determinations of ventilation rates per person were made based on on-site carbon dioxide and airflow measurement techniques but the use of peak CO2 concentrations led to inaccuracies, i.e., the overprediction of ventilation rates by as much as 100%. The measured values of the whole building air change rates, and their dependence on outdoor air temperature, did not change significantly over a three year period. The minimum air change rates were above the building design value and the ASHRAE Standard 62-1981, the standard on which the design was based, but the carbon dioxide levels were below the minimum recommendation given in Standard 62-1989. The whole building air change rate under minimum outdoor air intake conditions was determined to be twice the outdoor air intake rate provided by the minimum outdoor air intake fans. The additional air change rate with simultaneous low intake conditions was due primarily to leakage through the main outdoor air intake dampers.

200.055
PB93-135424 Not available NTIS
National Inst. of Standards and Technology (BFRIL)
Gaithersburg, MD.
Relation of CO2 Concentration to Office Building Ventilation.
Final rep.
Sep 92, 16p
Sponsored by Department of Energy, Washington, DC.
Pub. in ASTP 106/7, p77-92 1990.

Keywords: **Office buildings, Ventilation, Carbon dioxide, Indoor air quality, Air infiltration, Concentration ratio, Tracer techniques, Indoor air pollution, Concentration (Composition), Reprints.**

Tracer gas techniques have been used to study air exchange in many office buildings for many years. The analysis of the concentration of carbon dioxide generated by building occupants has been used as an alternate means of evaluating building air exchange and ventilation system performance. Various techniques for CO2 analysis have been proposed. These include measuring the decay rate of CO2 concentration after the occupants leave the building, analyzing real-time CO2 concentration data in conjunction with a mass balance equation, and using instantaneous CO2 concentration readings to directly determine air exchange rates. Local CO2 concentration models have been suggested as specific assumptions and unique conditions in order to yield reliable information on building air exchange characteristics, and the requirements may not always be met in office buildings. This paper discusses the relationship between CO2 concentration data and building air exchange.

200.056
PB92-148295 PC A07/MF A02
Dayton, OH.
Modifications to Furniture Fire Model for HAZARD SYSTEM.
Final rep.
1990-91
M. A. Deitenberger.
Oct 91, 127p UDR-TR-91-126, NIST/GCR-92/601
Grant NIST NABD OD1051
See also PB98-218366 and PB91-206664. Sponsored by National Inst. of Standards and Technology (BFRIL), Gaithersburg, MD.

Keywords: **Fires, Furniture, Computerized simulation, Mathematical models, Burning rate, Combustion, Buildings, Fire resistant materials, Fire tests, FAST/FFM computer program.**

The report describes the work accomplished during the period from 31 July 1990 through 31 July 1991 by the University of Dayton Research Institute under grant number 60NAODOD1051 for the National Institute of Standards and Technology furniture fire model (FFM) for inclusion in the HAZARD SYSTEM required three major tasks: (1) comparison of the FFM/FM predicted with standard fire test bums measured in the furniture calorimeter, (2) development of an algorithm for personal computers to calculate flame and smoke spread parameters, and (3) conversion of FFM to a Flame Spread Model (FSM) for a single panel. The code was implemented on the PC for use with the HAZARD SYSTEM. The applications included compartmentation, structural fire resistance, ignitability of a secondary combustible item, and room flashover studies.

200.057
PB92-164771 PC A04/MF A01
National Inst. of Standards and Technology (BFRIL)
Gaithersburg, MD.
The Measurement of the People Movement Time for Elevator Evacuation.
J. H. Kline, and D. M. Alford.
Feb 92, 68p NISTIR-4789.

See also PB84-118397 and PB87-237771. Sponsored by Public Buildings Service, Washington, DC.

Keywords: **Fires, Buildings, Elevators, Evacuation, Evacuating (Transportation), Safety engineering, Human factors engineering, Computer application.**

The paper is a part of a project sponsored by the U.S. General Services Administration (GSA) to study occupant use of elevators during building evacuations. A detailed method of analysis of people movement by elevators during emergency building evacuation is presented including the time for people to enter and exit elevators and the equations of elevator car motion, also a computer program for people movement during elevator evacuation and examples. Runs of this are listed in appendices. The method and computer routine presented in this paper are intended to be used in a later part of the GSA elevator project to help study the feasibility of elevator fire evacuation.

200.058
PB92-165471 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Measurement and Research Laboratory.
Stopping Cigarette- Initiated Fires: Can It Be Done. Final rep.
J. D. Petersen, and M. D. McGiboney.
1988, 5p.
See also PB90-241480.
Pub. in International Connections 2, n5 p17-21 Sep/Oct 88.

Keywords: **Ignition, Fire, Flammbility, Cigarette, Fire tests, Combustion, Heat transfer, Reprints.**

A Congressionally-mandated three-year study on the feasibility of less fire-prone cigarettes has been completed. The conclusions are that is technically feasible and may be commercially feasible to develop cigarettes that will have a significantly reduced propensity to ignite upholstered furniture or mattresses. Furthermore, the overall impact on other aspects of the United States society and economy may be minimal. A small amount of work remains, notably the development of a valid test method for ignition propensity of a cigarette. The Congress is currently considering further legislation.

200.059
PB92-205384 PC A04/MF A01
National Inst. of Standards and Technology (BFRIL)
Gaithersburg, MD.
Influence of Ignition Source on the Flaming Fire Hazard of Upholstered Furniture.
Jun 92, 72p NISTIR-4847.

Keywords: **Fire hazards, Upholstery, Ignition, Furniture, Houses, Calorimeters, Cigarettes, Smoke, Detectors.**

A set of upholstered chairs constructed from five different fabric/foam combinations was subjected to a variety of ignition sources suggested by fire statistics. The sources included a cigarette, a small match or lighter, a railroad lantern, a space heater, and a large flame source (CTB 133 equivalent gas burner). The tests were performed in a furniture calorimeter at the maximum reproduction rates. The results from the tests show that the ignition hazard posed by the different ignition scenarios did not predict when a working smoke detector was present. When a detector was present, the results from the ignited scenarios considered confirm the importance of a low peak heat release rate and a slow rate of rise to lessen the hazard of upholstered furniture fires.
Final rep.  
Keywords: *Elevators(Lifts), *Evacuation, *Fire safety, *Smoke, Handicapped persons, Emergencies, Fire tests, Pressurizing, Buildings, Fires, Reprints, Piston effect.  
A joint U.S./Canadian project was undertaken to evaluate the potential impact of the pressurization of the handicapped during a fire. The project consisted of conceptual studies, full-scale fire experiments, and theoretical analysis. This paper summarizes the findings that are relevant to the design of smoke control systems for elevators. A methodology of dealing with elevator piston effect is discussed. Elevator piston effect is the transient pressures produced by elevator car motion, and this effect depends on air temperature, fire loading, building layout, and hoistway size. All other things being equal, piston effect is considerably greater for single-car hoistways than for multiple-car hoistways. Different approaches for dealing with the pressure fluctuations due to the opening and closing of building doors are presented. An approach to the fire door design analysis is presented with example analyses of different elevator smoke control systems. Results indicate that many types of elevator door designs can be designed to provide acceptable levels of pressurization even under severe conditions of doors opening and closing.

200,061 PB92-238641 PC A04/MF A01 George Mason Univ., Fairfax, VA.  
Human Factors Considerations in the Potential for Using Elevators in Building Emergency Evacuation Plans.  
Contract SENVB16527  
See also PB93-130458 and PB92-187129. Sponsored by National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.  
If elevators could be used in fire emergencies, the safety of building occupants with mobility limitations could considerably improve. However, at the time when the occupants to evacuate might be reduced. The report covers a study of human factors considerations related to the possibility of using elevators for evacuation in fires. It covers the selection of the fundamental approach to organizing elevator evacuations for specific buildings; the coordination and direction of the evacuation; the decision-making, information and communication needs to permit a coordinated evacuation and the documentation, training and requirements to permit a proper implementation of the fire emergency plan.

200,062 PB92-238682 PC A03/MF A01 National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.  
J. R. Lawless. Aug. 92, 35p NISTIR-4799  
See also PB90-154626. Sponsored by Carpet and Rug Inst. Dept., GA  
Keywords: * Carpets, * Test methods, * Flammability testing, Heat flux, Ignition, Floor coverings, Flame propagation, Fire tests, Standards, Precision, *ASTM E648-91A.  
The primary goal of the project was to develop data to be used in writing a precision statement for the newly revised ASTM E 648 test procedure. Revisions to the standard included the use of a new line pilot burner, improved detector of flow rate, addition of an extended chamber equilibration time before the apparatus is calibrated. An interlaboratory test program was conducted to develop the precision data. In the course of the study, seven laboratories performed tests on seven sets of flooring materials. Six carpets and one resilient flooring material were selected for the evaluation. The experimental procedure was followed and each carpet sample was identified using procedures recommended in ASTM E 691 standard on interlaboratory studies. Results from the program show that for the test substrate, the critical radiant flux is 10.7 percent. Two carpet samples have been identified. A large variation in test results for two carpet products appears to be associated with carpet non-uniformity. Recommendations are made for research to develop an understanding of the variations associated with the specific style of carpeting.

200,063 PB93-125052 PC A03/MF A01 Hughes Associates, Inc., Columbia, MD.  
C. L. Beyler. Jul 89, 24p NIST/GCR-92-618  
Contract 14PB-92255  
Sponsored by National Inst. of Standards and Technology, Gaithersburg, MD. Technology Administration.  
The paper reviews the furniture fire model and the documentation of the model in terms of its adequacy, accuracy, generality, and validity. Individual elements of the model are assessed as well as the overall modeling approach. Serious deficiencies in the model are identified which make it of little value in its present form. Many of the submodels used have not been validated by comparison with literature data, and these submodels differ substantially from well accepted methods in the literature. This brings into question the correctness of the model and its relation to the state of the art. The model has a large number of inputs which are not determined by definite procedures. The documentation of the model is highly fragmented and incomplete. These attributes seriously compromise the validity and usefulness of the model. Extensive work would be required to make the model useful in hazardous evaluations. These include extensive validation of submodels, evaluations of the adequacy of the overall program including experimental and numerical experiments. and a revision of methods for developing the inputs required.

200,064 PB93-125060 PC A08/MF A02 National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.  
Computer Model of the Smoldering Ignition of Furniture.  
H. E. Miller, and G. Walton. Sep. 92, 103p NISTIR- 4973  
The paper describes a user-friendly computer model, TMS/SPUB2. The model calculates the temperature field throughout the test sample which can undergo exothermic pyrolysis, when it is exposed to an arbitrary (localized) heat flux which can move uniformly, radially, or at a constant gradient. TMS/SPUB2 has successfully simulated the thermal runway signifying smoldering ignition of the substrate when it is exposed to a constant external heating flux. The process is taken into consideration are three-dimensional heat conduction in the substrate, pyrolysis of the latter, and the diffusion of air into it at the top surface. TMS/SPUB2 takes into account the fact that the substrate consists of two layers (a foam pad covered by a fabric), with the possibility of an air gap between them, up to three pyrolytic reaction steps, and with temperature-dependent thermophysical constants. TMS/SPUB2 solves the differential equations describing the physics and chemistry of the heating and ignition process numerically, the results have been compared with a set of ignition experiments, and have been found to be semi-quantitatively correct, both for the ignition temperature and for the time to ignition. Analysis of the experiments indicates that the substrate, which consists of a thin fabric layer over a thick foam binder behaves as a thick thermally thin layer. Use of TMS/SPUB2 shows that smoldering ignition would result from a stationary hot spot of intensity and dimension simulating a quitely smoldering cigarette. A users' guide is included.

200,065 PB93-125597 Not available NTIS National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Measurement and Research Div.  
Characterization of the California Technical Bulletin 133 Ignition Source and a Comparable Gas Burner.  
Final rep.  
Keywords: * Chairs, * Flammability testing, * Ignition, Burning rate, Fire tests, Flammability, Calorimeters, Gas burners, Standards, Test methods, Fabrics, Furnitu re, Test facilities, Reprints.  
The California Bulletin (CB) 133 upholstery fire source is based on the use of crumpled newspaper. The present work examined the reproducibility of several apparatus this source was used to place on an inert chair mock-up. The tendency of this source to heat the side arms of a chair, the area of the seat back subjected to high heat exposures, and the duration all showed substantial variability. For inherently lesser variability a gas burner is preferred. A gas burner, derived from that developed at the British Fire Research Station, was shaped so as to deposit a similar pattern of heat to that of the CB 133 source. The two sources were tested for comparability both on chair mock-ups and on full-scale chairs made from a wide variety of materials. The results indicate that the gas burner, as used here, is a somewhat less severe ignition source than the CB 133 igniter.

200,066 PB93-125598 Not available NTIS National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Science and Engineering Div.  
Chair Burns in the TB133 Room, the ASTM Room, the Furniture Calorimeter and the Cone Calorimeter.  
Final rep.  
Keywords: * Fire tests, * Chairs, * Upholstery, Fire hazards, Calorimeters, Test facilities, Burning rate, Combustion, Furniture, Mathematical models, Fabrics, Standards, Test methods, Reprints.  
Ten sets of upholstered chairs were tested in the California Technical Bulletin 133 (TB133) room, in the proposed ASTM room and in the NIST furniture calorimeter. The chairs varied only in the type of fabric, type of foam, and whether or not there was a fiberglass interliner present. The rooms were instrumented to measure the total heat release rate of the chairs. A relationship was established between the peak heat release rate in the rooms and the temperature rise 25 mm below the ceiling above the chair. The combinations of fabric, fiberglass interliner, and foam were also tested in the Cone calorimeter. A correlation of the full scale and bench scale results for these set of chairs was obtained. The authors reported that the temperature rise in the room, using Hazard I and the measured heat release rates.  

Building Standards & Codes  

200,067 PB92-159615 Not available NTIS National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
BUILDING INDUSTRY TECHNOLOGY

Building Standards & Codes

United States Standards and Building Regulations: Problems and Opportunities for International Trade
Final rept.

Keywords: *Building codes, *International trade, Design standards, Certification, Construction, Tests, Regulations, Reprints, European Community.

The paper will outline the United States building standards and regulatory system including testing and certification. Comparisons with the European community '92 developments will be drawn. The paper will address the consensus process for the development of standards, organizations involved in the building standards development, and their relationship to regulating building construction. The methods and participatory and enviroveing regulations will be reviewed. Actions which the United States should take to accommodate international commerce will be shared.

PB92-160050 Not available NTIS
National Inst of Standards and Technology (BFRIL), Gaithersburg, MD. Building and Fire Research Lab. Office.
Research for Standards and Conformity Assessment.
Final rept.

Keywords: *Building codes, *Standards, Design standards, Tests, Regulations, Construction materials, Technology transfer, Certification, Reprints.

Standards are a major mechanism for communication between buyers and sellers of building products and services and the basis for regulations protecting public health, safety and welfare. Therefore, standards provide a valuable vehicle for the transfer of knowledge from research to building practice. Research for standards includes research to improve the performance of building products and services, and research to improve the development and use of standards and regulations. Trends for research for standards and conformity assessment are described in the context of U.S. and international activities.

PB92-165539 Not available NTIS
National Inst of Standards and Technology (BFRIL), Gaithersburg, MD. Center for Building Technology. Codes, Standards, and Institutions: Pressures for Change.
Final rept.

Keywords: *Building codes, *Standards, Construction industry, International trade, Product development, United States, European communities, Regulations, Certification, Reprints.

Understanding the U.S. building regulatory system and the roles of standards and their development organizations is essential to the introduction of new products or practices against the backdrop of the building regulatory system. U.S. practices for development and enforcement of building standards and codes are described with an emphasis on the process for the introduction of new products or practices. The paper reviews current and near-future expected changes in the international construction market for products and services. The importance of standards as a basis for regulations, contracts, and quality-assurance systems is discussed. A review of building and construction standards and their development and use in the United States is covered, including product approval as supported by laboratory acceptance and certification. The European EC '92 programs, the development and use of international standards, and related certification and testing programs are reviewed.

PB92-171834 Not available NTIS
National Inst of Standards and Technology (BFRIL), Gaithersburg, MD. Building and Fire Research Lab. Office.
Activities of the Interagency Committee on Seismic Safety in Construction.
Final rept.
R. N. Wright. 1991. 7p
Sponsored by Federal Construction Council, Washington, D.C.


Keywords: *Building codes, *Earthquake engineering, Site occupancy, Design standards, Seismic resistance, Earthquake maps, Earthquake resistant structures, Earthquake resistance, Reprints.

The Intercagency Committee on Seismic Safety in Construction (ICSSC) assists federal agencies involved in construction to develop and incorporate earthquake hazards reduction measures in their ongoing programs. ICSSC proposed an executive order for seismic safety in construction that became the basis for Executive Order 12699, 'Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction,' dated January 5, 1990. The National Earthquake Hazards Reduction Program Reauthorization Act of October 20, 1990, calls for ICSSC to provide standards for existing federal and federally assisted buildings by 1994. ICSSC will participate in cooperative activities with the private sector to develop nationally recognized standards suitable for federal use in the assessment of the seismic resistance of existing buildings and the strengthening of those inadequately resistant.

PB92-173012 PC A19/MF A04 National Inst of Standards and Technology (BFRIL), Gaithersburg, MD.
HVC Functional Inspection and Testing Guide.
See also PB91-216697. Sponsored by General Servs Administration, Washington, DC.

Keywords: *Specifications, *Federal buildings, *Space Heating, Ventilation, Air Conditioning (HVAC) equipment and systems prior to their acceptance. Functional inspection and testing used herein refers to those actions necessary to verify system performance and operating conditions. Commissioning process is defined by ASHRAE in ANSI/ASHRAE 1-1988 'Guideline for Design and Testing of HVAC systems operated in conformity with the design intent. The process starts at the pre-design phase and goes through the design phase, the construction phase, the functional performance tests of installed equipment, sub-systems and complete systems before acceptance, and ends with the post acceptance phase.

PB92-196602 PC A16/MF A03 National Conference on State Building Codes and Standards, Inc., Herndon, VA.
Seismic Provisions of State and Local Building Codes and Their Enforcement.
Final rept.
May 92, 364p NIST/GCR-91/599
Contract DCN-84-2674-A.

Keywords: *Building codes, *Earthquake resistant structures, *Seismic design, State government, Regulations, Local government, Surveys, Earthquake engineering, Site occupancy, Earthquake resistant structures, Earthquake resistance, Reprints.

The report provides technical and administrative information on the status of seismic design and construction provisions adopted by state and local jurisdictions and their enforcement. Federal agencies must determine if state and local design and construction standards and practices provide adequate seismic safety when considering where to design and build Federal facilities in the United States. The document presents a compilation and summarization of building codes and seismic design and enforcement data on the 50 states, the three U.S. territories, 186 of the largest local jurisdictions (all cities over 100,000 in population), and 1,164 other units of local government (county/city). The methodology for selecting the points of contact is explained in detail in Appendix A. In short, the contacts were selected based on the prevalence and seismic risk. All states had a minimum of five contact points; each of the three U.S. territories constitute one contact, and each of the 186 largest local units constitute one contact. Twelve states had only the minimum five contact points since they were located entirely in Seismic Map Areas 1 and 2 (low seismic risk). Five states with relatively high population had areas located higher than Map Area 3 and were, therefore, allocated an additional contact point for each 500,000 of total state population. Sixteen states with higher populations, but with no areas higher than Map Area 3, were allotted an additional contact for every county in Map Area 3 with a population over 25,000. Additional contacts were then made in the metropolitan areas surrounding the 186 major cities if located in Map Areas 2 and 3. The remaining contact points were made in the U.S. counties that are located in Map Areas 4 through 7 according to a formula based on the seismic risk of the county and its population.

PB92-205343 PC A03/MF A01 National Inst of Standards and Technology (BFRIL), Gaithersburg, MD.
D. Todd, and A. Bieniawski. Jun 92, 24p NISTIR-4852
Also pub. as Interagency Committee on Seismic Safety in Construction rept. no. ICSSC/PR-2.1A. See also PB91-148092. Prepared in cooperation with Interagency Committee on Seismic Safety in Construction.

Keywords: *Earthquake resistant structures, *Building codes, *Public buildings, *Earthquake engineering, Safety, Standards, Design standards, Regulations, Seismic waves, Hazards, Government policies, Seismic safety, Seismic codes, Seismic design.

Executive Order 12699, 'Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction,' was signed by the President to further the goals of Public Law 95-124, the "Earthquake Hazards Reduction Act of 1977," as amended. These guidelines and procedures for implementing the Order have been prepared, with advice and consent of the Interagency Committee on Seismic Safety in Construction. The Executive Order applies only to new construction. All buildings owned, leased, constructed, and operated (through state and local grants, or guarantees of loans), or regulated by the Federal government must conform to the requirements of the Order. Each Federal facility is therefore individually responsible for ensuring appropriate seismic design and construction standards are applied to new construction under its purview. These guidelines recommend that each agency name an agency seismic safety coordinator to serve as a focal point for the agency's seismic program. Guidelines for determining the adequacy of local building codes are provided. Recommended implementation procedures include requiring written acknowledgement of agency seismic design and construction requirements from the building architect, engineer, contractor, and/or owner.

PB92-213297 PC A09/MF A02 Council of American Building Officials, Falls Church, VA.
Assessment of the Seismic Provisions of Model Building Codes.
Final rept.
Jul 92, 176p NIST/GCR-91/598
Contract SBNIC6532.
Sponsored by National Inst. of Standards and Technology (BFRIL), Gaithersburg, MD., and Federal Emergency Management Agency, Washington, DC.

Keywords: *Building codes, *Earthquake resistant structures, *Seismic design, Federal and state government, Regulations, Local government, Earthquakes, Government policies, Seismic safety, Building codes, Seismic engineering, Standards, Design criteria, Tables(Data), Regulations, Specifications, Executive Order 12699.
The seismic provisions of four major model building codes are compared to the 1986 edition of the NEHRP Recommended Provisions for the Development of Seismic Regulations for New Buildings. The 1986 BOCA National, 1992 SBCBI Standard, and 1991 ICBO Uniform Building Codes are found to be substantially equivalent to the NEHRP Recommended Provisions. The CABO 1 and 2 Family Dwelling Code is found to be not equivalent. Crosswalks indicate comparable NEHRP section numbers for each of the compared codes. The report was prepared to assist the Interagency Committee on Seismic Safety in Construction (ICSSC), a Federal agency in identifying codes appropriate for use in implementing Executive Order 12699, "Seismic Safety of Federal and Federally Assisted and/or Insured New Building Construction." The CCSC recommends the use of codes and standards that are substantially equivalent to the NEHRP Recommended Provisions.


A comprehensive methodology has been developed for obtaining and using smoke toxicity data for fire hazard assessment. The description of the methodology comprises: determination that the post-flashover fire is the proper focus of smoke inhalation deaths; criteria for a useful bench-scale toxic potency (LC50) measurement method; a method which meets these criteria, especially validation against real-scale fires; a computational procedure for correcting the results for the CO levels observed in real-scale post-flashover fires, procedures for reducing the usage of animals and broadening the applicability of data by interpreting gas measurement data using the N-Gas Model; and a procedure for identifying whether a product produces smoke within the ordinary range of toxic potency for post-flashover fires.


Over one billion square feet of EPDM (ethylene-propylene-diene terpolymer) are installed annually. The most frequently cited failure mode for this system is the failure of adhesives made from elastomers. Adhesives produced during manufacture may be one of the causes of seam failure, since these pasticulates could block the formation of adhesive bonds. To test this hypothesis, the T-peel strength of butyl-adhered, EPDM joints is ascertained as a function of contamination level and cure time. The results indicate that the Contemer joint is the data quite well and that at high contamination levels, the Contemer model predicts that the maximum strength does not increase as much as it does for a clean joint and the joints failed adhesively. The maximum achievable strength is in well-cleaned joints that are also adhered cohesively. These fire investigations emphasize the importance of surface cleanliness and the need for standards and guidelines to assure the performance of joints.

Construction Management & Techniques

200.075
PB93-120814
PC A21/MF A04
National Inst. of Standards and Technology (BFRIL), Gaithersburg, MD

Standards Referenced in Model, State, and City Building Codes.


Keywords: *Building codes, *Standards, Construction materials, Design standards, State government, Publications, Specifications, Construction industry, Civil engineering, Municipalities.

The publication provides a list of the standards that are referenced in the building codes promulgated by: (1) the three model building code organizations; i.e., Building Officials and Code Administrators International, Inc. (BOCA), International Conference of Building Officials (ICBO), and the Southern Building Code Congress International, Inc. (SBCCI); (2) the 29 states that have mandatory state building codes; and (3) 35 selected U.S. cities. In addition to identifying each standard referenced in the above-named codes, the publication lists the current date of the standard, its title, the codes in which it is included, the date of the last revision, and the location in the code where the standard is referenced, and the date of the standard referenced in the code. It is intended to provide assistance to the building community in updating, using and maintaining the standards referenced in building codes.

200.076
PB93-129633
Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research


Keywords: *Building codes, *Fire safety, *Standardization, Buildings, Fire hazards, Design standards, Models, Standards, Fire protection, Reprints.

The paper presents a strategy for the development and implementation of performance-based fire codes on an international scale. The process begins with agreement on a common set of goals which underlie the code. Existing code bodies then decide on an appropriate set of quantitative prediction tools with which they are comfortable, and use them to quantify the degree to which their current code addresses these goals by establishing a standard "design fire" for each occupancy. By applying standard safety criteria and safety factors appropriate to the choice of predictive methods, the performance of any building can be quantified against the stated goals. To allow for an orderly transition from current codes, an interim code structure under which currently acceptable methods are deemed to satisfy the code is presented.

Construction Materials, Components, & Equipment

200.070
PB92-132984
PC A06/MF A02
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research


H. E. Nelson. Oct 90, 121 p DSTIR-4380

Contract GS/BS-97-03. See also PB86-203049 and PB92-106919Sponsored by Public Buildings Service, Washington, DC.


FPTOOL is a computerized package of relatively simple engineering equations and models. A package of engineering tools useful in estimating potential fire hazard and the response of the space and fire protection systems to the developing hazard is presented. The computations used established engineering relations.

The paper outlines those relationships for the benefit of engineers and others interested in using the tools in the package.

200.080
PB92-144831
Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Materials Div.

Building Standards & Codes
Building Industry Technology

Construction Materials, Components, & Equipment

structural failure of or heat conduction through the boundaries.

200.083
PB92-170760 Not available NTIS National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Environment Div.

Transient Moisture and Heat Transfer in Multi-Layered Isothermal Walls: Comparison of Predicted and Measured Results.

Sponsored by Department of Energy, Washington, DC.


A distributed-capacity, finite-difference model is presented for predicting the transient heat and moisture diffusion through a multilayer plane wall. The model is one-dimensional and uses a single potential (i.e., water vapor pressure) to predict the moisture transfer rate. The model was used with independently measured moisture properties to predict the results of a simple experiment. Two plane walls, measuring 2 ft by 2 ft by 4.5 in. thick (0.61 by 0.61 by 0.11 m) were exposed to a step decrease in temperature and humidity at their exterior surfaces. The walls were comprised of gypsum board with interior latex paint, cavity insulation, and white pine with exterior oil-base paint. One of the walls contained a Vapor Invasion (V.I.) veneer, Desicross, the other with cellulose insulation. Moisture was permitted to accumulate within the walls during a 34 day period. The model was compared with good agreement to the accumulation of moisture in the wood. Laboratory methods to measure independently the moisture properties of the materials are also described. The effect of moisture accumulation on the overall thermal resistance of the two walls was investigated.

200.084
PB92-171081 Not available NTIS National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Materials Div.

Integrated Knowledge Systems for Roofing Technology.

Final Rep. G. Frohndorff, 1988, 6p

Keywords: *Roofing, "Knowledge bases(Artificial intelligence)", "Heterogeneous information systems engineering", Databases, Service life, Reprints.

Computers provide new opportunities for advancing roofing technology. One of the opportunities lies in the ability to integrate and process knowledge to aid decision-making. Integrated knowledge systems (consisting of mathematical models, expert systems, and data bases) appear to have the potential for representing virtually all knowledge of roofing technology and making the knowledge readily available. Examples of the contents of an integrated knowledge system are given using service life of roofing membranes as an example. As possibilities for forming integrated knowledge systems grow, it will be important to understand the implications so that actions may be taken to maximize the benefits. Because of the magnitude of the task of developing a complete integrated system, extensive collaboration among researchers and others will be needed if the necessary resources are to be raised and used effectively.

200.085
PB92-171172 Not available NTIS National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Building Materials Div.

Comment on 'Fluid Flow in a Random Porous Medium, *Network Model Effective Medium Approximation'.

Final rep. E. J. Garboczi, 1990, 2p

Keywords: Construction materials, *Porous materials, *Fluid flow, Cracks, Percolation, Porosity, Permeability, Mathematical models, Cracking(Fracturing), Reprints.

In a recent article, a simple lattice-based crack percolation model was introduced to study the effect of medium approximation. The effective-medium theory developed for this model gave a prediction for the critical fraction of cracks at which a connected pathway first appeared in the lattice. This paper computes the critical fraction of cracks numerically and finds that its values are much less than the effective medium prediction of 0.5. Reasons for this disagreement are discussed.

200.086
PB92-171180 Not available NTIS National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Materials Div.


Final rep. E. J. Garboczi, and D. P. Bentz. 1990, 7p
Sponsored by Northwestern Univ., Evanston, IL.

Keywords: *Cements, *Transport properties, *Fluid flow, Diffusivity, Porous materials, Permeability, Prescribed boundary conditions, Percolation, Microstructure, Porosity, Reprints.

Fluid flow under applied pressure gradients and ionic diffusion under applied concentration gradients are important transport mechanisms that take place in the pore space of cementitious materials. This paper describes: (1) a new analytical percolation-theory-based equation for calculating the permeability of porous materials and (2) a new numerical method for computing effective diffusivities of microstructural models or digitized images of actual porous materials, and (3) a new digitized-image mercury intrusion simulation technique.

200.087
PB92-171503 Not available NTIS National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Materials Div.

Effect of Copolymeric Level on Strength of Butyl-Adhered EPDM Joints in EPDM Single-Ply Roofing Membranes.

Pub. in Fire Technology, p113-127 May 91.

Keywords: *Fires, *Buildings, *Computer programs, Ceilings(Architecture), Vents, Ventilation, Ducts, Draft(Gas flow), Reprints, LAVENT computer program.

A computer program, LAVENT, is now available which computes the heating of fuses links due to the presence of a ceiling jet imbedded in an upper layer. An important result is that the two-dimensional structure of the ceiling jet is taken into account such that the location of the link beneath the ceiling plays a role in the response of the link. The links can be used to activate ceiling vents such that the effect of the upper layer ceiling may be studied. Additional applications would include the study of upper layer containment through the use of a combination of draft curtains and ceiling vents. The computer program is a large computer program of a large domain composed of a combination of walls and draft curtains.

200.090
PB92-175306 Not available NTIS National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Materials Div.

Mercury Porosimetry and Effective Networks for Permeability Calculations in Porous Materials.

Final rep. E. J. Garboczi, 1991, 5p


It is shown that a mercury porosimetry measurement can be considered as generating a mapping between a real pore structure and a random network of cylindrical tubes. The mapping is shown to preserve the hydraulic conductivity of individual pores having elliptical cross-sections. Thus, the assumption of circular cylindrical pores, commonly used to interpret mercury porosimetry results, does not necessarily invalidate the use of these measurements to predict the permeability of porous media with the Katz-Thompson equation. A regular lattice of randomly sized tubes with elliptical cross-sections is considered as a specific test of these ideas.

200.091
PB92-175793 Not available NTIS National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.

An experiment was conducted to assess the creep-rupture performance of joints fabricated from aged EPDM rubber membrane material. The rubber, sampled from the 1987-88 roof construction at Gannett-Corning, was cut into 4"x4" specimens (two strips of cleaned aged rubber adhered to one strip of cleaned new rubber), and the second designated as 'new strip' specimens (two strips of cleaned new rubber bonded together). Both sets were stressed in peel under creep conditions to determine their time-to-failure. The mean time-to-failure of the new seam was significantly longer than that of the patch joints. The locus of failure of the patch joints (and also new seam joints) is at the interface between the surfaces of the new rubber and the tape.
Automated Low-Temperature Guarded Hot Plate for Measuring Apparent Conductivity. Final rep.


A guarded-hot-plate apparatus has been developed for measuring the apparent conductivity of flat-plate thermal insulation materials at low temperatures. Relevant ranges of physical variables which can be accommodated (under different conditions) are: diameter, 203 mm (fixed); thickness, 5 to 30 mm; mean specimen temperature, 100 to 400 K; temperature differences, 3 to 150 K; temperature gradients, 0.1 to 10 K/m; and thermal resistance, 0.02 to 1.5 K sq m/W. Conductivity can be measured in dry air, gaseous nitrogen, helium, argon, or neon, or in vacuum. Apparent conductivity of an insulation material can be studied as a function of temperature, fill-gas pressure, or species, given insight into the transfer processes present in the material. Control of the main heater may be stabilized either at constant heater power or constant heater temperature. The apparatus will be useful in development of low-temperature Standard Reference Materials, and is being used to study heat transfer in closed-cell foam insulation containing HCFC blowing agents.

200.092
PB92-181031
PC A07/MF A02
National Inst. of Standards and Technology (BFRIL), Gaithersburg, MD.


Construction is one of the Nation's largest industries. The 1992 industrial outlook says, in 1991, new construction was $415 billion, about 7.3 percent of the U.S. Gross National Product. During the same period, costs of new construction exceeded $100 billion annual. The quality of the constructed facilities directly affects the productivity of the U.S. building and fire community and affects the safety and quality of life of all constructed facilities. Over two-thirds of the Nation's fixed reproducible wealth is invested in the constructed facilities. This report summarizes BFRIF's research for 1992. The report is arranged by its research programs: structural engineering, materials science and engineering, fire science and fire engineering, and fire measurement and research. Each summary lists the project title, the BFRIF point of contact, sponsor, research, and recent results.

200.093
PB92-213131
PC A03/MF A01
National Inst. of Standards and Technology (BFRIL), Gaithersburg, MD.
Modelling smoker motion through compartmentalized structures.
W. J. Jones, and G. P. Forney. 6 Jul 92, 35p NISTIR-4494.
See also PB86-138625 and PB91-144436.


The paper describes a model of fire growth and smoke transport for compartmentalized structures, with emphasis on those aspects which are important in making correct predictions of smoke movement in multicompart- ment structures. In particular, the authors are interested in the ability to model the movement of toxic gases from the smoke source to the compartment. The newest phenomena in the model are vertical flow and mechanical ventilation. Finally, they have improved the radiation transport scheme which affects energy distribution, and therefore the buoyancy forces. These are very important in actual situations relevant to fire growth and smoke propagation, as is demonstrated.

200.094
PB92-212337
PC A03/MF A01
National Inst. of Standards and Technology (BFRIL), Gaithersburg, MD.
CORRIDOR: A Routine for Estimating the Initial Wall Fire. (Front Resulting from High Temperature Fire Exposure to a Corridor.


A first order model and computer program implementing previously developed procedures for estimating the speed, depth, and temperature of a fire produced gravity wave front in a corridor have been developed. The program has been incorporated into the FPETOOL and adjustments made to accommodate fires that occur in the corridor or in a room adjacent to the corridor. Comparisons to test results are presented and show reasonable correlation. A user's guide is included.

200.095
PB92-213632
PC A03/MF A01
National Inst. of Standards and Technology (BFRIL), Gaithersburg, MD.
Semi-Quantitative Model for the Burning Rate of Solid Materials.
See also PB86-159945.


An analytical model was developed to describe the combustion characteristics of polymeric building materials. The solid materials and is described in the report. Included are flame heat transfer, charing, transient conduction, and water application. The model qualitatively describes the burning rate of both charing and thermo-plastic-like solids. It illustrates how the steady-state heat of gasification can be derived from peak burning rate test data taken as a function of irradiance. Experimental data are shown to support this derivation. The model was used to show how energy release rate can be predicted and how well they represent real data from full-scale and model room linear experiments.

200.096
PB92-213388
PC A06/MF A02
Rutgers - The State Univ., New Brunswick, N.J.
Flow Through an Ambient Vent as Related to Compartment Fire Environments.
Grant NABN7/D07479.
Sponsored by National Inst. of Standards and Technology (BFRIL), Gaithersburg, MD.


A detailed investigation has been carried out on the flow exchange through a horizontal compartment containing a fire. A Plexiglas tank with a vented horizontal partition in the middle was constructed to simulate the barrier effect produced by a fire in the cooler ambient environment by filling the upper and lower compartment with brine and pure water, respectively. Experiments have been carried out on combined natural convection flow by imposing a pressure difference across the vent. The flow rates through the vent were determined for a range of governing parameters, such as the partition height, and the opening width. The flow rate was measured by determining the pressure difference across the opening and the opening length to diameter ratio. The basic characteristics of the flow were then analyzed. The effect of the opening size on the pressure difference was also studied. Volume flow rates were obtained as a function of the governing parameters in terms of correlation equations, from which quantitative information of the effect of parameters on the flow exchange through the vent can be determined. These results can thus be applied to the modeling of fire growth in vented rooms.

200.097
PB92-222769
PC A03/MF A01
National Inst. of Standards and Technology (BFRIL), Gaithersburg, MD.
Implicitly Coupling Heat Conduction into a Zone Fire Model.
Prepared in cooperation with Clemson Univ., SC.


The report examines several methods for coupling the partial differential equations that arise in conductive heat transfer with the ordinary differential equations that arise in zone fire modeling. Two existing algorithms (method of lines and time splitting) are discussed and a new strategy is proposed for performing this coupling. This strategy couples the wall surface temperature rather than the entire wall temperature profile with the other zone fire models. The variable variables by requiring that the wall surface temperature gradient and the incident heat flux (sum of convective and net radiative flux) satisfy Fourier's law.

200.098
PB92-236470


A complete approximate set of equations is developed to describe fire spread over a surface and its resultant energy release. Wall, floor, and ceiling orientations are considered. The wall and floor model data are accepted in terms of available test method results, e.g., Cone Calorimeter and LIFT apparatus. Several applications are presented to show how energy release rates can be predicted and how well they represent real data from full-scale and model room line air experiments.

200.099
PB92-236488


The paper describes expert technology, including the principles of the development and applications of expert systems. The paper also discusses the applications of expert systems in roofing and provides an example of their use to reduce leakage problems in built-up bitu- minous membranes.

200.100
PB92-236476
BUILDING INDUSTRY TECHNOLOGY

Construction Materials, Components, & Equipment

Keywords: *Construction materials, *Diffusivity, *Moisture content, Paint, Diffusion, Transport properties, Humidity, Test methods, Wood, Wallboard, Temperature effects, Reprints.

Experimental techniques were developed for measuring moisture diffusion coefficients of building materials. Results were obtained for white pine, gypsum board, and a latex paint coating at nominal ambient temperature and 0.26 and 0.75 Eph for 0.26 and 0.75 Eph conditions. Moisture transfer rates were also measured for gypsum board specimens with two coats of latex paint on one surface. The data were analyzed to determine the permeance of the paint layer. Permeance was also found to depend strongly on ambient relative humidity.


An analytical model is presented for the one-dimensional transient gasification of a noncharring thermoplastic material at a constant incident external radiant heat flux. The model provides for temperature-dependent thermal properties and time-dependent density, and the rate of heat transfer from the surface. It assumes that the external radiant flux is absorbed only at the surface and that both the heat of vaporization and vaporization temperature can be specified and are constant. Calculated results are compared to experiments with poly(methylmethacrylate) (PMMA) agreement between theory and experiment is much better for a high external radiant flux than for a low external radiant flux. Under the latter condition, surface absorption and degradation are of a significant role but are not represented in the current model. Variational thermal properties, however, are shown to be non-constant providing an accurate effective temperature is chosen for their evaluation.

200.102 PB92-238617 PC A03/MF A01 National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Note on the Pressure Equations Used in Zone Fire Modeling.


Examples of simple zone fire models are analyzed. The models illustrate the nature of the numerical problems commonly encountered in zone models of enclosure fires. Often these difficulties arise in the solution of the equations for the pressure in connected rooms, and they arise because the pressure equalizes much more rapidly than the flow rate. A simple mathematical formulation using the models is very simple, analytical techniques can be applied and some insight gained regarding the nature of these problems. The use of three independent differential equations coupled with algebraic equations. Singular perturbation methods and phase plane analysis, together with numerical integration of the appropriately nondimensionalized equations, are employed to examine the stable nature of the equations associated with the models. The authors conclude that many of the difficulties associated with numerical integration of zone fire models in general may be circumvented by appropriate analysis of the zone fire model equations.


Building and Fire Research Publications, 1991 is the second edition to reflect the combined publications of the Building and Fire Research Laboratory (BFRL) for calendar year 1991. In 1991 the Center for Building Technology (CBT) and the Center for Fire Research (CFR) were both reorganized to form BFRL. The publication is a supplement to Building and Fire Research Laboratory Publications, 1990 and previous editions of Fire Research Publications and is a companion to Building Technology Publications. Contact the author if you would like information about earlier editions. Only publications prepared by or for BFRL are included. The American Society for Testing and Materials (ASTM) and National Institute of Standards and Technology (NIST) personnel for BFRL, or by external laboratories under contract or grant from BFRL are cited.


The report contains the Research Priorities, Recommendations and Summaries of papers presented at the first international conference. The conference was organized to bring together a cross-section of the researchers, users, and sponsors of fire suppression-related research worldwide. The conference (International Conference on Fire Research Board) and NIST (National Institute of Standards and Technology) jointly organized the conference that was held in Stockholm. The complete proceedings are available from NIST and BRANDFORSK.


Factors controlling the spread of smoldering combustion on solid wood (red oak, white pine) were examined in a series of experiments designed to enable self-sustaining smolder. The sample was in the form of a U-shaped channel 74 cm long with 6.4 cm thick walls. A controlled flow of air was confined to the interior of the channel. Smoldering was initiated on the interior surface of the upstream end of this channel (yielding forward smolder propagation), the downstream (end reverse smolder) in separate tests the air flow velocity (referred to the initial cross-section of the channel) was varied from 0 to 2 cm/sec. At the low end of this range, the smoldering process was prone to extinction; at the high end it was increasingly likely to transition to the flame. A simple energy balance model indicates a central role of radiative transfer in sustaining the smolder process.
BUILDING INDUSTRY TECHNOLOGY

Construction Materials, Components, & Equipment

Fire prevention, Reprints, Forum for International Co-
operation on Fire Research.

The paper makes the case for international fire re-
search, discusses the development and activities of the
Forum for International Cooperation on Fire Re-
search (FORUM) an informal association of heads
of fire research organizations around the world, and
suggests how the FORUM and IAFSS may support one
another.

200.109
PB93-129443 Not available NTIS
National Inst. of Standards and Technology (NIST),
Gaithersburg, MD. Structures Div.
Punching Shear Behavior of Lightweight Concrete Slabs and Shells.
Final rep.
1990, 7p
Pub. in AIC Structural Jnl. 87, n4 p386-392 Jul/Aug 90.

Keywords: *Reinforced concrete, *Shear properties, *Lightweight concrete, *Concrete Slabs, *Shells

Results of an experimental investigation of the punching
shear strength of reinforced and prestressed light-
weight concrete beams with reinforcing bars in the
typical configuration of exterior wall panels of
offshore structures are summarized. Eight continuous slabs, one simple span slab, and six single-span shell slabs were tested. The main variables in-
vestigated were amount of shear reinforcement, shell
curvature, prestressing, span continuity condition, and
size of loaded area. The punching shear strengths ob-
erved were much higher than those predicted by the
1983 ACI Building Code (ACI 318-83), particularly in
the specimens with a large linear curvature of the ex-
terior walls of offshore structures summarized were
simulated. The higher strengths were a result of the follow-
the relatively small span-to-thickness ratios of the spec-
iments, superior performance of the headed shear
reinforcing bars used in the study when compared to
standard conicuts, and the presence of action pro-
duced by shell curvature.

200.110
PB93-129500 Not available NTIS
National Inst. of Standards and Technology (NIST),
Gaithersburg, MD. Fire Measurement and Research
Dv.
Concrete Calorimeter for Controlled-Atmosphere
Studies.
Final rep.
V. Babirackis, W. H. Twilley, M. Janssens, and S.
Yusa. 1992, 7p

Keywords: *Fire tests, *Calorimeters. *Buildings, Thermal
measurements. Combustion, Heat transfer, Burn-
ing rates. Test facilities. Thermal measuring instru-
ments, Fires, Reprints, *Concrete calorimeters.

Many fires occur in ambient atmospheric conditions. To
investigate certain types of fires, however, it is nec-
essary to consider combustion where the oxidizer is
not 21% oxygen/79% nitrogen. The Concrete Calorimeter
(ASM E 1354, ISO DIS 5660) has recently become the
tool of choice for studying the fire properties of
products and materials. Its standard use involves burn-
ings specimens with room air being drawn in for comb-
nition. To facilitate studying fires involving different
atmospheres, a special version of the Concrete Calorime-
ter was designed. This unit allows controlled combus-
tion atmospheres to be created by the use of bottled
or piped gases. To make such operation feasible, a large
number of design details of the standard calorimeter had
to be modified. After the feasibility study (PB93-130409)
ground for these changes and provides an explanation of
how the controlled-atmospheres unit is operated.

200.111
PB93-130409 Not available NTIS
National Inst. of Standards and Technology (BFR),
Gaithersburg, MD. Building and Fire Research Lab. 
Final rep.
E. E. Smelt, 1989, 6p

Structural Analyses

200.114
PB92-154103 Not available NTIS
National Inst. of Standards and Technology (BFR),
Gaithersburg, MD. Structures Div.
Simple Approach to Precast Beam-Column Con-
nection Analysis.
Final rep.
G. S. Cheok, and H. S. Lew. 1992, 21p
Pub. in Proceedings of AIC (American Concrete Insti-
ute) International Conference on Evaluation and Re-
habilitation of Concrete Structures and Innovations in Design, Hong Kong, December 3-6, 1991, p1283-1293

Keywords: *Precast concrete, *Structural design,
*Beams(Supports), *Columns(Supports), *Ductility, Structural members, Concrete construction, Concrete durability, Reinforced concrete, Cyclic loads, Reprints.

An experimental study of precast concrete beam-
column connections. The precast beam-column connec-
tion study was initiated to provide data for the development of a rational design procedure for such connections in high seismic regions. The objective of the study is to
develop a moment resistant precast concrete connec-
tion that is economical and easily constructed. All tests were conducted at 1/3 scale and 1/4 scale.
The monolithic concrete specimens were designed to
1985 Uniform Building Code (UBC) Seismic Zone 2 and
4 criteria. All specimens tested were similar to those
for the monolithic specimens designed to UBC seismic Zones 2 and 4. Results from the monolithic specimens provide a comparison with results from the precast tests. Compar-
isons of the performances of the monolithic beam-
column connections with those of the precast, post-
tensioned connections were based on the connection
strength, energy absorbed, ductility, and failure mode for
the two types of beam-column connections.

200.115
PB92-170778 Not available NTIS
National Inst. of Standards and Technology (BFR),
Gaithersburg, MD. Structures Div.
Periodic and Chaotic Oscillations of Modified Stoker Column.
Final rep.
G. R. Coko, and E. Simu. 1991, 16p
See also PB92-215849. Sponsored by Department of Energy.
Pub. in Jnl.of Engineering Mechanics 117, n9 p2049-
2064 Sep 91.

Keywords: *Dynamic response, *Structural vibration,
*Columns(Supports), *Dynamic structural analysis,
Dissipative systems, Oscillations, Buckling, Degrees of freedom, Mathematical models. Vibration damping, Reprints.

Records are presented of typical measured motions of a
multi-supported Stoker Column. Tests included the motion around a stable fixed point of the unforced column; periodic snap-through motion around the un-
stable fixed point; and chaotic motion. Characteriza-
tions of the recorded chaotic motion include the auto-
correlation function; the spectral density plot; capacity
area plot; and comparisons of numerical simulations performed in which spring stiffnesses measured under static conditions and dissipative forces were based on the viscous damping model were used. The experimental device was represented as a multidegree-of-freedom system that approximated the distributed mass and stiffness of the structure. The simula-
tions yielded chaotic motions comparable qualita-
tively to, though different quantitatively from, those re-
produced in the laboratory. The effect of the estimated
fractal dimension, the influence of the spring mass
distribution was not sufficiently strong to affect the di-
rectional pattern of the chaotic phase space for the at-
tractor of the chaotic motion.

200.116
PB92-171974 PC A03/MF A01
National Inst. of Standards and Technology (BFR),
Gaithersburg, MD.
Mar 92, 50p NISTIR-4782
See also PB91-167239.

Keywords: *Dynamic response, *Structural vibration,

A 6-story commercial office building in San Bruno, Cali-
ifornia, was extensively instrumented after the Loma Prieta Earthquake of October 17, 1989 and sustained no visible damage, was subjected to ambient vibration tests in September 1990. A total of 15 accelerometers were recorded from the 13 accelerometers installed prior to the Loma Prieta earthquake. Comparison of dynamic characteristics re-
vealed that the first-mode response frequency de-
duced from the Loma Prieta records is significantly lower than that deduced from ambient vibration tests,
and the damping ratio for strong motion is substantially higher than in an ambient earthquake. A computer model of the building was developed and applied using two different boundary conditions: fixed-base and spring-supported. A fixed base condition was used to simulate the building response to ambient vibration, and the spring-supported condition was used to simulate its interaction with soil-structure interaction and thus simulate the response to a earthquake. The results were validated by the Loma Prieta earthquake. Results of analyses showed that the first-mode response frequencies for the two cases differ only slightly. This is consistent with observed from measurements. The results suggest that the first-mode response frequencies between ambient and strong motion. The building was due largely to soil-structure interaction.

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200.117

PB92-189552

PC A08/MF A02

National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.


Special Issue.

N. J. Raufaust. Apr 92, 162p NIST/SP-832-VOL-1 Also available from Suppl. of Docs. as SN003-003-0315-V-2. See also Volume 1, PB92-189562.

Keywords: *Earthquake resistant structures, Vibration isolators, Structural vibration, Bearings, Vibration damping, Earthquake engineering, Japan, Seismic waves, Earthquakes, Specifications, Dynamic response, Effectiveness, Case histories, Performance evaluation, Guidelines, Buildings, Structural members, Displacement, *Foreign technology, Translations.

The report is Volume One of a two volume series on passive energy dissipating systems for buildings and other structures. The volume, Earthquake Protection in Buildings through Base Isolation describes energy dissipating systems and reviews their applications and effectiveness. The documents provide guidelines for evaluating energy dissipating systems and a directory of systems used in buildings and other structures. The original reports in Japanese were published by the Building Center of Japan under the sponsorship of the Japanese Ministry of Construction (MOC). The MOC provides these reports to the National Institute of Standards and Technology for their translation into English and for publication. The subjects addressed in these reports include: the history and types of passive energy dissipators; their applications, evaluations, and performance; and case histories of these devices exposed to seismic loading.

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200.119

PB92-197607

Not available NTIS

National Inst. of Standards and Technology (NIST), Gaithersburg, MD.

Experimental Study of Gusseted Connections.

Final rept. 1989, 49p  Also see PB92-127279.


Keywords: *Steel structures, Gusset plates, Buckling, Framed structures, Deflection, Columns(Supports), Loads(Forces), Structural members, Failure, Moments, Failure, Reprints.

An experimental program was undertaken at the National Institute of Standards and Technology (NIST) to determine the behavior of gusseted connections for laterally braced steel buildings. The tests included the influence of the members framing into the connection. Three nearly full-scale braced frame subassemblies were tested. The parameters which were varied included the gusset geometry and column orientation. The specimens were loaded to failure in their plane and load-deformation as well as strain data were recorded. The tests were mode for the two strong-axis column connections was gusset buckling. The weak-axis column connection failed by tearing of the gusset plate. The weak-axis connection was also gusseted and each specimen was distributed to the beam and column in the strong-axis column connection. This moment was carried primarily by the beam in the weak-axis connection due to the flexibility in the web connection. Comparisons of nominal capacities with the experimental values resulted in a "strength ratio" in excess of one.

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200.120

PB92-198068

Not available NTIS

National Bureau of Standards (NIST), Gaithersburg, MD. Structures Div.

Hurricane Climatology.

Final rept. 1987, 7p  Also available from Supp. of Docs. as SN003-003-0315-V-3. See also Volume 1, PB92-189562.

Keywords: *Building codes, Hurricanes, Wind pressure, Wind velocity, Storm damage, Dynamic loads, Loads(Forces), Climatology, Structural engineering, Buildings, Reprints.

The paper briefly recalls the recent evolution of models employed in engineering hurricane climatology. It lists some major applications around the world of the relationship between hurricane interaction for estimating hurricane (cyclogenesis) wind speeds corresponding to various mean recurrence intervals. It is noted that the research efforts in estimating gale force theory might enable hurricane wind speed distribution tails to be established more realistically than has so far been possible. This would improve prospects for estimating wind load factors for hurricane-prone regions on a considerably more objective basis than is now the case.

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200.121

PB92-201102

PC A05/MF A02

National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.


Special Issue.

N. J. Raufaust. Apr 92, 97p NIST/SP-835 Also available from Suppl. of Docs. as SN003-003-0315-V-3. See also Volume 1, PB92-189562.

Keywords: *Seismic effects, Wind(Meteorology), Disasters, *Structural design, Highways, Damage, Loadings, Soil-structure interactions, Wind loads, Tsunamis, *Earthquakes, Buildings, Water waves, Civil engineering, Japan, United States, Foreign technology.

The Panel on Wind and Seismic Effects was established in 1969. Sixteen U.S. and six Japanese agencies participate with representatives of private sector organizations, to develop and exchange technologies aimed at reducing damages from high winds, earthquakes, and tsunamis. The efforts have been produced through collaboration between U.S. and Japanese member researchers working in 11 task committees. Each committee focuses on specific technical issues, e.g. earthquake strong motion data. The Panel provides the vehicle to exchange technical data and information on building codes, standards, seismic design, civil and structural engineering lifelines, buildings, and water front structures, and to exchange high wind and seismic response records. The Panel is working between the U.S. and Japan (even numbered years in the U.S.; odd numbered years in Japan). These one-week technical meetings provide the forum to discuss ongoing research and research results; one-week technical study tours follow the meetings.

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200.122

PB93-113579

PC A05/MF A01

National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.


Keywords: *Dynamic response, Structural vibration, "Buildings, Seismic effects, "Structural damping, Soil-structure interactions, Earthquakes, Data acquisition, Earthquake engineering, Buildings, Displacement, "Earthquake, Loma Prieta Earthquake, San Francisco(California).

The report describes the collection and analysis of ambient vibration data from five buildings in the San Francisco Bay area that experienced strong shaking during the Loma Prieta earthquake of October 17, 1989. All five buildings represent a range of construction materials, structural systems, foundation systems and building dimensions. Results of the analysis are compared to similar analyses carried out on strong-motion response records obtained from the same buildings during the earthquake. While the lower modes of vibration can be reliably identified from ambient vibration records, the frequencies of these modes are in each case significantly different. Economical, performance estimates derived from strong-motion response records. When soil-structure interaction is involved, the strong-motion mode shapes can range from 70 to 80 percent of the corresponding values extracted from ambient vibration records. Estimates of structural damping derived from ambient vibration data are substantially smaller than those derived from strong-motion data and are consistent with predictions of a damping model based on force balance arguments. The lower bound of damping estimates obtained from strong-motion response records in the study is consistent with published literature. The study is significant factor, the overall damping for strong-motion response may be 3 to 4 times the indicated lower bound.

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200.123

PB93-113552

PC A09/MF A02

National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.


Sponsored by Department of Transportation, Washington, DC. Office of the Secretary.

Keywords: *Workstations, Office buildings, Workpl. site based on force balance arguments. Specimens of machine systems, Furniture, Human factors engineering, US DOT, Telecommunication, Illuminating.

The report contains a series of papers prepared for a Department of Transportation (DOT) workshop conducted on November 13-14, 1991. The DOT workshop was held to assist the Department in planning a new Headquarters Building. Eighteen experts, representing various disciplines associated with building design and use participated in a workshop, and prepared papers prior to the meeting. The present report contains these papers. The Biennial report (NISTIR 4801), will describe the workshop proceedings. Workshop presentations covered the following topics: workstation design process, visually challenging trades, workstation standards and criteria, ergonomics, human resource issues, leading edge workstation design, impact of new technology, and research and work allocation design, lighting, environmental technologies, information and data systems, building design, facility management, forecasts of the office of-the-future. These issues were dis-
BUILDING INDUSTRY TECHNOLOGY  
Structural Analyses

200.124  PB93-118115  PC A20/MF A04  National Inst. of Standards and Technology (BFRIL), Gaithersburg, MD.  


Also available from: Supt. of Docs., as SN003-003-03176-3. Prepared in cooperation with Dames and Moore, Los Angeles, CA. Sponsored by National Science Foundation, Washington, DC, and Public Works Research Institute, Tokyo (Japan).  

Keywords: *Earthquake damage, *Meetings, *Disasters, *Earthquake resistance, Earthquake engineering, Seismic effects, Japan, United States, Highway bridges, Risk, Damage assessment, Design analysis, Reinforcement(Structures), Seismic waves, Earthquakes, Repair, Dynamic response, Tunnels, *Lifeline systems.  

These proceedings document the results of the Fourth U.S.-Japan Workshop on Earthquake Disaster Prevention for Lifeline Systems held on August 19-21, 1992, in Los Angeles, California. The theme of the workshop focused on Future Directions for Research, Application, and Design of Lifeline Systems. Technical topics discussed include: effects of soils on lifeline components; seismic design and retrofit of lifeline systems; dynamic response and analysis of lifeline systems; repair and rehabilitation of lifeline systems; system reliability methods for lifeline systems; post-earthquake damage detection procedures; socioeconomic and environmental impact of lifeline system failure; and emergency and disaster response management of lifeline systems. Thirty papers were presented in two days of plenary sessions; 16 papers from Japan and 14 papers from the U.S.  

200.125  PB93-120152  PC A25/MF A06  National Inst. of Standards and Technology (BFRIL), Gaithersburg, MD.  

Wind and Seismic Effects. Proceedings of the Joint Meeting held as part of the U.S.-Japan Cooperative Program in Natural Resources Panel on Wind and Seismic Effects (24th). Special pub. (Final).  

N. J. Raufatse, Sep 92, 60pp NIST/SP-843  

Also available from: Supt. of Docs. as SN003-003-03180-1. See also PB92-116425.  


The publication is the proceedings of the 24th Joint Meeting of the U.S.-Japan Panel on Wind and Seismic Effects. The meeting was held at the National Institute of Standards and Technology, Gaithersburg, Maryland during May 19-22, 1992. The proceedings include the program, list of members, panel resolutions, task committee reports, and 45 technical papers. The papers were presented under five themes: (I) - Wind Engineering, (II) - Storm Surge and Tsunamis, (III) - Joint Cooperative Research Program, (IV) - Earthquake Engineering, (V) - Summaries of Task Committee Workshop Reports (oral presentations only).  

The report summarizes the first two years of a research effort directed toward understanding the generation and spread of toxic gases, particularly carbon monoxide, in real-time compartment fires. As most fatalities are the result of exposure to toxic products of combustion, it is essential that methods be devised to evaluate the toxic hazards posed by specific substances in varying building designs. While toxic products are produced during both smoldering and open combustion modes, the rate of generation of toxic products of incomplete combustion, such as carbon monoxide, is greatest under conditions where compartment flow dynamics create oxygen deficient combustion.  

200.129  PB92-156751  PC A03/MF A01  National Inst. of Standards and Technology (BFRIL), Gaithersburg, MD.  

Fire Modeling of Room Fires, W. D. Davis, G. P. Forney, and J. H. Klotz, Nov 91, 46pp NIST-4673  

See also PB98-201538.  

Keywords: *Fires, *Buildings, Computerized simulations, Fires(Gas flow), Ceilings(Architecture), Computational fluid dynamics, FLOW3D model.  

The application of the Harwell field model, FLOW3D, to model compartment fires is investigated. Two experiments are chosen to model numerically. The first experiment is a single room fire where the vertical structure of the ceiling jet produced by the fire is measured and the temperature response of simulated fusible links to the ceiling jet is available. The second experiment consists of three rooms with a fire. Temperature measurements using thermocouples in the floor and the corridors connecting the rooms. These two experiments provide an opportunity to investigate both two dimensional field modeling of fires. It is found that the numerical results using the field model are in reasonable agreement with the experimental data. FLOW3D is enhanced by the addition of a simple fusible link algorithm previously used in the zone fire model LAVEN'T. The algorithm used in conjunction with the Harwell field produces good agreement with the measured fusible link temperatures found in the single room experiment.  

200.130  PB92-156769  PC A04/MF A01  National Inst. of Standards and Technology (BFRIL), Gaithersburg, MD.  


Sponsored by Public Buildings Service, Washington, DC.  

Keywords: *Fires, *Flashover, *Office buildings, Smoke, Fire safety, Doors, Fire tests.  

The study examined the effect of a post-flashover room fire on a corridor and an attached target room. The target room was a 2.44 m wide, a 2.44 m high, and an entry alcove, 0.85 m long, 1.1 m wide and 2.0 m high. Gas temperatures, wall surface temperatures and concentrations of oxygen, carbon dioxide, and carbon monoxide were measured at selected points in the burn room, corridor, and target room. Various methods of protecting the target room from the effects of the post-flashover room fire were also examined. The target room and its doorway were protected using a simulated 'standard' door (with a face cut, a side cut, and an undercut), a reduced leakage door (undercut only), and a commercial accordion fire door. In addition, the target room with the 'standard' door was tested using mechanical pressurization. Pressurization of the target room and reduction of the amount of door leakage were found to reduce the rate of fire spread into the target room. The flow in the corridor was effective in reducing temperature rise and the penetration of products of combustion into the target room. Measurements from the study were used to examine a recently proposed model for predicting the flow velocity of the initial wave down the corridor. The model predictions and predicted values agreed within the limits of uncertainty for the data.  

200.131  PB92-165133  Not available NTIS  National Inst. of Standards and Technology (BFRIL), Gaithersburg, MD. Building and Fire Research Lab. Office.  

Floors Models: The Future is Now.  

BUILDING INDUSTRY TECHNOLOGY

General

Keywords: "Buildings, *Fires, *Models, Mathematical models, Safety engineering, Computer applications, Risk assessment,ornado Protection Investments for Homeowners."

The高科技 is available for modeling fire protection for homeowners. It explores how to include the decision-making process information on an individual's risk exposure and risk attitude. The AHP is applied to the choice of purchasing smoke detectors, a sprinkler system, or a combination of the two. Two hypothetical cases are assumed, one in which the homeowner is risk-taking and has lower-than-average risk exposure, and one in which the homeowner is risk-averse and has higher-than-average risk exposure. Probabilities of fire, death, injury, and property loss, subjectively derived from national fire statistics, are used in combination with more easily quantifiable benefit and cost criteria such as system price, property tax increase, and insurance savings. The study focuses on the decision making of homeowners, but the results are also of interest to builders of residential homes, fire chiefs, property insurers, and others who make decisions about fire protection investments.

200.127
PB92-171891  Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Staging Areas for Persons with Mobility Limitations.
Prepared in cooperation with George Mason Univ., Fairfax, VA. Sponsoring by Public Buildings Service, Washington, DC.

Keywords: "Fire safety, Office buildings, *Handicapped workers, *Evacuating/Transportation, Smoke, Sprinkler systems, Flashover, Disabled persons."

The National Institute of Standards and Technology (NIST) is engaged in a project funded by the General Services Administration (GSA) to evaluate the concept of staging area as a means of fire protection for persons with disabilities as it applies to Federal office buildings. There is a rising concern for the safety of fire building occupants who cannot travel the building emergency route exits in the same manner or as quickly as expected of able-bodied persons. One proposed solution for providing safety for persons with such disabilities is the provision of staging areas where they can 'safety wait' until they can be assisted in safely leaving the building. The GSA has modified six buildings for fire protection of persons with mobility disabilities. Spaces that were turned into staging areas include passenger elevator lobbies, sections of corridors, and rooms. The conclusions were: (1) staging areas can be either a haven of safety or a death trap; (2) in many cases, the persons most needing the staging area protection may be unable to reach that area before their pathway (corridor or aisle ways) becomes lethal; and (3) in the case of a sprinkler system eliminates the life threat to all occupants regardless of their individual abilities.

200.124
PB92-175579  Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Building and Fire Research Lab.

200.125
PB92-175587  Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Fire Science and Engineering Div.
Cooperation Among Fire Control and Compartment Fire Models.

Keywords: "Fires, *Buildings, Safety engineering, Computerized simulation, Mathematical models, Reprints."

An approach for appraising the expected performance of compartment fire models is presented. The approach involves comparing the results of well documented test data to selected outputs of the model. The paper applies the approach to four zone compartment fire models and offers a brief analysis of the results of that application. The test data was obtained from room fire tests involving both wood and plastic cribs reported by Quinlivan and McCaffrey in 1980. The models compared were FIRST9X, FAST, CCFM-VENTS, and FPETOOL.

200.126
PB92-187129  PC A09/MF A01
George Mason Univ., Fairfax. VA
Human Aspects of Staging Areas for Fire Safety in GSA Buildings.
B. M. Levin and N. E. Gruner. Apr 92, 59p NIST/GCR-92-006
Contract SBN166527

Keywords: "Fires, *Office buildings, *Evacuation, Handicapped people, Fire safety, Human factors engi-neering, Apr 92, 59p NIST/GCR-92-006

One approach for ensuring the safety of disabled occupants of office buildings, in a fire emergency, is to provide a staging area or an area of refuge where the disabled occupants can wait safely until they can be assisted out of the building or the fire is extinguished. GSA has retrofitted office buildings with staging areas to provide the fire safety for disabled occupants. This is a report of a project to study the six installations to determine the feasibility of staging areas from a human behavior perspective and to make recommendations for upgrading current and future installations. The study showed that government employees will accept and use staging areas. The study revealed the need to pay attention to details in designing the communications system; the need for training (both an office team and the occupants); and the need for special procedures for maintenance.

200.127
PB92-187117  PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

BOUSSINESQ Algorithm for Buoyant Convection in Polygonal Domains.
See also PB91-178848.

Keywords: "Convection, Computational fluid dynamics, Navier-Stokes equations, Finite difference theory, Mathematical models, Hydrodynamics, Polynomials, Algorithms, "Building fires, Room fires, Boussinesq models."

A 2-D Boussinesq model describing heat-driven buoyant convection in a polygonal enclosure is presented. The Boussinesq model is based on the time-dependent Navier-Stokes equations with constant viscosity and thermal conductivity; no turbulence model or other empiricism is introduced. The polygonal domain is mapped via a Schwartz-Christoffel transformation onto a rectangle. A finite difference scheme is used to solve the Navier-Stokes equations, and an elliptic solver is used to solve the pressure equation. Computational results for high Reynolds numbers are presented through the use of Lagrange polynomials which allow one to visualize the flow patterns.

200.138
PB92-171845  PC A03/MF A01
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Sprinkler Fire Suppression Algorithm for the GSA Engineering Fire Assessment System.
D. Madzvikayi, and R. L. Vettori. May 92, 42p NIST-RR-4833

Keywords: "Fires tests, *Sprinklers, *Algorithms, Mathematical models, CFD, Office buildings."

A study was conducted to develop a sprinkler fire sup-pression algorithm for use with sprinkler activation time models. Large scale experiments were performed to determine the heat release rate (HRR) of selected office fuel packages with and without sprinklers operating. Eight different fuel packages were evaluated. The results from these experiments were used to develop a time dependent HRR reduction factor.

200.139
PB92-175599  Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Building and Fire Research Lab. Office.
NIST Labs Research Assures Building Safety, Reduces Fire Loss.
J. G. Gross. 1991, 2p

Keywords: "Buildings, *Fires tests, *Research manage-ment, US NIST, Standards, Technology transfer, Reprints."

The article reviews the mission capability and current research program of the National Institute of Standards and Technology Building and Fire Research Lab- oratory. Unique laboratory facilities are identified. Standards development and technology transfer activities are cited.

200.140
PB93-116390  PC A09/MF A02
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
H. J. Jessen. Sep 92, 18p NTIS-GCR-92185
See also report for 1991, PB92-112218.

Keywords: "Fires prevention, *Fires tests, Research projects, Buildings, Combustion, Carbon monoxide, Smoke, Grants, Soot, Safety engineering."

The report describes the research projects performed in the Building and Fire Research Laboratory (BFRL) in 1992, and under its grants program from October 1, 1991 through September 30, 1992.
The course of the fire is traced in terms of developing fire phenomena. Special emphasis is given to burning rate of building furnishings, smoke layer temperature, layer level, oxygen consumption, combustion efficiency, flashover, exterior fire response, sprinkler operation, smoke movement and some contamination.

BUSINESS & ECONOMICS

Banking & Finance

200.142
PB92-187152
PC A03/MF A01
National Inst of Standards and Technology, Gaithersburg, MD. Technology Administration.
PBX Administrator's Security Standards Developed by the Federal Deposit Insurance Corporation.
R. Roback. Apr 92, 44p NISTIR-4816

Consumer Affairs

200.143
PB93-124956
PC A03/MF A01
National Inst of Standards and Technology (TS), Gaithersburg, MD.
K. Bucher. Oct 92, 33p NIST/HS-133-ED-3-SUPPL.

Domestic Commerce, Marketing, & Economics

200.146
PB92-233279
PC A05/MF A02
National Inst of Standards and Technology (TS), Gaithersburg, MD. State Technology Extension Program.
200.144
PB93-129302
Not available NTIS
National Inst of Standards and Technology (TS), Gaithersburg, MD. Weights and Measures Program.
National Conference on Weights and Measures Task Force on Fraud, Fraud Survey Report.
J. A. Koenig. 1988, 75p

International Commerce, Marketing, & Economics

200.147
PB92-144385
PC A03/MF A01
National Inst of Standards and Technology, Gaithersburg, MD. Office of Standards Code and Information.

Building Industry Technology

General

G. A. Lichtstein. Sep 92, 100p NIST/GRC-92/616

BUILDING INDUSTRY TECHNOLOGY

General

G. A. Lichtstein. Sep 92, 100p NIST/GRC-92/616

BNB

BUILDING INDUSTRY TECHNOLOGY

General

G. A. Lichtstein. Sep 92, 100p NIST/GRC-92/616

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BUILDING INDUSTRY TECHNOLOGY

General

G. A. Lichtstein. Sep 92, 100p NIST/GRC-92/616

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BUILDING INDUSTRY TECHNOLOGY

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G. A. Lichtstein. Sep 92, 100p NIST/GRC-92/616

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BUILDING INDUSTRY TECHNOLOGY

General

G. A. Lichtstein. Sep 92, 100p NIST/GRC-92/616

BNB
American Plywood Association (APA), the National Forest Products Association (NFPA), and the American Lumber Standards Committee (ALSC). The purpose was to explore ways in which the U.S. Government could assist that industry in conforming to new standards aimed at gaining acceptance of its products in such international markets as the European Community (EC).

200.149
PB92-156885


The article provides an overview of the standards-related implications that will further facilitate market access for U.S. exporters resulting from implementation of the Canada-U.S. Free Trade Agreement. Trade enhancements resulting from advanced notification procedures, transparency, harmonization of standards, and mutual acceptance of test data are summarized. Contacts for obtaining additional information are provided.

200.150
PB92-187095

Keywords: *International trade, *Standards, Technical assistance, Compliance, Regulations, Tables, Data), General Agreement on Tariffs and Trade, Notification, Trade barriers.

The report describes the GATT Standards Code activities conducted by the Standards Code and Information Program, National Institute of Standards and Technology (NIST), for calendar year 1991. NIST 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 standards-based rules that might significantly affect trade; assisting U.S. industry with standards-related trade problems; and responding to inquiries about proposed foreign and U.S. regulations.

200.151
PB92-236512

Keywords: *International trade, *Standardization, Certification, Standards, Tests, Exports, United States, Market, Reprints, *EC(European Community).

The paper describes the activities in the European community (EC) directed toward the harmonization of standards, testing and certification activities in preparation for the implementation of the "internal market" by the end of 1992. The paper provides contact points for persons desiring further information about these EC activities.

200.152
PB93-125532
CHEMISTRY
Analytical Chemistry

200.165

Keywords: *X-ray analysis, X-ray scattering, Reprints, FIB-FPM computer program, NBS/GSC computer program, COLA algorithm, Secondary targets.*

Several influential coefficient algorithms have been published which use fundamental parameter equations for correction of interelement effects in x-ray analysis. The Capacity Optimization Laser Excitation Algorithm (COLA) is one such algorithm and is used in the program NBS/GSC. Another COLA-based computer program called FLY-FPM has been developed in China by one of the authors (L. Feng). Using FLY-FPM as a starting point, the authors developed a new COLA-based program dedicated for use with Xeex x-ray spectrometers which employ both tube and secondary targets for excitation. For direct tube excitation, the NBS/GSC spectral distribution algorithm is used in this program. For secondary target excitation the radiation is usually treated as being monochromatic, and fundamental parameter expression are formulated with this in mind. This assumption, however, is not rigorously true especially when low atomic number secondary targets are employed. For this reason, the authors have extended the NIST standard tube calculation and distribution algorithm to include scattering phenomena from the secondary target. Some of the main features of the Kevex program will be discussed in the paper with emphasis on the theoretical treatment of both coherent and incoherent primary x-ray scattering from secondary targets.

200.168

Keywords: *Government/industry relations, Standardization, Metrology, Cooperation, Metals, Reprints, *Standard reference materials, US NIST.*

The paper reviews the cooperation between ASTM and the National Bureau of Standards (NBS) in a Research Associate Program to certify and distribute metal standard Reference Materials (SRMs). Since the joint program began in 1975, over 200 SRM types have been completed and made available to the technical community. Besides describing the cooperation between NBS and ASTM, the status of the metal SRM program at NBS and shows how SRMs, in general, integrate with the standards-writing activities of ASTM. The program has been very successful over the past 12 years—in fact, a model for industry-governmental technical cooperation—a difficult technical problem must now be solved to assure future success. This problem is a growing shortage of classical chemists who are expert in the analytical/metrological techniques needed to certify SRMs. A proposal is made that the current work of ASTM and NBS be expanded to include addressing this serious shortage.

200.169

Keywords: *Mass spectrometry, *Lithium isotopes, *Isotope ratio, Lithium, Inorganic compounds, Accuracy, Precision, Reprints.*

An improved procedure for the determination of lithium isotopic ratios which is based on the use of Li2BO4 that the loading material has been investigated. The Li2BO4, in combination with Li2BO4, and promote ionization were established. Li isotopes in standard solutions have been measured with a precision of 0.023% rsd. The effects of sample loading parameters on precision, such as sample size and purity, Li2BO4, have been evaluated. Using this procedure, Li isotope composition in an unknown sample was determined. Reprints.

200.170

Keywords: *Coal tar, Chemical analysis, Spectrum, Liquid chromatography, Benzopyrene, Polycyclic aromatic hydrocarbons, Concentration(Composition), Carcinogens, Toxicity, Reprints, *Standard reference materials, *SRM 1597, *Benzopyrene/methyl.*

Concentrations of individual methylbenzopyrene and its dimethyl isomers were determined on a coal tar standard reference material (SRM 1597) by using liquid chromatography (LC) (normal and reversed phase) and high resolution mass spectrometry (Shpol’skii spectrometry). This is the first report on the unambiguous identification and quantification of each MBP isomer in a real sample and will provide information on the distribution of these highly carcinogenic compounds in coal tar.

200.171

Keywords: *Radiation analysis, *Activation analysis, *Gamma ray spectroscopy, High sensitivity, Figure of merit, Counting methods, Optimization, Reprints.*

In activation analysis, optimizing conditions can generally improve precision or increase the number of sam- ples that can be counted, or both. Much is gained in sensitivity by using high-efficiency detectors. With care in selection of detector and shield materials, the only initial cost of a detector is the shielding which is the interactions of cosmic-ray particles with the detector and the detector itself. Application of Coop- eration criteria to two excellent modern detectors shows that for the ultimate in sensitivity in quantitating a simple spectrum, high efficiency overwhelms low resolution, low background, or any other criterion of detector quality in the choice of detectors for a given measurement. In practice, the choice is not so simple when counting corrections are large, when multiplets are present which the detector cannot fully resolve, when the total count rate is high, when background peak (e.g., Co-57) are large, or when counting uncertainty limits the accuracy of, or when requirements of sample shape dictate the counting configuration.

200.172

Keywords: *Rare earth elements, *Liquid chromatography, *Chemical analysis, Isotope dilution, Fly ash, Reprints, Inductively coupled plasma mass spectrosco- py.*

High-performance liquid chromatography (HPLC) is used to separate the rare earth elements (REEs) prior to detection in inductively coupled plasma mass spectrometry (ICP-MS). The use of HPLC-ICP-MS in series combines the separation power and speed of HPLC with the sensitivity, isotopic selectivity and speed of ICP-MS. The detection limits for the REEs are in the ppb to ppt range and the response is linear for four orders of magnitude. A preliminary comparison of iso- tope dilution and external standard results for the detection limits of REEs in National Institute of Standards and Technology (NIST) Standard Reference Material (SRM 1633a) Fly Ash is presented.

200.173

Keywords: *Polychlorinated biphenyls, Gas chromatography, Contaminants, Sediments, Rivers, Water pollution detection, Reprints.*

Using a polymeric C18 high performance liquid chromato- graphic (HPLC) column, which demonstrates excellent separation selectivity toward carbodin compounds in an earlier column evaluation, the effects of mobile phase, MD and DC elution on selectivity, and column temperature are investigated. A seven-component carbodin mixture was used to monitor changes in separate selectivity in response to variations in HPLC conditions. Both acetone and tetrahydrofuran (THF) improved the resolution of echinenone and alpha-carotone, THF was selected for use as a modifier due to its solvating properties. At concentrations greater than 6% THF, the resolution of lutein and zeaxanthin deteriorated significantly. Temperature was varied from 15 to 35 °C in 5 °C increments. Resolution of lutein/zeaxanthin and betacarotene were better at lower temperatures while echinenone/alpha-carotene separation improved as temperature increased. A method for quantitating all carotenes was achieved at 20 °C using 5% THF as a mobile phase modifier. Method applicability is demonstrated for serum and food carotenoids.
CHEMISTRY

Analytical Chemistry

Performance of a Tuneable Secondary X-ray Spectrometer.


Keywords: X-ray spectrometers, Position sensitive detectors, X-ray scattering, X-ray fluorescence, Emission spectra, Performance, Reprints.

An efficient, high-resolution secondary x-ray spectrometer with a spherical to�al internal reflection/total internal reflection is used to study emission spectra. Even with the highest available incident flux of x-rays the signal count rate can be increased by up to 100% when dispersed by the analyzing crystal.

The problem is most serious in studies of gas targets, or at low energies where fluorescence yields are low. For thin dispersive detector it is su£cient to allow observations of spectral peak widths which are narrower than lifetime broadening widths. Polarization dependence of the fluorescence can also be studied.

200,177


Keywords: Sulfur, Steels, Mass spectrometry, Calibration standards, Sulfur 34, Isotope dilution, Reprints.

Total sulfur was determined in chips in six different low alloy steel NBS Standard Reference Materials (SRMs) and in four different steel samples from foreign institutions by isotope dilution thermal ionization mass spectrometry. This procedure determines the concentration of sulfur accurately and absolutely within the 3% (as an internal standard). The concentrations of sulfur found in these alloys are lower than the recommended (microg/g S). SRM 1764: 118.8 \pm 2.4, SRM 1765: 37.8 \pm 1.9, SRM 1766: 23.5 \pm 1.5, SRM 1767: 90.84 \pm 0.98, SRM 132b: 30.27 \pm 0.78 and SRM C2423: 6.4 \pm 1.23. The uncertainties are 95% confidence intervals and include all known sources of error and systematic error. These standards will be useful for calibrating analytical techniques that rely on external standards for the determination of sulfur in steels.

200,178

W. F. Koch.

Keywords: Chemical analysis, Ion exchange chromatography, Laboratory equipment, Sample preparation, Control, Rain, Sulfur, Pollution standards, Chlorine, Isotope dilution, Radio Reference Materials, Standards, Reprints, Standard reference materials.

Ion chromatography is used extensively at the National Institute of Standards and Technology in the analysis of radioactivity. In this method the primary emphasis is on the determination of the non-metals, especially sulfur and chlorine. Procedures have been standardized and are described in this report. This method will improve the accuracy and precision of the technique. Sample preparation is a critical component of the analytical process. There is no preferred method of sample preparation it involves the use of a high-pressure oxygen bomb. The types of materials analyzed include fuels, botanicals, biologies, and rainwater.

200,179


Keywords: Electron-microscope analysis, Diffusion, Electron energy-loss spectroscopy, Imaging, Optical microscopy, Reprints, Reprints, Wavelength dispersive analysis.

A new, simplified procedure for correcting the defocus observed in low-magnification digital maps taken with the electron microscope using wavelength spectrometers is described. This procedure uses a wavelength scan of the analyzed element and the geometric relationship between the specimen and the diffracting crystal to calculate a model standard which is subsequently used in the quantitation of each pixel of the unknown map. The results of this new procedure are compared with the earlier method of using an experimentally obtained standard map.

200,180
PB92-237494 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Inorganic Analytical Research Div. Laser-Enhanced Ionization as an Element Specific Detector for Liquid Chromatography.


Keywords: Ion exchange chromatography, Dcetectors, Ion concentration, Ion, Spectroscopy, Analysis, Ion detection, Laser application, Metals, Chemical analysis, Ionization, Reprints, Laser-enhanced ionization, Trialkylmethylamines.

Measurement of individual forms of a metal rather than the total concentration of that metal is very useful because properties such harbor ionization and toxicity vary widely among forms. Liquid chromatography (LC) provides the necessary separation of these forms, but the dilution coming from the chromatographic process makes a sensitive detector crucial. Laser-enhanced ionization (LEI) is the most sensitive flame atomic absorption method, and is well-suited for use as an LC detector. LC-LEI is applied here to the measurement of trialkylmethylamines.

200,181

I. J. Yeo and S. M. Seltzer.


Keywords: X-ray fluorescence analysis, "Pattern recognition" qualitative analysis, Computing, Analytical samples, Field tests, Pigments, Paints, Reprints, Geologic samples.

In many applications of energy-dispersive x-ray fluorescence (XRF) analysis, quantitative information concerning the chemical composition of the samples is not required. Rather, one is interested in whether a given sample is similar to some reference material or not. Chemical composition for each sample from one sample to the next. We have investigated the use of pattern-recognition techniques in such applications. These techniques will be demonstrated with experimental data that the pattern-recognition approach is extremely simple and it. It uses only a simple parameter, the normalized coefficient, and can be applied directly to raw data. The efficacy of the method is illustrated with SUL spectra of geological and pigmen samples, and proportional counter spectra of geological samples. The pattern-recognition method should be ideally...
CHEMISTRY

Analytical Chemistry

suited for field XRF applications, and the algorithm can be easily implemented on a personal computer.

200.182
PB93-125344 Not available NTIS National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Inorganic Analytical Research Div.

Quality assurance comprises a set of experimental and statistical procedures designed to test, systematically and objectively, whether a method used is in a state of statistical control, and consequently whether it is capable of producing data that can be used with confidence. The simplest quality control procedure is to include a standard material in each batch of samples to be analyzed, chosen to be homogenous and a close match to the samples with regard to major elements and important minor elements. The precision of activation analysis can often be improved by combining multiple gamma rays, radionuclides, and sublimation products that they agree. The overall uncertainty includes Poisson counting statistics and other sources of random and systematic error. The definition of statements of uncertainty used with reported analytical results should be clearly stated.

200.185
PB93-130367 Not available NTIS National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Inorganic Analytical Research Div.

The old EPA/NMI Mass Spectral Database is now known as the NIST/EPA/MSDC Mass Spectral Database. The 1988 update of that database included spectrums of a number of new compounds and many new improvements including the initial results of a systematic effort aimed at improving the quality of the database. About 65% of the results which appeared in earlier versions of the database have been corrected already. The new version of the database has nine search modes, and can be used as a means of matching unknown spectra, as well as serving the same functions as a collection of spectra of peak index in chart copy. The 1988 update provided structural information on about 80% of the compounds for the first time. Close to 100% of the compounds in the next update will be associated with chemical structures.

200.186
PB93-135311 Not available NTIS National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.

Optimization of Large Scale Chromatography for Biotechnological Applications.

Final rep.
A. P. Peskin, and S. R. Rudge, 1992, 1p

Keywords: *Biotechnology, *Chromatography, *Economic analysis, Pumps, Pumps, Columns, Particle size, Reprints.

An economic evaluation of a chromatographic separation is discussed. The effects of particle size, cycle time, solvent, and column costs are analyzed. With small particles (<20 micrometers), the cost of the packing can be as much as 99% of the total cost of the process, whereas with large particles (>60 micrometers), resin costs are less than half of the total. A strong optimum is found between 20-40 micrometers for maximum productivity, using both Gaussian and the mass transfer model of Laplace and Amundson. A new compilation of resin costs, column costs, and pump costs is given.

200.187
PB93-135432 Not available NTIS National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Surface and Microanalysis Science Div.

Application of a Numerical Procedure in the Calculation of the Atomic Number Correction in Electron Probe Microanalysis.

Final rep.
R. L. Gille, and C. F. Fiori, 1989, 4p


A general method for computing the loss of x-ray generation due to the energy distribution of backscattered electrons from a specimen is demonstrated. Since the method employs an appropriate numerical procedure to evaluate the required integrals, any x-ray cross-section or electron deexcitation function can be easily programmed.

Basic & Synthetic Chemistry

200.186
PB93-144435 Not available NTIS National Inst. of Standards and Technology (CSTL), Gaithersburg, MD Chemical Kinetics and Thermodynamics Div.

Development of Beta-Carotene Mixture Precipitated from Liquid Solvents with High-Pressure CO2.

Final rep.
Grant NSF-CT86-16493
Sponsored by National Science Foundation, Washington, DC.

Keywords: *Carotenoids, *Purification, Crystalization, Precipitation, Chemical, Carbon dioxide, Solvents, High pressure, Reprints.

Solsids precipitation from liquid solvents, with dissolution by high-pressure CO2 as an antisolute to create supersaturation is a potentially attractive crystallization process. Solids can be recrystallized and easily isolated from the liquid solvent. The gas antisolvent solvent process was used to separate and purify beta-carotene from a mixture containing carotenoid oxidation products. The beta-carotene was successfully separated from oxides, and an enriched trans-beta-carotene was obtained from cis isomers. The separation was carried out in both batch conditions. Relative solubility of the analyte and the antisolvent (CO2) has a dramatic influence on the absolute yield and purity of the product.

200.189
PB92-170612 Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Analytical Chemistry, Structural, and Conformational Studies of 2,7-anhydro-L-glycero-beta-D-manno- octopyranose and Its O-acetyl Derivative.

Final rep.
M. G. Ambrose, A. J. Fallaci, and B. Coxon, 1990, 7p

Keywords: *Carbohydrates, *Molecular structure, *Conformational changes, Isomers, Nuclear magnetic resonance, Spectrum analysis, Reprints, *Pyranoses.

The molecular structures and chair conformations of 2,7-anhydro-L-glycero-beta-D-manno-octopyranose and its O-acetyl derivates have been determined by one-dimensional and two-dimensional proton and carbon-13 nuclear magnetic resonance (NMR) spectroscopy. Proton NMR assignments have been confirmed by selective homonuclear spin decoupling and by 2D COSY techniques. Assignments of carbon-13 NMR chemical shifts have been determined by 2D heteronuclear carbon-proton chemical shift correlation spectroscopy.

Industrial Chemistry & Chemical Process Engineering

200.190
PB92-159649 Not available NTIS National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.

Mass Transfer in Supercritical Extraction from Solid Matrices.

Final rep.
M. C. Jones, 1991, 17p
CHEMISTRY

Industrial Chemistry & Chemical Process Engineering

Most modeling studies of flow through porous media assume homogeneous porosity at the scale of observation. However, many industrial applications of packed beds make use of packed packing materials that are coarse relative to the dimensions of the containing vessel. This introduces a stochastic spatial element due to an inherent randomness in packed packings, that affects local flow fields. The authors' research indicates that these effects may alter global flow patterns significantly. The paper will describe the investigations, both experimental and numerical, studying the effects of random packing on forced and mixed convective flows. The experimental study is based on visualization of flow through a test apparatus with square cross section that is filled with glass spheres of a given diameter. Top and bottom temperatures can be controlled to induce internal convective flows.

PB93-135333

Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Thermophysics Div.

Liquid-Vapor Surface Sensors for Liquid Nitrogen and Hydrogen.

Final rept.
J. D. Siegworth, R. O. Voth, and S. M. Snyder, 1992, 7p
Contract NASA-C-329009-K
Sponsored by National Aeronautics and Space Administration, Cleveland, OH, Lewis Research Center.

Keywords: "Liquid-vapor interfaces, 'Optical measuring instruments,' 'Liquid nitrogen,' 'Liquid hydrogen, 'Surface resistance thermometers, Detectors, Cryogenics, Reprints."

Test of resistance thermometers as liquid-vapor interface sensors for LH2 and LN2 showed that most could be made to detect the liquid surface, but a tiny silicon sensor developed at NASA Goddard gave the fastest response and the greatest signal change. Tests of a commercial optical surface sensor and two modified versions of it showed how the right sensors can relax and rapidly detect the liquid-vapor interface of both hydrogen and nitrogen.

PB93-135481

Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Thermophysics Div.

Application of Process Analysis to a Separator-Solubilizer for Supercritical Fluid Extraction.

Final rept.
T. J. Bruno, 1992, 10p

Keywords: "Separators, Supercritical fluids, Process control, Food processing, Separation, Automation, Duplex detectors, 'Supercritical fluid extraction, 'Sepsol."

The paper describes a simple, automated produce separator (called Sepsol, an acronym for separate/solubilize) for use in the supercritical fluid extraction (SFE) of chemical substances, especially high value-added natural products that are of interest in food and pharmaceutical industries. Special consideration is given to the more important process analysis and control issues. Sepsol is especially applicable to the rather difficult case of extractions from aqueous or wet cell broths or matrices. There is a need for a single unit operation that provides: (1) decompression of the supercritical fluid (SF) solution and precipitation of the product, (2) separation of residual carry-over water from upstream in the process, and (3) the dissolution or dispersion of the product into a suitable stabilizing oil matrix directly appropriate for sale. Process analyzers are used in situ to monitor product concentration and quality, and to provide process control. The controls automatically draw product at the appropriate concentration, and provides for compensation of upset conditions.

Photo & Radiation Chemistry

PB94-135475

Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Electro-Optical and Physics Div.

Computer programs, Reprints, Lambda line, HEPROP-88 computer program.

Codes of helium properties previously published by the present authors are limited in range and/or accuracy and are not self-documented. In response, the authors have described a new code for the range 0.6 to 1500 K, with pressures to the melting line of 10(8) Pascal's, including an accurate description of the lambda line. Included are 26 pairs of allowed input parameters, and a module for interactive input and output. The program is written in ANSI-standard Fortran, and runs on both personal computers and mainframes.

200.191

PB92-175124

Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.

Regenerative Performance with Noble Gas Mixtures.

Final rept.
D. E. Daney, 1991, 8p
Sponsored by Air Force Space Technology Center, Kirtland AFB, NV.

Keywords: "Regenerators, 'Argon, 'Krypton, 'Helium, Binary mixtures, Heat transfer, Cryogenics, Reprints."

The performance of regenerators that use noble gas mixtures is compared to the performance of those that use pure helium gas. Both helium-argon and helium-krypton mixtures are investigated. For some heat transfer surfaces, a modest gain in heat transfer can be achieved with these mixtures. The concomitant increase in pressure drop, however, more offsets the heat transfer gain, and the net regeneration loss increases for all the cases evaluated.

200.192

PB92-175629

Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.

Three Layer Membrane Model for Characterizing Ultrafiltration Membranes.

Final rept.

Keywords: "Ultrafiltration, 'Membranes, 'Mathematical modeling, 'Mass transfer, 'Solute concentration, 'Composition, Reprints."

To characterize ultrafiltration membranes, it is important to understand their intrinsic, macromolecular-rejection properties. The concentration of a membrane's permeability parameters requires an understanding of the mass transfer at the solute at the membrane interface. The solute concentration is difficult to measure experimentally, and has been previously estimated using various forms of a mass transfer coefficient. In the paper, the authors present an analytical, steady-state model for predicting ultrafiltration solute concentrations at the membrane interface from experimentally measured parameters and known solute physical properties - without the use of a mass transfer correlation. The authors then extend the model by looking at mass transfer through the membrane itself, in order to predict membrane permeability parameters.

200.193

PB92-175983

Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.

Study of Convection in Coarse-Packed Beds by a Fiberoptic Laser Fluorescence Probe Array and Numerical Modeling.

Final rept.
J. D. Wolfe, and M. C. Jones, 1990, 8p
Sponsored by Department of Energy, Washington, DC.
Office of Basic Energy Sciences.

Keywords: "Flow distribution, 'Beds(Process engineering), 'Flow visualization Fiber optics, 'Fiberoptic techniques, 'Fluorescence dyes, 'Convection, 'Fluid dynamics, Reprints."

The authors describe a new experimental technique designed for the study of global fluid motion in packed beds. The method uses fiberoptic sensors illuminated by laser light to detect the presence of a fluorescent dye injected into a small throughflow from top to bottom. Breakthrough patterns, residence time distributions, and maps of probes recording cellular flow are presented together with plots of the standard deviation of arrival times for isothermal flow and flow with significant thermal gradients.

200.194

PB92-197623

Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD. Office of the Director.

Characterization of Catalyst Materials as Reference Standards.

Final rept.
R. A. Haines, 1989, 7p


Through a series of round robin tests conducted by participating laboratories, ASTM Committee D-32 on Catalysts has characterized a variety of catalyst materials using standard test methods. Materials include fluid cracking catalysts, zeolites, silicas, aluminas, supported metals, and a gas oil feedstock. Properties characterized include surface area, crush strength, catalytic microactivity, particle size, unit cell dimensions and metal content. These materials are available from the National Institute of Standards and Technology as reference materials.

200.195

PB92-197854

Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.

Tracer Experiment on Packed Beds with Forced and Mixed Convection Using Fiberoptic Fluorescence Probes.

Final rept.
M. C. Jones, and J. D. Wolfe, 1991, 8p
Sponsored by Department of Energy, Washington, DC.
Office of Basic Energy Sciences.

Keywords: "Flow distribution, 'Beds(Process engineering), 'Flow visualization Fiber optics, 'Fiberoptic techniques, 'Fluorescence dyes, 'Convection, 'Fluid dynamics, Reprints."

The authors describe a new experimental technique designed for the study of global fluid motion in packed beds. The method uses fiberoptic sensors illuminated by laser light to detect the presence of a fluorescent dye injected into a small throughflow from top to bottom. Breakthrough patterns, residence time distributions, and maps of probes recording cellular flow are presented together with plots of the standard deviation of arrival times for isothermal flow and flow with significant thermal gradients.

200.196

PB92-236792

Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Chemical Engineering Science Div.


Final rept.
B. A. Hands, V. Arp, and R. D. McCarty, 1988, 4p
Sponsored by National Institute of Standards and Technology, Moffett Field, CA, Ames Research Center.

Keywords: "Helium, 'Transport properties, 'Temperature dependence, 'Superfluidity, 'Equations of state, "
PHOTOMISSEION STUDY OF BAO OVERLAYERS ADSORBED ON W(110) AND THEIR INTERACTION WITH H2O, CO2, AND O2

Final report.
Sponsored by Office of Naval Research, Arlington, VA.


The electronic structure of barium oxide overlays on W(110) and with hydrogen adsorption has been examined using ultraviolet photo electron spectroscopy. At room temperature water vapor and carbon dioxide doses of 5×10^11 to 1×10^13 c/cm² adsorbed on W(110) to produce low coverages of H2O and CO3 species. Heating the W(110)-(5x5)-1×1-BaO surface following water or carbon dioxide exposure dissipates the adsorbed hydroxide or carbonate. On the lower coverage c(2x1)-BaO and c(2x4)-BaO adlayers complete dissociation of a fraction of the adsorbed water or carbon dioxide molecules is observed. All interactions of oxygen with W(110) is enhanced by the presence of barium oxide on the tungsten surface. The results are compared with the findings of a previous study of barium oxide films adsorbed on W(110).

200.200

PHOTOMISSEION STUDY OF BAO OVERLAYERS ADSORBED ON W(110) AND THEIR INTERACTION WITH H2O, CO2, AND O2

Final report.
Contract DE-AC02-78CH00544
Sponsored by Department of Energy, Washington, DC.

Keywords: "Nitrogen oxides, *Desorption, Silicon, Surface chemistry, Lasers, Surface properties, Reprints, *Laser induced desorption.

The results of a quantum-state-resolved study of the laser-induced desorption (LID) of NO from Si(111) 7×7 at a surface temperature of 100 K are reported. All aspects of the LID are found to be sensitive to the initial coverage. The coverage dependence indicates that there are two desorption mechanisms, one operative at low coverages that is quenched with increasing NO exposure, and one operative at high coverage. The reported characterization of the low coverage channel. Most of the energy in the desorbed NO occurs as vibration and translation, with the rotations substantially cooler. The LID-desorption for propylene on Si(111) 7×7 is consistent with the ground spin-orbit state. The energy partitioning shows strikingly little change as the desorption-laser wavelength from 1000 to 355 nm. This, coupled with a quantitative study of the yield on the same photon energy range and selective oxidation experiments, establishes that the desorption is specifically due to an interaction involving photogenerated holes in the rest-atom localized, intrinsic surface state of the 7×7 reconstructed surface. It is suggested that the surface state hole drives the desorption by neutralization of a NO(-delta) adsorbate.
Physical & Theoretical Chemistry

200.210 AD-2253 551/6 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD.
Vibrational Spectra of Molecular Ions Isolated in Solid Neon: HCCH + and HCC!
Forney, M. E.; Jacobson, W. Thompson. c1992, 13p ARQ-25664-12-CH
Contract ARO-MIPR-120-90
Available for download.

Keywords: Neon, Solids, Molecular ions, Vibrational spectra, Neon, calcarons, Argon, Chemical bonds, Microwave discharges, Polarizability, Stretching.

When a Ne:C2H2 sample is codoped at approximately 5 K with a beam of neon atoms that has been excited in a microwave discharge, a sharp, prominent absorption assigned to upspin(3) of HCCH + appears at 3137.6 cm(-1), very close to the previously reported gas-phase band center. Experiments on carbon-13 and deuterium substituted samples support this assignment and permit the identification of all of the infrared-active CH- and CD-stretching fundamentals of the isotopically substituted acetylene cations, with the exception of the CH-stretching and stretching-interaction force constants. The absorptions of the carbon-13 substituted acetylene cations are identified in the analogous argon matrix experiments, but exhibit a matrix shift of approximately 30 cm(-1), possibly because of the larger polarizability of argon.

200.211 AD-FO07 9157/2 PC A01/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.
State Specific Studies of the Laser Induced Desorption of NO from Si(111)
L. J. Richter, S. A. Bunin, D. S. King, and R. R.
Cavagnal. 22 May 92, 4p
Contract ATST-84ER11520
This article is from the "Optical Society of America (OSA) Photon Science Technical Meeting Series. The Optical Society of America has prepared and published the Photon Science Technical Meeting Series. The Optical Society of America (OSA) has prepared and published the Photon Science Technical Meeting Series.

Keywords: Nitrogen oxides, Stick, Adsorbates, Coordinating, Heating, Photons, Substrates, Energy transfer, Radiation pressure, Surface chemistry, Laser-induced desorption, Nitrogen oxides(NO), Component Reprints.

A wide variety of chemical processes at semiconductor surfaces have been observed to be promoted by laser-induced desorption. The possible mechanisms for the transfer of the initial photon energy to the reaction coordinate are many, including simple substrate heating, substrate carrier driven reactions, and localized adiabatic photoexcitation. State-resolved studies of laser-induced reaction products have proven extremely illuminating as they often allow the distinction and quantification of various competing excitation mechanisms. We present here the results of a state-resolved study of the laser-induced desorption (LID) of NO from Si(111) in which the energy partitioning in the desorbed NO is found to vary dramatically with the initial NO coverage due to the presence of competing excitation channels.

Photocatalysis and Radiation Chemistry

200.212 PB82-144187 Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD.
Effectivity of the Liquid-Vapor Interface Close to the Critical Point; A Theoretical Analysis.
See also PB87-161480.
Pub. in International Jnl. of Thermophysics 11, n1 p13-24 1990.

Keywords: Liquid-vapor interfaces, Ellipsometry, Critical point, Reprints.

It is shown that to second order in the thickness of the interface the ellipsometric coefficient for a liquid-vapor interface varies with wavelength as e = a + b/\lambda. The first is found using Drude's formula and the dielectric constant profile which follows from the Fisk-Woodruff model. The second contribution due to capillary wave fluctuations of the position of the interface. Finally the third contribution is due to fluctuations of the density profile around the Fisk-Woodruff profile with a wavelength up to roughly the bulk correlation length and thus short compared to the capillary length. One may apply the results in the paper also to an interface of any fluid if one makes the necessary replacements.

200.213 PB82-144310 Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD.
Physics of the Electric Microfield in Ionic and Polar Media.
Final rept. Blum, J. and B. Hubbard. 1990, 4p
See also AD-222 A534.

Keywords: Electric fields, Condensates, Variations, Stochastic processes, Probability theory, Correla-
ths, Reprints.

The authors discuss general stochastic features of dynamic, microscopic electric field fluctuations in simple, condensed media.

200.214 PB82-144377 Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD.
Energy Transfer from Optoacoustic Measurements and Fourier Transform Deconvolution.
Pub. in International Jnl. of Chemical Kinetics 21, n1 p1029-1047 1989.

Keywords: Sulfur hexafluoride, Discrete Fourier transform, Ultrasound, Acoustic signals, Lasers, Energy transfer, Acoustooptics, Argon, Reprints.

The rate of V->R energy relaxation following pulsed IR laser excitation is measured by employing an optoacoustic single pulse method. Under present experi-
mental conditions, the operation of convoluition applies. The experimental optoacoustic waveform can be viewed as convolution of the kinetic relaxation waveform with an optoacoustic waveform obtained under very fast energy relaxation conditions. A discrete Fourier transform deconvolution method is appli-
cd to optoacoustic measurements on SF6 in argon to obtain the time constant, tau, or energy transfer.

The authors found that it was necessary to carry out a micro torr, in good agreement with other methods. These results were obtained without requiring either a theoretical description of the pressure waveform or an assumed laser irradiation geometry. For conversion to...
apply, the differential equation describing the pressure pulse might be linear under the conditions of the experiment. The linearity of the system can usually be tested experimentally.


Keywords: Binary mixtures, Carbon dioxide, Nitrogen, Butanes, Thermodynamic equilibrium, Phase studies, Density(Mass/Volume), Mathematical models, Reprints. Vapor-liquid equilibria for the binary systems N2/CO2, N2/n-C4H10, and CO2/n-C4H10 were measured from 220 to 394 K. Coexisting densities were also measured over the temperature range, 77 K to 394 K. The data were modeled with two commercial software packages, DDMIX and Equi-phase.


Keywords: Refrigerants, Fluorocarbons, Specific heat, Equations of state, Virial coefficients, Molecular relaxation, Acoustic velocity, Thermodynamic properties, Reprints.

The speed of sound in gaseous 1,1-dichloro-2,2,2-trifluoroethane (CH2FCl-CF2, commonly known as R12) has been measured at temperatures T between 260 and 335 K at pressures p from 1.6 to 77 kPa. Perfect-gas heat capacities and second and third acoustical virial coefficients have been calculated from the results. The second and third acoustical virial coefficients are used to determine the density virial coefficients B(T) and C(T) and an effective square-well potential. The acoustical estimates of B(T) and C(T) are consistent with B(T) and C(T) deduced from high-quality (p,v,T) results. The combined values of B(T) and C(T) cover a reduced temperature range of 0.57 to 0.99. The authors have also measured the speed of sound in 1,2-dichloro-1,2,2-trifluoroethane (CH2F-CF2, commonly known as R123a). This isomer of R123 is a significant impurity in R123 as manufactured and used. The authors present the results of the vibrational relaxation time for R123.


Keywords: Styrene, Indene, Alkylated aromatics, Proton transport, Lewis bases, Reprints, Proton affinity.

The authors report experimental and theoretical AM1 proton affinities of Styrene, beta-methylstyrenes and indene. The computed AM1 proton affinities for the species of interest were in good agreement with the experimental values. Trans-beta-methylstyrene was found to have a proton affinity slightly lower than that of styrene. This is an unusual result since methyl substitution in most classes of compounds increase the proton affinity by 2.4 kcal/mole. The lower basicity of trans-beta-methylcyclopropenyl amine compared to styrene is due to the greater stabilizing effect of the methyl group in the neutral species compared to the cation.


Keywords: Acetaldehyde, Ground state, Fourier transform spectrometers, Rotational states, Vibrational states, Least squares method, Microwave spectroscopy, Classical models, Torso, Reprints. New microwave measurements on the ground state of acetaldehyde have been carried out using a Fourier transform spectrometer in the region from 7 to 26 GHz (typical measurement uncertainty 4 kHz). A conventional Fabry-Perot etalon in the region from 45 to 116 GHz (typical measurement uncertainty 40 kHz). These new ground state measurements and remeasurements have been added to two theoretical models of a data set containing far-infrared combination differences from the literature, microwave transitions from the literature, and the new microwave transitions.


Keywords: Refrigerants, Equations of state, Diatomic properties, Acoustic velocity, Surface tension, Vapor pressure, Virial coefficients, Density, Reprints, US NIST, NIST, NIST. The activities in the Thermophysics Division at NIST to produce both property measurements and correlations are discussed. These activities are directed toward properties that will be alternatives to the fully halogenated compounds presently used as working fluids. Seven property measurement apparatuses and three property correlation projects are described.


Keywords: Light scattering, Electrooptics, Electric fields, Correlation functions, Variance(Statistics), Auto-correlation, Suspensions, Mobility, Reprints. The homodyne correlation function for light scattered from a aqueous suspension of particles in a uniform oscillating electric field is calculated, using the mobility, as a function of frequency. The correlation function has an exponential decay that is modulated at frequency omega/2pi with amplitude (1/e^c/omega) - c/omega)^2, where c is the scattering vector. The plot of omega vs./omega/2pi is the amplitude and frequency of the oscillating field, and c/omega is the variance of the mobility of the particles. The variance can be determined by fitting the theoretical correlation function to homodyne photon auto-correlation measurements. The technique has the advantage of insensitivity to convection of the particle from heating by the applied electric field.


Keywords: Emission spectra, Polarization(Waves), Excitation, Anisotropy, Reprints, Chlorotrifluoromethane, X-ray emission. Strongly anisotropic, polarized C K-V x-ray emission from gas-phase CF3Cl has been observed following resonant excitation with a linearly polarized x-ray beam. Distinctively different angular distributions are observed for x-ray emission involving molecular orbitals of different symmetries. A classical model of the x-ray absorption-emission process accurately describes the observed radiation patterns.


Keywords: Physical chemistry, Supercritical fluids, Reaction kinetics, Combustion, Propellants, Molecular orbitals, Thermodynamic properties, Cyclotropendane, Solutes, Liquids, Solids, Solubility, Nitrogen, Oxygen, Molecular vibration, Molecular rotation, Constants, Carbon dioxide, Ab-initio calculations.

Contents.

Chemical Kinetic Database for Propellant Combustion. I. Reactions Involving NO, N2, HNO, HNO2, HCN, and N2O; Ab-Inito Calculations and Ideal Gas Thermodynamic Functions of Cyclotropendane and Cyclotropendane Derivatives; Improved Fits for the Vibrational and Rotational Constants of Many States of Nitrogen and Oxygen; Solubilities of Solids and Liquids of Low Volatility in Supercritical Carbon Dioxide.
dioxide have been published up to the end of 1989, with the temperature and pressure ranges of the experimental measurements, the experimental method, and results shown to be the source of data for pure compounds, which were presented in tabular form in the original publications, are shown in a series of figures along with correlation lines for each isotherm. The method of correlation was to fit the experimental data for each isotherm, in the form of the natural logarithm of the product of mole fraction and pressure, to a linear function of density above a pressure of 100 bars. The constants obtained from the fitting procedures are given in the tables. Procedures for estimating errors from these constants, the solubilities of the compounds at temperatures and pressures different from those of the experimental data are suggested. (Copyright c 1991 by the U.S. Secretary of Commerce.)

200.227
PB92-148113
Not available NTIS
American Chemical Society, Washington, DC.
D. R. Lide, c1991, 283p
See also PB92-148121 through PB92-148154 and PB92-148063. Prepared in cooperation with American Inst. of Physics, New York. Sponsored by National Inst. of Standards and Technology, Gaithersburg, MD. Available from American Chemical Society, 1155 16th St, NW, Washington, DC. 20036-9976.
Sixteen Thousand Evaluated Experimental Thermodynamic Property Data for Water and Steam.

Contents:
Wavelengths and Energy Level Classifications for the Spectra of Aluminum (Al I through Al XIII); Energy Levels of Krypton, Kr I through Kr XIX; Thermodynamic Properties of Oxygen from the Triple Point to 300 K with Pressures to 80 MPa; Sixteen Thousand Evaluated Experimental Thermodynamic Property Data for Water and Steam.

Keywords: *Thermodynamic properties, Levels, Energy levels, Ions, Water, Steam, Multicharged ions, Wavelengths, Tables(Data).

200.228
PB92-148121
Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD.
Wavelengths and Energy Level Classifications for the Spectra of Tellurium (Te I through Te VIII); V. Kaufman, and W. C. Martin, c1991, 82p

Keywords: *Aluminum ions, Aluminum, Energy levels, Water, 1Wavelengths, Energy levels, Water, Atomic spectra, Ion Data, Tables(Data).

Wavelengths and their classifications have been compiled for the spectra and all positive ions of aluminum (Z = 13). The selections of data are based on the compilations of energy levels by Martin and Zavod, 1979, J. Phys. Chem. 83 Data 8, 817-864, with some updating from the more recent literature. Wavelengths (or wave-numbers) calculated from the differences of the energy levels are given along with the observed values for all classified lines; these calculated wavelengths should in general be more accurate than the observed values whatever the two values differ significantly. Calculated wavelengths are also given for a number of lines that have not yet been observed, including some important forbidden transitions. The complete data are given in separate tables for the different spectra. No limitation has been imposed on the wavelength range of the classified lines, except for the omission of x-ray transitions in the neutral atom. Two finding lists are also included, one for Te I through Te VI and another for Te VII through Te VIII.


Keywords: *Thermodynamic properties, Energy levels, Water, Wavelengths, Ions, Tables(Data).

200.229
PB92-148139
Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD.
Energy Levels of Krypton, Kr I through Kr XXXI.
J. Sugar, and A. Musgrove, c1991, 57p
Published by the National Institute of Standards and Technology. (Copyright c 1991 by the U.S. Secretary of Commerce.)

200.230
PB92-148147
Not available NTIS
Idaho Univ., Moscow.
Thermodynamic Properties of Oxygen from the Triple Point to 300 K with Pressures to 80 MPa.

Keywords: *Thermodynamic properties, Oxygen, Equations of state, Acoustic velocity, Specific heat, Enthalpy, Entropy, Density, Pressure dependence, Critical point, Triple point, Tables(Data).

A joint project by the authors has resulted in two new thermodynamic property formulations for oxygen. The fundamental equation explicit in Helmholtz energy by Schmidt and Wagner and Schmidt, calibrated with the compilation of the property tables presented here, and for comparisons of calculated properties to the experimental data. The formulation by Schmidt and Wagner is based in the paper in comparisons of properties calculated by the two formulations. These comparisons provide the basis for independent assessment of the accuracy of the available data and calculated properties. The fundamental equation is valid for thermodynamic properties of oxygen from the freezing line to 300 K at pressures to 80 MPa. A separate vapor pressure equation and equations for the saturated liquid and saturated vapor density at pressures up to 20 MPa are included. Functions for calculating internal energy, enthalpy, entropy, isochoric heat capacity (Cv), isobaric heat capacity (Cp) and isothermal compressibility are included. Tables of thermodynamic properties of oxygen are given within the range of validity of the fundamental equation. The fundamental equation reported here may be used to calculate densities with an uncertainty of 0.1 percent, heat capacities within 2.0 percent, and velocity of sound values within 1 percent. These uncertainties are valid for the range outside of the critical region. (Copyright c 1991 by the U.S. Secretary of Commerce.)

200.231
PB92-148154
Not available NTIS
Keio Univ., Yokohama (Japan). Dept. of Mechanical Engineering.
Sixteen Thousand Evaluated Experimental Thermodynamic Property Data for Water and Steam.
Prepared in cooperation with National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Thermodynamic properties of water from the freezing line to 300 K at pressures to 80 MPa. Various properties are given here. Prepared in cooperation with National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Included in Jnl. of Physical and Chemical Reference Data, Vol 20, Number 5, September/October 1991. Available from American Chemical Society, 1155 16th St, NW, Washington, DC. 20036-9976.

Keywords: *Thermodynamic properties, Steam tables(Thermodynamics), Water, Equation of state, Acoustic velocity, Vapor pressure, Metastable state, Pressure dependence, Equations of state, Tables(Data).

200.232
PB92-148158
Not available NTIS
U. of Michigan, Ann Arbor.
Experimental Thermodynamic Properties of Methane and Its Reaction Products.

Keywords: *Thermodynamic properties, Methane, Reaction products, Tables(Data).
As part of the activities of the International Association for Physical and Theoretical Chemistry, the American Society of Chemistry, and the American Chemical Society, joint teams of experts were convened to tabulate and evaluate values for properties of thermal and chemical stability. The data are grouped by state or phase: ideal-gas properties; sublimation and melting curves; saturation properties; properties of liquid water at ambient pressure; thermodynamic properties of the single-phase state; and of metastable states. In each category, a subdivision is made by property. Properties include the volume, enthalpy, heat capacities, sound velocity, internal energy and Joule-Thomson and related coefficients. The data were selected from approximately 16,000 data points and covers a century of experimental work at temperatures from 253 to 2173 K and pressures of up to 1000 MPa.

200.232
PB92-141812

Available from American Chemical Society, 1155 16th St, NW, Washington, DC. 20036-9976.

Keywords: *Physical chemistry, Atomic weights, Standards, Equations of State, Thermodynamic properties, Methane, Propulsion, Sulfuric acid, Carbon dioxide, Solubility, Reaction kinetics, High-temperature tests, Combustion, Atmospheric chemistry, *Foreign technology, Isotopic composition.

Contents:
A New Equation of State and Tables of Thermodynamic Properties for Methane Covering the Range from the Melting Line to 625 K at Pressures up to 1000 MPa;
Thermodynamic Properties of the Aqueous Sulfuric Acid System to 350 K;
The Solubility of Carbon Dioxide in Water at Low Pressure;
Chemical Kinetic Data Sheets for High Temperature Reactions. Part II;
Atomic Weights of the Elements 1989;
Isotopic Compositions of the Elements 1989.

200.235
PB92-1419170
Not available NTIS Buchum (Germany, F.R.). Inst. fuer Thermo- und Fluiddynamik. New Equation of State and Tables of Thermodynamic Properties for Methane Covering the Range from the Melting Line to 625 K at Pressures up to 1000 MPa;

Keywords: *Equations of State, *Thermodynamic properties, *Methane, Tables(Data), Pressures, Specific heat, Helmholtz free energy, Entropy, Phase-transformation temperatures, Melting, Liquid-vapor interfaces, Saturation, Virial coefficients.

The work reviews the data on thermodynamic properties of methane which were available up to the middle of 1991 and presents a new equation of state in the form of a fundamental equation valid in the Helmholtz free energy. A new strategy for optimizing the structure of the fundamental thermodynamic relations was selected to determine the functional form of the equation. The Helmholtz function containing 40 fitted coefficients was fitted to selected experimental data and the following properties: (1) thermodynamic functions of the single phase (P, rho, T) and (2) of the liquid-vapor saturation curve (Psub(s), rho sub(s)) including the Maxwell construction and the liquid-vapor coexistence curve (capacity c upsilon, (5) isobaric heat capacity (sub p), (6) difference of enthalpy delta h, and (7) second virial coefficient B. Independent equations are also included for the vapor pressure, the saturated liquid and vapor densities, the isobaric ideal gas heat capacity and the heat current function. The equation is valid up to 3000 MPa and 5000 K. Tables for the thermodynamic properties of methane from 90 K to 620 K for pressures up to 1000 MPa are presented. To verify the accuracy of the new formulation, the agreement of selected thermodynamic properties with experimental results and existing equations of state for methane. (Copyright (c) 1991 by the U.S. Secretary of Commerce.)

200.234
PB92-1416188
Not available NTIS Northwest Aeronautics and Space Administration, Cleveland, OH. Lewis Research Center. Thermodynamic Properties of the Aqueous Sulfuric Acid System;


Keywords: *Thermodynamic properties, *Sulfuric acid, Electrolytes, Liquid phases, Specific heat, Entropy, Melting points, Electromotive force, Tables(Data), Osmosis, Activity coefficients, Heat of fusion, Solidification, Latent heat, Energy, Freezing, Phase transformations, Entropy.

Experimental measurements for aqueous sulfuric acid and its related pure, solid phases have been thermodynamically analyzed and correlated as a function of temperature and pressure, yielding functions for pure water to pure acid. The pure phases included anhydrous sulfuric acid, five of its hydrates and ice. Experimental data were correlated through the use of models which incorporate the contributions of the enthalpy of dilution, both solution and pure phase heat capacities, electromotive force and solidification energies. The correlation yielded mutually consistent expressions for the Gibbs energy of each phase and these functions generally reproduce the experimental data to 0.75 percent. The Gibbs energy functions of the pure solid phases were used to generate tables of their thermodynamic properties. The Gibb's energy function for aqueous sulfuric acid was used to produce tables of both integral and partial molar solution properties as a function of sulfuric acid mole fraction every 50 and 100 mole percent. (Copyright (c) 1991 by the U.S. Secretary of Commerce.)

200.236
PB92-1418196

Keywords: *Carbon dioxide, *Solubility, Hennys law, Low-pressure tests, Water, Entropy, Vapor phases, Thermodynamic data, *Isotopic composition.

The system carbon dioxide-water is of great scientific and technological importance. Thus, it has been studied often. The literature for the solubility of carbon dioxide in water is vast and interdisciplinary. An exhaustive survey was conducted and approximately 100 experimental investigations were found that reported solubility data at pressures below 1 MPa. A model based on Henry's law was used to correlate the low pressure data (those up to 1 MPa). The following correlation of the Henry's constants (expressed on a molar fraction basis) was developed: K(MPa) = 6.8346 + 1288.77T-376680/sq T + 2.977 x 10 to the 8th power/cu T, the correlation is valid for T less than or equal to 443 K(less than or equal to)160 C) when T is in K. Any experimental data that deviated significantly from this model were duly noted. (Copyright (c) 1991 by the U.S. Secretary of Commerce.)

200.237
PB92-1418204
Not available NTIS Advanced Chemistry Corp., Los Angeles, CA. Chemical Kinetic Data Sheets for High Temperature Processes, Part II.


Keywords: *Chemical reactions, Reaction kinetics, *High temperature tests, High pressure, Physical chemistry, Polynomials, *Thermodynamics, Vapor phases, Graphs (Charts), Thermochromy, Oxygen atoms, Alkanes, Hydroxyl radicals, Halogen organic compounds, Oxygen, Ammonia.

Rate coefficient measurements for over fifty gas-phase and a few solid-phase reactions were made and compared to theoretical calculations. The results of the work are summarized here in forty-nine Data Sheets, one sheet for each reaction or set of reactions of a pair of reagents. The reactions chosen are of interest in propulsion, combustion, and atmospheric chemistry. Each Data Sheet consists of two pages that include a brief resume of the important experimental measurements and theoretical calculations, a graphical presentation of the data, a recommended rate coefficient at standard temperature and pressure, AT(sup n) exp(B/T), with probable uncertainty limits, a discussion of the basis for the recommendation, and the effects of the reverse reaction where applicable, and pertinent references. (Copyright (c) 1991 by the U.S. Secretary of Commerce.)

200.238
PB92-1418212

Keywords: *Atomic weights, *Standards, Chemical elements, Radioisotopes, Half life, Extraterrestrial matter, Tables(Data), Isotopic composition.

The biennial review of atomic weight, A(sub r)(E), determinations, and other cognate data has resulted in changes for nickel, K = 0.99999 + 0.001 to 0.999994 + 0.00002 and for antimony from 121.75 + 0.03 to 121.757 + 0.003 due to new calibrated measurements. The deconvolution of the isotopic composition of mercury has also been improved during the last two years, the Commission was able to reduce the uncertainty of the atomic weight of this element from 200.59 + 0.03 to 200.59 + 0.02. Due to the nearly constant isotopic composition of protactinium in nature, where (231) Pa is the predominant isotope, the atomic weight of this element was fixed to 231.03586 + 0.00002. The Table of Isotopic Compositions of the Elements 1989 will be published as a companion paper to that on Atomic Weights of the Elements 1989. The Table of Standard Atomic Weights contains significant Figures and current data on isotopic compositions of nonferrous materials are included to benefit users who are more interested in the data that have been determined during the last 25 years. The given table has full validity to the precision limit of their interest. The Table of Atomic Weights to Four Significant Figures was prepared and has been published separately. (Copyright (c) 1991 by the U.S. Secretary of Commerce.)
consistent with $q_{sub} n(E)$ values listed in the Table of Standard Atomic Weights 1989. (Copyright © 1991 by the U.S. Secretary of Commerce.)

200, 246
PB92-149749  PC E99/MF A06
National Inst. of Standards and Technology (PL),
Gaithersburg, MD.

Wavenumber Calibration Tables from Heterodyne Frequency Measurements, Special publ. (Final).
A. G. Maki, and J. S. Wells. Dec 91, 647p NIST/SP-221
Also available from Supt. of Docs. as SN003-003

Keywords: *Molecular spectra, *Infrared spectra, Carbon monoxide, Carbon disulfide, Nitric oxide, Nitrous oxides, infrared spectrometers, Frequencies, Tables(Data), *Calibration atlases, Carbon sulfide.

The new calibration atlas is based on frequency rather than wavelength calibration techniques for absolute references. Since a limited number of absolute frequency measurements is possible, additional data from alternate methodologies are used for different frequency measurements within each band investigated by the Fourier transform spectrometers. Data in these complementary techniques include the best Fourier transform measurements available. Included in the tables of the atlas are a description of the heterodyne frequency measurement techniques, details of the analysis including the Hamiltonians and least-squares-fitting and calculation procedures. Also included are other relevant considerations such as intensities and lens-surface parameters. A 350-entry bibliography which contains all data sources used and a subsequent section on errors concludes the text portion. The larger portion of the atlas consists of several hundred spectral-maps/facing-tables pages for the various calibration molecules. The spectral maps (as well as the facing tables) are calculated from the molecular-dynamics database developed for the work. The primary calibration molecules are the linear triatomic, carbon

200, 244
PB92-151486
Not available NTIS
National Inst. of Standards and Technology (CSTL),
Gaithersburg, MD.

Compressed Liquid Densities and Saturation
Densities of Chlorodifluoromethane (R22).

D. R. DelBagh, and G. Morrison. 1992, 4p
Published in Jnl. of Chemical and Engineering Data 37, n1 p117-120.

Keywords: *Densities(Mass/volume), *Fluorohydrocarbons, High pressure, Pressure dependence, Tempera-

Density measurements for liquid chlorodifluoromethane (R22) were made with a vibrating tube densimeter. The data range from 0.444 to 1.334 g/cc along 13 isotherms and 372 K and pressures between 1000 and 6200 kPa. The accuracy of the data is estimated to be $0.05\%$, except in the near-critical region.

200, 243
PB92-154210
Not available NTIS
National Inst. of Standards and Technology (PL),
Gaithersburg, MD.

Molecular-Beam Spectrum of the 3.3-μm ν12 Band of Benzene.
Final rept.
Sponsored by National Aeronautics and Space Admin-
istration, Washington, DC. Upper Atmospheric Research
Program.

Published in Jnl. of Molecular Spectroscopy 149, p391-398 1991.

Keywords: Benzene, Intermediate infrared radiation.
Molecular spectroscopy, Molecular beams, Infrared spectra,
Infrared lasers, Tunable lasers, High resolution, Reprints, Color center lasers.

The ν12(1e) fundamental band of C6H6 has been recorded under collisionless-temperature (approx. 10 K) molecular-beam conditions using bolometric detection of molecules excited by a linear-scan-controlled-color-center laser referenced to a dual-wavelength polarization-stabilized He/Ne laser. The sub-
Doppler instrumental linewidth of approx. 12 MHz (full width at half maximum) is a result of nearly every transition. Improved spectroscopic constants are obtained in a fit yielding a standard deviation of approx. 2 MHz, reflecting the measurement precision. A weak anharmonic or parallel 2-Controrsion perturbation is observed in the K = -5 and -6 sublevels and is attributed to a closely resonant, lower-lying high-order combination level.

200, 244
PB92-154269
Not available NTIS
National Inst. of Standards and Technology (PL),
Gaithersburg, MD.

Opto-Therm-Deflection Microwave-Sideband CO2-Laser Spectroscopy of NH3.

Published in Jnl. of Chemical Physics 85, p567-579 1991.

Keywords: *Hydrogen cyanide, *Ammonia, *Complexes, Laser spectroscopy, Van der Waals forces, In-
molecular forces, Hydrogen bonds, Carbon dioxide lasers, infrared spectra, Reprints.

A microwave-sideband CO2 laser is used together with an electric-resonance optothermal spectrometer to measure infrared absorption lines of NH3. The infrared radiation is produced by mixing Lamb-dip-stabilized CO2 laser radiation with synthesizer-derived microwave radiation in a CdTe-buffered GaAs stripe electrooptic waveguide modulator. For NH3 a symmetric top spectrometer is observed with a band origin at 1041.7/cm, blue-shifted approx. 91.8/cm from the hypothetical inversion-free ν2 band origin of free NH3, which is produced by 90°Wawas zero-point binding energy, D(0), for the excited state. The observed Delta B of -14.3 MHz, implying a hyd-
gen-governed Coriolis interaction, is consistent with this blue shift. The vibrationally excited complex does not pre-
odissociate within the approx. 1 ms transit time between the laser excitation region and the mass separator, impli-
ating that D(0) is greater than the laser frequency, approx. 1042/cm.

200, 245
PB92-154277
Not available NTIS
National Inst. of Standards and Technology (CSTL),
Gaithersburg, MD.

Thermophysical Property Measurements of Gaseous Refrigerants from Speed-of-Sound Measurements. 2. Re-

results for 1,1-dichloro-1-fluoroethane (CCl2FCH3).

A. R. H. Goodwin, and M. R. Moldover. 1991, 6p
Published in Jnl. of Chemical Physics 85, p320-5235, Oct 91.

Keywords: *Refrigerants, Acoustic velocity, Virial co-
eficients, Specific heat, Thermophysical properties, Re-

The speed of sound in gaseous 1,1-dichloro-1-fluoro-
ethane (CCl2FCH3), commonly known as R141b has been measured between 260 and 315 K. Perfect-gas heat capacities and second acoustic virial coefficients have been calculated from the results. The second acoustic virial coefficients are used to estimate the density virial coefficients B(T) and an unambiguous well potential. The estimates of B(T) are consistent with B(T) deduced from high-quality p(V,m) T results. Estimates are given for the vibrational relaxation time for R141b.
CHEMISTRY

Physical & Theoretical Chemistry

200.248
PB29-154311 Not available NTIS National Inst. of Standards and Technology (PL), Gaithersburg, MD, Molecular Physics Div.

Keywords: "Photodissociation, Laser induced fluorescence, excited state, Predissociation, Molecular beams, lifetime, Repetits, "Nitric oxide dimers."

The photodissociation spectra, predissociative lifetime, limit of fragmentation and transition of energy distributions, and product energy and vector correlations of overtones excited nitric oxide dimer, (NO2), have been measured using pulsed molecular beam and Doppler profile analysis techniques. The nu(1) + nu(5) and 2nu(5) modes of NO2 were excited by infrared pumping, and NO fragments were detected with sub-Doppler resolution by laser-induced fluorescence. The predissociative lifetimes of nu(1) + nu(5) and 2nu(5) excited NO dimers are 34 - 6 and 20 - 3 ps, respectively. The results are discussed in terms of the dissociation and energy partitioning mechanisms.

200.248
PB29-154483 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD, Reactor Division

Sponsored by Department of Energy, Washington, DC.

Keywords: "Fullerences, Rotational states, Neutron scattering, Elastic scattering, Temperature dependence, Repetits, "Buckminsterfullerene."
Coherent quasielastic neutron scattering has been used to investigate the character of the rotational dynamics in the high-temperature solid phase of C60. The observed scattering can be described by a model in which each molecule undergoes rotational diffusion with a time constant that is correlated with the moments of adjacent molecules. The rotational diffusion constant D(R) is (14 + 4 - 0.4) x 10 to the 10th power/s at 260 K and (8 + 2.5 - 0.8) x 10 to the 10th power/s at 520 K. The temperature dependence of D(R) is consistent with a thermally activated process having an activation energy of 39 - 15 meV.

200.250
PB29-154541 Not available NTIS National Inst. of Standards and Technology (PL), Gaithersburg, MD, Molecular Physics Div.


Keywords: "Hydrogen cyanide, Pressure dependence, Tunable lasers, Infrared lasers, Repetits, Self-broadening, O branches."
O-branch spectra of the nu(1)+nu(2) (4004/cm) and nu(2)+nu(3) (2806/cm) combination bands and the nu(1)+nu(2)+nu(3) (1387/cm) overtone band of HCN have been recorded at pressures from 0.13 to 53.3 kPa (1 to 400 Torr) using a tunable difference-frequency laser. The self-broadening coefficients are the same for all three bands involving the nu(2)+nu(3) Pi bending mode and are within experimental error of those reported previously for other Sigma and Pi vibrational bands.

200.251
PB29-154566 Not available NTIS National Inst. of Standards and Technology (CSTL), Gaithersburg, MD, Surface and Microanalysis Science Div.


Keywords: "Surface analysis, Auger electron spectroscopy, Ion scattering analysis, Rutherford scattering, X-ray photoelectron spectroscopy, Comparison, Repeatability, Secondary ion mass spectroscopy, Secondary neutral mass spectroscopy."
A short review is presented of the six techniques in common use for surface analysis. Information is given on their capabilities and their relative strengths and limitations.

200.252
PB29-151322 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD, Metallurgy Div.


Keywords: "Iron, "Phase studies, "Potassium, Solubility, Repetits."
The system Fe-K is evaluated, particularly with respect to the solubility of Fe in liquid K.

200.253
PB29-154657 Not available NTIS National Inst. of Standards and Technology (CSTL), Gaithersburg, MD, Thermophysics Div.


Keywords: "Supercritical fluids, Thermodynamic properties, Critical functions, Critical point, Solubilility, Divergence, Mixtures, Repetits, "Krichevski parameter, Henry constant."
The thermodynamic properties of dilute solutions near the critical point of the solvent—such as phase equilibria, critical lines, partial molar properties, Henry constants, K factors, and solubility—are all shown to be determined by the critical value of one thermodynamic derivative, (partial derivative of P with respect to x)(superscript c) of the cubic aqueous potassium chloride Krichevski parameter. This parameter also governs the linear increase of log x with density in super-critical solutions. The authors relate the deviation from direct correlation theory to the Krichevski parameter. The divergence of the partial molar volume of the solute does not lead to an additional increase of solubility in dilute supercritical solutions, as will be shown here.

200.254
PB29-154715 Not available NTIS National Inst. of Standards and Technology (CSTL), Gaithersburg, MD, Surface and Microanalysis Science Div.

See also PB98-157978 and Part 3, PB98-154723.


Keywords: "Mean free path, Electron scattering, Auger electron spectroscopy, X-ray photoelectron spectroscopy, Inelastic scattering, EV range 10-2000, eV range 1-100, Chemical elements, Repetits."
The authors report calculations of electron inelastic mean free paths (IMFPs) for 50-2000 eV electrons in a group of 27 elements (C, Mg, Al, Si, Ti, V, Cr, Fe, Ni, Cu, Y, Zr, Nb, Mo, Ru, Rh, Pd, Ag, Hf, Ta, W, Re, Os, Ir, Pt, Au, and B). The work extends their previous calculations (Surf. Interface Anal. 11, 577 (1988)) for the 2000 eV range. Substantial variations were found in the shapes of the IMFP versus energy curves from element to element over the 50-2000 eV range and they attribute these variations to the differences in electron transporting properties of each material. Their calculated IMFPs were fitted to a modified form of the Bethe equation, and their parameters were used to estimate IMFPs in other materials. The equation has four parameters. These four parameters could be empirically related to several material parameters for their group of elements (atomic weight, bulk density and number of valence electron per atom). IMFPs were calculated from these empirical expressions and the authors found that the root mean square difference between these IMFPs and those initially calculated was 13%. The modified Bethe equation and their parameters will be useful in providing a consistent set of IMFPs which are widely used by many authors. Since the same algorithm has been used for calculating IMFPs, the authors' predictive IMFP formula is considered to be particularly useful for predicting the IMFP dependence on energy in the 50-2000 eV range and the material dependence for a given energy.
a group of 27 elements, there are substantial differences in the shapes of the IMFP versus energy curves from compound to compound for energies below 200 eV; these differences are significant. Germanium in May. In all, the author tries to summarize for physical chemists the work with Larche on Stressed Solids.

This is a summary of a plenary lecture given to the Bunsengesellschaft für Physikalische Chemie at the 95th Annual Meeting in May. In all, the author tries to summarize for physical chemists the work with Larche on Stressed Solids.

The high resolution laser induced fluorescence spectroscopy of the 0(0)-1(1) (Sup(1)Δ(1)) transition in 1.4-Dimethylhexane has been studied in a molecular beam using the rotational resolution and the study of the effects of the internal rotation of the two methyl groups. All strong lines were assigned to the rotational transitions in both the ground and excited electronic states were determined. The internal rotation of the two methyl groups manifests itself in this spectrum by a splitting of each rotational transition into three lines. The splitting of the lines is 40 - 0 MHz and constant up to J = 11 and K = 11. The intensity ratio of the lines is 12.1 ± 10.1 within 10%. No further splittings were observed in the investigated frequency range. It is shown that the spectrum is totally explained by the simple model of two independent internal rotors attached to an asymmetric rotor frame. A barrier height of 50 + 10 - 0 cm in the excited (Sup(1)Δ(1)) state is concluded.

Shear viscosity coefficients of compressed gas carbon dioxide, ethane and three carbon dioxide + ethane mixture compositions have been measured with a torsional crystal viscometer at temperatures up to 500K and at pressures up to 50 MPa. Most of the data are presented in terms of a state, High temperature, High pressure, Temperature dependence, Pressure dependence, Reprints.

The shear viscosity coefficients of saturated and compressed fluid chlorotrifluoromethane (R13) have been measured with a torsional crystal viscometer at temperatures between 100 and 320 K, at pressures up to 35 MPa, and at densities between 1.7 and 17.7 mol/L. The dependences of the fluid (1/viscosity) on molar volume and temperature have been examined. At
molar volumes between 0.06 and 0.12 L/mol, the
dependence on molar volume is linear, and there is no
significant temperature dependence at fixed volume.
The data in the volume range have been correlated with
a fluidity-volume equation. Most of the differences
between the data and the equation are smaller than 3%

PB20-265
PB92-159516 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Chemical Kinetics Div.
Direct Rate Measurements of the Combination and
Disproportionation of Vinyl Radicals.
Final rep.
A. F. Farrow and A. H. Laufer. 1990. 4p
Keywords: *Chemical radicals, *Disproportionation, *Reac-
tion rate, Kinetics, Radicals, Thermochemistry, Reprints,*Vinyl radicals, *Combination reactions.
The rates of removal of vinyl radicals (C2H3) by means of
combination and disproportionation reactions have
been directly measured. Vacuum ultraviolet (UV) flash photolysis of divinylmercury was used to gener-
ate vinyl radicals and UV absorption kinetic spectro-
copy used to monitor the time history of vinyl radicals
trough the reaction of C2H5. A rate for the constant for vinyl radical decay was determined to be
1.0 x 10 to the -10 power cc/molecule/sec-1. A ratio of 4.7 for the rate constant for the disproportion-
consstants was measured using gas chromatographic anal-
ysis of the final reaction products. Absorption coeffi-
cients for the vinyl radical absorption in the 1650A
region were redetermined. The absolute rate con-
tants for combination and disproportionation are then
8.2 x 10 to the -1 power cc/molecule/sec-1 and 1.9 x 10 to the -11 power cc/molecule/sec-1, respectively.

PB20-266
PB92-159540 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Chemical Process Metrology Div.
Observation of a Speed-Dependent Collisional In-
homogeneity in H2 Vibrational Line Profiles.
Final rep.
R. L. Farrow, G. J. Rosasco, L. A. Rahn, and G. O.
Sitz. 1989. 4p
Keywords: *Hydrogen, *Molecular spectra, *Vibration,
*Spectrum analysis, Spectrum analysis, Spectral lines.
Raman spectroscopy, Reprints.
The authors report the first observations, to the au-
tors knowledge, of inhomogeneous broadening in the
vibrational line profiles of a gas in the ‘impact’ den-
sity regime. In measurements up to 27 atmages (where the
spectra are clearly dominated by collision broad-
ning), non-Lorentzian, asymmetric features are ob-
served in Raman Q-branch transitions of H2 dilute in a
heavy perturber gas. The authors compare these mea-
surements with an inhomogeneous line-profile model based on strong speed dependences in the
collision cross-sections. Quantitative agreement of
the results is obtained only when spectral line narrowing resulting from speed-changing collisions is included.

PB20-267
PB92-159839 Not available NTIS
National Inst. of Standards and Technology (CSTL),
Bozler, CO. Thermophysics Div.
Thermal Conductivity and Heat Capacity of Fluid
Nitrogen.
Final rep.
Neto de Castro. 1991. 31p
Sponsored by Department of Energy, Washington, DC.
PB. 45-297, 45-331, 45-332.
Keywords: *Nitrogen, *Thermal conductivity, *Specific
heat, Pressure dependence, Temperature dependence,
Thermal diffusivity, Isotherms, Cryogenics, Reprints.
The paper presents new absolute measurements of the
thermal conductivity and the thermal diffusivity of
different nitrogen mixtures in a transient hot wire cal-

PB20-268
PB92-159862 Not available NTIS
National Inst. of Standards and Technology (CSTL),
Boulder, CO. Thermophysics Div.
Vapor-Liquid Equilibrium and the Modified Leung-
Griffiths Model.
Final rep.
J. C. Rainwater. 1991. 106p
Sponsored by Department of Energy, Washington, DC.
Pub. in Superfluid Technology Reviews: Modern Theory

PB20-269
PB92-159953 Not available NTIS
National Inst. of Standards and Technology (CSTL),
Gaithersburg, MD. Thermophysics Div.
Capillary Waves of Fluid Interfaces Near a Critical
Point.
Final rep.
J. V. Sengers, J. M. J. van Leeuwen, and J. W.
Dijkstra. 1991. 20p
Keywords: *Capillary waves, *Liquid-vapor interfaces,
Sulfur hexafluoride, Temperature dependence, Sur-
fice tension, Critical point, Binary fluids, Reflectivity,
Reprints.
A fluid interface near a critical point is commonly pic-

NPB20-270
PB92-159995 Not available NTIS
National Inst. of Standards and Technology (NML),
Bozler, CO. Chemical Engineering Div.
Aqueous Two-Phase Extraction in Bioseparations:
An Assessment.
S. K. Siddar, K. D. Cole, R. M. Stewart, D. C. Szlak,
P. Todd, and H. Cabezaz. 1991. 4p
Keywords: *Extraction, *Fermentation, Thermody-
namics, Cost analysis, Cultured cells, Culture media,
Ligands, Reprints.
Aqueous two-phase extraction has promise as a tech-
nique for protein recovery, fermentation or cell
culture broth. Several impediments exist to its wide-
spread commercial practice, however. Availability of
low-cost solvents and ligand systems, reliable measure-
ment methods for partition coefficients, accurate ther-

PB20-271
PB92-160019 Not available NTIS
National Inst. of Standards and Technology (CSTL),
Gaithersburg, MD. Thermophysics Div.
Determination of Electron Scattering Stud-
ies on Fluids: Preliminary Results for Conidal Sus-
pensions.
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Statistical Physics 62, n56 p1015-1023
Keywords: *Test equipment, *Suspensions, *Disper-
sions, Small angle scattering, Neutron scattering,
Shear tests, Shear flow, Concentric spheres, Couette
flow, Microphases, Reprints, *Collodial suspensions,
*Shearing cells.
A Couette-type concentric cylinder apparatus to inves-
tigate liquids at equilibrium and under shear has been
crafted and tested. The apparatus is designed for
a ne-new fluid and is optimized as a general purpose
equipments to the small-angle neutron scattering (SANS) equipment. It is versatile and rugged: a wide range of shear rates and operating temperatures can be cov-
ered; and controls are fully automated. Test results with shear colloidal suspensions of 91-nm poly-
mer are presented. Evidence of shear-in-
duced structure changes is clear.

PB20-272
PB92-160035 Not available NTIS
National Inst. of Standards and Technology (CSTL),
Gaithersburg, MD. Biotechnology Div.
Separation Physics Final rep.
P. Todd. 1991. 64p
Pub. in Low-Gravity Fluids and Transport Phenomena,
Keywords: *Electrophoresis, *Reduced gravity, Space
processing, Membranes, Convection, Separation,
Reprints, Biphasic extraction.
The physics of three broad categories of separation
methods has been investigated in low gravity and elec-
trokinetic methods, biphasic extraction and ultrafiltration
membrane casting. Of these, electrophoresis has been studied most intensively, including free zone
electrophoresis, free flow electrophoresis, isoelectric focusing and isochromatography. It is generally found that three methods have gravity dependent
processes, previously poorly understood, are revealed
trough low-gravity studies. In each of these fields, ac-
complishments in laboratory research and in low-gravity
(space) research are summarized, in some cases with
critiques. Governing equations for most condi-
tions are provided, and studies of the role of these
convection are cited. Approximately 120 scientific arti-
cles appear in the bibliography.
Stimulated Raman Probing of Supercooling and Phase Transitions in Large N2 Clusters Formed in Free Jet Expansions.

Final rept.


Keywords: *Solid clusters, *Nitrogen, Phase transformation, Free molecules, Liquid-gas, Free jets, Raman spectroscopy, Supercooling, Reprints.

High-resolution stimulated Raman spectroscopy (SRS) has been used to examine N2 and N2/H2 free jet expansions and also equilibrium samples of N2 from 15 to 110 K. Data are presented for both liquid and supercooled liquid clusters which supercool and subsequently freeze to form crystalline beta-N2 solid and, in these experiments, undergo a further transformation to a partially annealed alpha-N2 form. CW-SRS frequency and infrared data obtained for equilibrium samples of the condensed phases of N2 yielded frequency-temperature relations used in deducing internal temperatures for the clusters produced in the expansion experiments. A study of the cooling curves indicates a mean cluster diameter of 35 nm and favors a prompt freezing process rather than a gradual conversion of liquid to solid in a single cluster on the microsecond time scale of the experiments. Supercooling limits of 34 to 44 K are deduced for the liquid, far below the triple point temperature of 64 K. Equilibrium samples freeze. The results show that the high spectral and spatial resolution of non-linear Raman methods such as SRS make it possible to study a unique probing of the condensation processes in free jet expansions.

200.276
PB92-165216 Not available NTIS National Inst. of Standards and Technology (NIST), Boulder, CO. Quantum Physics Div.

Bomb Calorimetric and NMR Studies on Crystalline Hexagonalite.

Final rept.


The enthalpy of combustion of crystalline hexagonalite (C12H20N6O7(cr),cr) has been determined by combustion of the compound and an enthalpy of combustion at 298.15 K for the following reaction: C12H20N6O7(cr) + 13.52O2(g) = 12CO2(g) + 10H2O(l) + 0.5O2(g) + 10.5H2O(l). This is deduced from calorimetry to be characteristic hexane and several other oligoglycines. To determine the water content of the hexagonalite. The energy contribution to the enthalpy of formation of crystalline hexagonalite for the repeating unit, (CH2-CO-NH-), is compared to similar values derived from related peptides and amino acids in the solid phase.

200.277
PB92-165240 Not available NTIS National Inst. of Standards and Technology (NPL), Boulder, CO. Time and Frequency Div.

Molecular Parameters of Chromium Hydride in its X(2Π) Complex +, (CH2)10H.

Final rept.


Keywords: *Chromium hydrides, Chemical radicals, Interstellar matter, Laser spectroscopy, Magnetic resonance, Far infrared radiation, Zeeman effect, Molecular structure, Rotational states, Reprints.

The far-infrared laser magnetic resonance spectrum of the CH radical in the nu = 0 level of its C(sup 2Π) state has been studied in detail. Signals associated with both ground-state transitions and C(sup 4Π) have been detected. Nearly 500 resonances for (52)CH have been assigned and used to determine molecular parameters for the structure of the CH radical. These parameters are well determined for low rotational transitions and for the CH radical. A four-order correction to the spin-spin coupling has been identified for the first time. Precise knowledge of the hyperfine structure of the CH radical has been calculated which may allow the detection of the CH radical in the interstellar medium.

200.278
PB92-165356 Not available NTIS National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Chemical Kinetics and Thermodynamics Div.

Estimation of Thermodynamic Properties of Organic Compounds in the Gas, Liquid, and Solid Phases at 298.15 K.

Final rept.


The paper provides a general overview of the NBS program in the estimation of the thermodynamic properties of organic compounds using the Benson approach and presents discussions of selected topics, such as: (1) relationships of the enthalpy of formation, heat capacity, and entropy at 298.15 K to those of the model compounds; (2) the determination of the entropies and enthalpies of formation; and (3) applications of unique solutions to the estimation of thermodynamic properties. and (3) explanations of unique solutions to the estimation of thermodynamic properties in the Glass, Liquid, and Solid Phases at 298.15 K. This information may be obtained at the NBS web site at http://www.ncstar.doe.gov/.

CHEMISTRY
Physical & Theoretical Chemistry

The stable gas products of germanium dissociation and subsequent radical reactions have been measured in pure germanium glow discharges. Characteristics of the initial germanium fragmentation are inferred from these data. The spatial distribution of discharge optical emission, and of film deposition on glass fibers, have also been measured. Finally, the surface reaction probability of depositing neutral radicals has been measured to be 0.6 ± 0.09 on the grounded electrode. Major differences between germanium and silane discharges occur in all these observations. Possible explana- tions of these differences are given, but much less comprehensive explanation of these results is made. This is based on the thermodynamics of the H2 release reaction at the growing surface.

200.280
PB92-165489 Not available NTIS National Inst. of Standards and Technology (NPL), Gaithersburg, MD. Surface Science Div. and Phenomenological Modeling of Melting in Lennard-Jones Clusters.

Final rept.

Keywords: *Solid clusters, Lennard-Jones potential, Mathematical models, Copolymers, Melting, Reprints.

Extensive molecular dynamics simulations were coupled to infinitely fast quenching by stoopid descent in order to obtain more information on the melting transition of Lennard-Jones small clusters (N=12-14). A procedure was used to determine the total of times I that the local minima of the potential energy surface are accessed in the transition region during a long tra- jecory. The computer experiment shows that I depends on temperature and presents a sigmoid shape. The temperature at which I is valued 1/2 is identified with the cluster melting temperature, Tm. This is a new criterion that can be framed into a phenomenological description of melting in clusters. The theoretical model is based on a mapping of the segments in a copolymer with the short time excitations of the cluster.
CHEMISTRY

Physical & Theoretical Chemistry

among the high energy local minima. Melting in this pseudo-polymer is obtained by calculating F exactly within a correlated walk approach. Cooperativity is evident when the shape of the slope of 1/T vs 1/N is high. Such is the 12-atom cluster in Table 1. The 14-atom cluster evolves before melting.

200.287
PB29-165574 Not available NTIS National Inst. of Standards and Technology (PL), Gaithersburg, MD. Chemical Thermodynamics Div.

Estimation Methods and Combustion Calorimetry on Organic Phosphorus Compounds.


Keywords: *Heat of formation, *Heat of combustion, *Phosphorus organic compounds, Enthalpy, Calorimetry, Reprints.*

Methods have been developed to estimate the enthalpy of formation of organic phosphorus compounds for which no data exists. Reaction enthalpies at 298 K have been calculated for a wide variety of phosphorus compounds. The additivity principle is used to derive group contribution values. Data evaluation and estimation schemes lead to formulation of an experimental calorimetry method for determination of the thermochemical properties of key organic phosphorus compounds. A series of combustion bomb calorimetry measurements were performed to obtain (a) data for the estimation of trifluorophosphate and related compounds for use in secondary standard for combustion calorimetry of organic phosphorus compounds and (b) an accurate enthalpy of formation of this key inorganic phosphorus compound. This datum and other enthalpy values which will be determined are necessary for the development of an estimation scheme for organic phosphorus compounds.

200.288
PB29-165802 Not available NTIS National Bureau of Standards (NBS), Gaithersburg, MD. Chemical Thermodynamics Div.


final rept.

D. R. Kirklin, and E. S. Domalski, 1987, 8p.


Keywords: *Phosphorus organic compounds, *Heat of combustion, *Chromatographic analysis, Calorimetry, Enthalpy, Phosphorus inorganic acids, Reprints, Ion chromatography.*

Enthalpies of combustion have been measured for several key organic phosphorus compounds. The NBS rotary bomb calorimeter was used to produce a homogeneous solution of the various oxoacids of phosphorus that are produced as a result of burning phosphorus compounds in oxygen. Ion chromatography was used to identify and determine the amounts of the inorganic phosphorus acids produced in side reactions during the combustion process. In addition to orthophosphoric acid, pyrophosphoric, and tripolyphosphoric acids were produced in the combustion of triphenylphosphine, triphenylphosphate, and triphenylphosphorane. The result is that the side reactions for which this technique must be applied to the calorimetric data. A significant increase in the reliability of this data on the enthalpies of combustion and formation of organic phosphorus compounds is now possible.

200.289
PB29-165919 Not available NTIS National Inst. of Standards and Technology (PL), Gaithersburg, MD. Molecular Physics Div.
Fourier-Transform Microwave Spectroscopy of the Deuterated Acetylene Dimers: The Interconversion Tunneling Motions of (DCCH)2, (DCCH)(DCH), (DCCH)2, DCCD-DCCD, HCH-DCCD, and HCH-DCH.

Fuller.upt.
K. Matsura, F. J. Lovas, and R. D. Suenram.
1991, 21p

Keywords: Microwave spectra, Rotational spectra, Deuterium content, Hydrogen bond, Molecular beams, Ultrarad temperature, Reprints. *Acetylene dimers.

Microwave spectra of the deuterated acetylene dimers were obtained using a beam microwave spectrometer. The authors observed the tunneling motion of the hydrogen atoms, which is a characteristic feature of deuterated molecules. The spectra were obtained using a Fourier transform microwave spectrometer. The authors compared the spectra of the different dimers and discussed the implications of these findings for the understanding of the interconversion tunneling motion.

200.290
PB92-165950
Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Molecular Spectroscopy Lab.
High-Resolution Spectroscopy on the A τilde transition of the DCH(1) molecule.
Fuller.upt.
G. W. M. Van Reine, W. L. Meerts, H. S. Smyth, and D. J. Terpstra.
1990, 20p

Keywords: *Silicon chlorides, Laser induced fluorescence, Rotational spectrum, Electron transitions, Molecular beams, High resolution, Near ultraviolet radiation, Reprints.

High-resolution laser-induced fluorescence spectra of Si(3Cl) and Si(3Cl2) have been obtained in the region of 200 nm
to 300 nm. The spectra were obtained using a dye laser and a high-resolution spectrometer. The authors discuss the implications of these findings for the understanding of the electronic structure of silicon chlorides.

200.291
PB92-165956
Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Molecular Physics Div.
Wave-Packet Analysis of Laser-Induced Half-Collision Processes.
Fuller.upt.
F. H. Mies, and A. Guisti-Suzor.
1991, 13p
Sponsored by North Atlantic Treaty Organization, Brussels (Belgium), and Air Force Office of Scientific Research, Boulder AFB, DC.
Tha. in Physical Review A 44, n11 p7547-7559, 1 Dec 91.

Keywords: *Multi-photon processes, Hydrogen ions 1+ plus, Gas ionization, Photoionization, Photoassociations, Bound state, Wave packets, Laser radiation, Scattering, Reprints, Floquet theory.

The usual approach to calculating multiphoton collision and half-collision processes uses the interaction picture and introduces a classical time-dependent field into the equations. A more rigorous approach is further simplified using the Floquet ansatz. In particular, the laser-induced decay of an initial bound state is derived from a half-collision Floquet ansatz that uses a complex quasienergy, whose imaginary part is identified with the laser-induced decay constant of the bound state. This interpretation presupposes a pure exponential decay of the initial state population and a Lorentzian distribution of product states in the infinite-depletion limit. Here the authors demonstrate how a full-collision Floquet ansatz can be derived from a Floquet ansatz constructed to represent scattering in the presence of a coherent state of the laser field. The wave packet uses the set of the time-independent Floquet ansatz wavefunctions for scattering in the field generated by quantized radiation number states. The resultant Floquet scattering states and the associated quasienergy spectrum contain the information in the infinite-depletion limit are obtained without approximation to exponential decay.

200.292
PB92-165975
Not available NTIS
National Inst. of Standards and Technology (NIST), Boulder, CO. Thermodynamics Div.
Optically Pumped Ultra-Violet Laser on SOB(3)(Sigma-tilde)(-X)(Sigma-tilde).
Fuller.upt.
1991, 5p
Contract No. AFWL-001-017 Sponsored by Weapons Lab., Kirtland AFB, NM.

Keywords: *Ultraviolet lasers, *Sulfur monoxide, Sulfur dioxide, Optical pumping, Gas lasers, Near ultraviolet radiation, Stimulated emission, Reprints.

Lasing has been demonstrated in sulfur monoxide by optical pumping of transitions in the SOB(3)(Sigma-tilde)(-X)(Sigma-tilde) band at 256 nm. The SO is produced by 193 nm photolysis of sulfur dioxide. Stimulated emission is observed in the (0, 0), (0, 9), (10, 10), and (11, 11) bands between 300 and 350 nm.

200.293
PB92-166040
Not available NTIS
National Inst. of Standards and Technology (NIST), Boulder, CO. Thermodynamics Div.
Non-equilibrium Molecular Dynamics Simulations of N-Butane and Isobutane Isotopes.
Fuller.upt.
1991, 21p
See also PB91-195636.


Nonequilibrium molecular dynamics simulations of N-butter and isobutane isotopes were carried out to study the effects of temperature on the behavior of these molecules. The authors discuss the implications of these findings for the understanding of the behavior of butane and isobutane isotopes.

200.294
PB92-166099
Not available NTIS
Laser Diagnostics for Investigation of Particle Formation Processes.
Fuller.upt.
1986, 14p

Keywords: *Particle production, Particle size distribution, Chemical vapor deposition, Metal powders, Optical fibers, Atomizing, Flames, Silica, Soot, Reprints, *Laser diagnostics.

Formation, growth and deposition of particles represent a critical part of several important industrial processes, such as production of carbon black, optical fibers, micro-electronic components, and metal corrosion. Laser diagnostics are used to develop a fundamental understanding of these processes. Formation of carbonaceous soot particles has been studied in laser-assisted combustion flames. Laser diagnostic techniques are also used to investigate metal powder atomization processes and the effect of operating conditions on particle size distribution.

200.295
PB92-166115
Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Chemical Kinetics Div.
L. W. Sieck, and M. Mauler.
1989.
Pub in Jnl. of Physical Chemistry 93, n4 p1586-1588 1989.


The stability of RS(-1)(dot)HOR association ions have been investigated by pulsed high-pressure mass spectrometry. Equilibrium constants were determined as a function of temperature and pressure by measuring the ratio of the delta H(sup 0) and delta S(sup 0) values for values of solvation. Dissociation energies, delta H(sup 0), of the found ion were found to be consistent with the model of the two molecular components. For CSCHs-1/-1HOR complexes, a linear correlation of the form delta H(sup 0)(ab) = 22.1-0.20 delta H(sup 0)(ab) was obtained, while for complexes incorporating HS-1/-1CHOR the delta H(sup 0)(ab) was also investigated, and was found to be consistent with the model of the two molecular components.

200.296
PB92-166198
Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Fire Measurement and Research Div.
Multiphoton Excitation Spectroscopy of the B(sup 1)Sigma(g) + and C(sup 1)Sigma(g) + Rydberg States of CO.
Fuller.upt.
1989, 8p
Pub in Jnl. of Chemical Physics 91, n4 p2041-2048 1989.

Keywords: *Carbon monoxide, *Rydberg states, *Two photon absorption, Laser induced fluorescence, Multiphoton processes, Transitions, Near-infrared, Rotational spectra, Polarization, Spectroscopy, Reprints.

Two-photon absorption spectra of the B(sup 1)Sigma(g) + and C(sup 1)Sigma(g) + Rydberg States of CO were obtained using a dye laser. The spectra were obtained using a dye laser and a high-resolution spectrometer. The authors discuss the implications of these findings for the understanding of the electronic structure of carbon monoxide.

200.297
PB92-166206
Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Chemical Kinetics Div.
Rate Constants for the Decomposition and Formation of Simple Alkanes Over Extended Temperature Pressure Ranges.
Fuller.upt.
W. Tsang.
1989, 16p

Keywords: CHEMISTRY
Physical & Theoretical Chemistry
CHEMISTRY
Physical & Theoretical Chemistry


Data on the kinetics of the decomposition of methane, ethane, propane and isobutane and the reverse radical combination processes have been examined. From room to combustion temperatures, the limiting high pressure rate expressions are presented. Fall-off effects have been treated in the context of RRKM theory and collision efficiencies and step sizes down determined for a number of collision partners. With argon the step size down appears to increase from a very low value of about 100 cm⁻¹ at room temperature to a 600 cm⁻¹ plateau at combustion temperatures. With a large polyatomic, the step size down is in the 1000-2000 cm⁻¹ range for temperatures from 300-1100 K. These results provide a basis for the prediction of rate constants over a wide range of conditions. The extension of these results to related systems is considered.

200.298
PB92-166222 Not available NTIS National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.

Pressure Dependent Linshter Measurements on OCS
Final rept.

Keywords: *Infrared spectrometers, Frequency shift, Pressure dependence, Computerized control systems, Line broadening, Infrared spectra, Vibrational spectra, Tunneling lifetimes, Reprints, *Carbonyl sulfide, Self-broadening.

A computer-controlled, frequency offset-locked spectrometer using a tunable diode laser is described and new measurements on carbonyl sulfide (OCS) are given. Two optical paths (one using R(3) and P(30)), have been measured for a vibrational transition near 10 micrometers. An average pressure-induced shift coefficient of 0.27 × 10⁻⁶ cm⁻¹ Torr⁻¹ has been obtained for the 206 cm⁻¹ line in the pure rotational band, which is about 0.6 for the diatom in its ground vibrational state (n=0) approaching the surface with a relative translational energy (Etransl) of 0.25 eV.

200.302
PB92-170082 Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.

Kinetic Measurements of the Gas-Phase Reactions of OH + Hydrogen Ethynyl, Hydroxy Ethynyl, Ketene, and Ketenethers
Final rept.


Absolute rate constants were determined for the gas-phase reactions of hydroxy radicals with a series of hydroxy ethers as well as the simplest hydroxy ketone and water. A method for use of flash photolysis resonance fluorescence technique. At 298 K, the measured rate constants were as follows (in units of 10 to the -12 power sec/molecule/sec): 2-methoxymethyl, 1.25 + 0.7; 2-ethoxymethylen, 18.7 + 0.2; 2-butoxymethylen, 23.1 + 0.9; 3-ethoxy-1-propanol, 22.0 + 0.3; 3-methoxy-1-butanol, 23.6 + 0.16; acetol, 3.0 + 0.3; and methoxymethaceton, 6.8 + 0.6. The kinetic data for 2-methoxymethanol obtained between 240 and 440 K were used to determine the following Arrhenius expression: k(sub-b) = (4.5 + or - 1.4)(10 to the -12th power)exp(325 + or - 100)/T (Kjoule/molecule/sec). For the results for all seven reactions we have found the dependency of the prefactor of OH rate constants for oxygenated organic compounds.

200.306
PB92-171162 Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Thermophysics Div.

Extended Corresponding States Models for High-Temperature Aqueous Solutions
Final rept.

Keywords: *Electron-molecule collisions, *Electron scattering, Adsorption, Desorption, Resonance, Surfaces, Metals, Reprints.

Some of the special features associated with molecular adsorption on metal surfaces which interact with electron-molecule scattering, beyond that inferred from straightforward extensions of gas phase picture are considered. Examples emphasizing the role of the image potential and resonance phenomena are presented.

200.307
PB92-170055 Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Thermodynamics Div.

Effect of Revisions of Debye-Huckel Limiting Law Coefficients on the Thermodynamic Parameters for Strong-Electrolyte Solutions
Final rept.

Keywords: *Activity coefficients, *Electrolytes, *Solutions, Dielectric properties, Thermodynamic properties, Reprints, *Debye-Huckel limiting law, Ion interactions.

In order to treat properly the thermodynamics of mixed aqueous electrolytes, parameters obtained from the binary systems must have all been calculated with the same Debye-Huckel limiting law slope. Improvements in experiment and correlation of experimental dielectric constant and PVT measurements cause subsequent changes in calculated values of Debye-Huckel limiting law slopes. Other is described for the adjustment of ion-interaction parameters, resulting from differences in the Debye-Huckel limiting law coefficients or molecular properties. This needs the need for refining the entire data base with the new Debye-Huckel coefficients. Illustration of the method is provided for the conversion of ion-interaction parameters obtained with an earlier dielectric constant equation to values obtained with a recently formulated dielectric constant equation.

200.309
PB92-170111 Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.

Molecular Alignment from Circular Dichroic Photoelectron Angular Distributions in (n + 1) Resonance Enhanced Multiphoton Ionization
Final rept.

Keywords: Multi-photon processes, Angular distribution, Photoionization, Photodetectors, Dichroism, Reprints, *Molecular alignment, Multiphoton ionization.

The theory for determination of molecular alignment from circular dichroism in photoelectron angular distributries (CDAD) is generalized to treat the case in which the incident laser and the ionizing one are not parallel. A new method of data analysis is presented here. Alignment created by surface waves is also given. Reactions which could be obtained by these procedures. For studies of orientation with elliptically polarized excitation, differential cross sections for a given collection angle are found to be, to a good approximation, independent of excited state orientation. Orientation can thus be obtained from differential cross sections by the methods developed by Kimmel, Sitz and Zare (J. Chem. Phys., 88, 6707 (1988)).

200.305
PB92-171117 Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.

Electron Scattering from Molecules Adsorbed on Surfaces
Final rept.

Keywords: *Electron-molecule collisions, *Electron scattering, Adsorption, Desorption, Resonance, Surfaces, Metals, Reprints.

Some of the special features associated with molecular adsorption on metal surfaces which interact with electron-molecule scattering, beyond that inferred from straightforward extensions of gas phase picture are considered. Examples emphasizing the role of the image potential and resonance phenomena are presented.

200.306
PB92-171123 Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Thermophysics Div.

Enthalpies of reaction at 298.15 K were calculated from evaluated data on the enthalpies of formation for combustion processes for selected hydrocarbons and chemical elements in both oxygen and in fluorine. A group of Thermo reactions were examined as well for fuel characterizations. Some conclusions were derived from the study with respect to the reactions which possessed high exothermicity.
CHEMISTRY

Physical & Theoretical Chemistry

200.307
PB92-17198 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Center for Chemical Technology. Transferability of Molecular Distributed Polarizabilities from a Simple Localized Orbital Based Method.

D. R. Garmer, and W. J. Stevens. 1989, 8p
Pub. in Jnl. of Physical Chemistry 93, n5 p2636-2670 1989.

Keywords: *Polarization*(Charge separation), *Molecular orbitals*, Hartree-Fock approximation, Quantum chemistry, Reprints, Molecular interactions.

A distributed model of molecular electric polarizability is presented in which the polarization of the charge density from each localized molecular orbital (LMO) is represented by a point dipole polarization located at the LMO charge centroid. Specifics of the generation of the polarizability tensors by finite-field Hartree-Fock SCF calculations are given and the application of the model to classical calculations of molecular interactions is briefly discussed. Large basis set calculations on a number of small molecules demonstrate that transfer of bond and lone pair polarizabilities and centroids among various molecules is possible, without involving intramolecular interactions between induced dipoles. A catalog of these transferable LMO properties is developed and a number of properties of bonded and lone pairs. A set of molecular dipole polarizabilities is then reproduced from the catalog as a successful test of this idea.

200.309
PB92-17217 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Molecular Physics Div. Microwave Spectra and Molecular Conformation of Methyl Diphenylphosphine. Microwave Spectra and Molecular Conformation of Methyl Diphenylphosphine.

Final rept.
Pub. in Jnl. of Molecular Structure 223, p273-286 Jun 90.

Keywords: *Molecular structure*, Microwave spectra, Rotational spectra, Electric dipoles, Dipole moments, Reprints, *Methyl diphenylphosphine*.

Two closely spaced a type low resolution microwave band series were observed for the normal, (13C) and (31P isotope labeled) species of Methyl Diphenylphosphine. The lower frequency series of the three isotopic series were assigned and assigned employing a pulsed beam Fabry-Perot cavity Fourier transform microwave spectrometer. The a and b type spectra of the three species were observed to be about 17 cm apart and are coupled by Fermi resonance which causes a considerable displacement of all the energy levels and transition frequencies. An effective resonance interaction of the type (nυ, J, k + 2νc-1/2)2nυ and (J, k) is particularly important for understanding the appearance of the spectrum. The Fermi resonance has been taken into account in a global fit of both bands that has allowed the authors to assign all of the strongest transitions. The Fermi interaction constant found is W = 8.13 + 0.14/cm and the unperturbed band separation is 6.0 + 0.4/cm. Other higher-order interactions have also been considered, including a delta(k) = 2 - 2νc. Over 1400 dipole transitions were fitted with a rms deviation of 0.02 cm. Transition wavenumbers, assignments, and lower state energies are made available for the strong transitions of HN3C between 853 and 920/cm.

200.311
R. D. Mountain, and D. Thirumalai. 1992. 4p


We show, using constant-pressure molecular-dynamcis calculations, that the deviation from Arrhenius behavior in transport properties in the supercooled states of Lennard-Jones (LJ) fluids and soft-sphere (SS) systems starts to occur when the time scale for obtaining ergodicity starts to increase dramatically. The temperature dependence in the self-diffusion coefficient for both the SS mixtures and the two-component LJ system follows the Vogel-Fulcher (VF) equation. The self-diffusion constants for the SS mixtures follows the Arrhenius law, whereas for the LJ system a VF behavior is found. Our results also demonstrate that relaxation processes involving condensed liquids are dominated by fluctuations in domains of the finite length.

200.312
M. P. Davis, 1992, 15p

Keywords: *Chemisorption*, *Hydrogen*, Neutron scattering, Inelastic scattering, Adsorption, Adsorbates, Catalysts, Palladium, Platinum, Nickel, Sulphides, Reprints, Deuteron isotope dilution neutron spectroscopy.

Recent incoherent inelastic neutron scattering studies of hydrogen and hydrogenous molecules adsorbed on high-surface-area catalytic materials such as palladium and platinum black, Raney nickel and metal sulphides, have revealed that there is a low energy transition of water about its local C2 axis in the complex.

200.313

Keywords: *Sodium ions*, *Activity coefficients*, Serum albumin, Mercury amalgams, Electric potential, Electrodes, Solutions, Reprints.

A method using sodium amalgam electrodes has been developed to study the effect of protein on activity coefficients and residual potential in solutions of sodium in protein-containing solutions. It has been applied to aqueous sodium chloride solutions of bovine serum albumin (BSA). The electrode slope of the electrode responses in protein containing medium does not change sufficiently before applying it to protein-containing solutions. The experimentally determined activity coefficients are in good agreement with the activity coefficients for aqueous sodium chloride solutions reported in literature. Therefore, the authors have used this method to measure the activity of NaCl solutions, containing varying concentrations of bovine serum albumin (BSA). The electrode slope of the electrode responses in protein containing medium does not change sufficiently before applying it to protein-containing solutions. The experimental relationship has been established between the concentra- tion of protein and the percent bias in the measure- ments. If measurements made in protein-containing solutions do not show any evidence of protein effect on liquid junction potential.

200.314

Keywords: *Colloids*, *Dispersions*, *Shear stress*, *Structure factors*, Polystyrene, Silicon dioxide, Mixtures, Neutron scattering, Melting, Reprints, Shear induced melting, Shearing cell.

Neutron scattering intensities from a aqueous mixture suspension of 91 nm polystyrene latex particles and 54 nm silica particles are reported in the range 0.02 < Q < 0.01 in the range 0.02 < Q < 0.01, where Q is the momentum transfer. The experiment was done at a mixture volume fraction of 0.15, and the polystyrene/silica particle ratio was ca. 1.7:1. Results are given for the suspension at rest and under shear. The shear data were obtained with a concentric cylinder shearing apparatus constructed and tested at the SANS facility of the National Institute of Standards and Technology and the pulsed neutron facility of the Los Alamos National Laboratory. The design and operation of the cell is described. A shear-induced neutron scattering pattern is compared with and contrasted to that of a pure polystyrene suspension that can form a crystal lattice in the liquid but which melts to a liquid-like structure under shear.

200.315
PB92-175520 Not available NTIS National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.


High-Resolution Measurements of the Bands of Carbon Disulfide between 2510 and 3150 (cm-1). Final rept.


Keywords: Absorption spectra, Band spectra, Vibrational spectra, Electronic transitions, High resolution, Frequency standards, Calibration standards, Reprints, *Carbon sulfide.

The four strongest absorption bands of OCS in the region from 2500 to 3150/cm have been measured with FT spectrometers with effective resolutions of about 0.010/cm, and better than 25% of the transitions have been identified in the spectrum and have been analyzed to obtain improved band centers and band intensity constants. Included in the bands identified are a few transitions due to the less abundant isotopomers (16O12C12S16, 16O12C12S18, 16O13C12S16, and 18O12C12S16). Relative values are given for the transition moments of some of the overlapping bands.


Keywords: *Nuclear magnetic resonance, *Carboxylates, *Carbon 13, Carbohydrate conformation, Computer programs, Reprints, *NMR spectrum editing.

The application of heteronuclear, multiple pulse techniques to the high-resolution nuclear magnetic resonance (NMR) spectroscopy of liquids has recently allowed the development of a number of methods for selective editing of the NMR signals of specific chemical groups. These methods are often described by the term NMR spectrum editing and they were initially implemented as one-dimensional (1D) techniques, but have recently been extended to the two-dimensional (2D) domain. The development of 2D NMR spectrum editing methods from the corresponding 1D techniques will be reviewed, particularly with reference to application of the versatile DEPT (Distortionless Enhancement by Polarization Transfer) pulse sequence to 2D (JCH)-resolved (13C NMR) spectroscopy. Generation of separate 2D NMR subspectra of chemical groups (for example, separate (13C NMR spectra for CH2, CH, and CH3 groups) requires the combination of two to three 2D data matrices, a process that may be efficiently achieved by special software written in Pascal.

Accurate Far-Infrared Rotational Frequencies of Carbon Monoxide. Final rept.
Pub. in Astrophysical J. 385, p763-765, 1 Febr. 92.

Keywords: *Carbon monoxide, *Rotational spectra, Far infrared radiation, Absorption spectra, High resolution, Ground state, Reprints.

High-resolution measurements of the pure rotational absorption spectrum of CO in its ground state are reported for the range J double prime ≥ 5-37. A least-squares fit to the data set, augmented by previous microwave measurements of the J double prime = 0-4 rotational transitions by other workers, determined the following accurate values for the molecular constants (1 a.u. errors of the last digits in parentheses): B₀ = 57.655 ± 0.026(12) MHz, D₀ = 1.850 ± 0.055(46) MHz, HO = 1.724 ± 0.059 (9) 10 to the -7 power MHz, and L₀ = 3.1(2) 10 to the -3 power MHz. A table of calculated CO rotational frequencies is given for the range J double prime ≥ 0-45, these frequencies are accurate to 1-0 or 10 kHz (2 sigma) for J double prime < or 28.


Keywords: *Specific heat, *Carbazoles, Calorimetry, Temperature dependence, Thermodynamic properties, Reprints, *9-Methylcarbazole.

The authors have measured the heat capacity of 9-methylcarbazole at over the range 4 to 345 K by adiabatic calorimetry and compared it with that measured by differential scanning calorimetry (d.s.c.) at over the range 120 to 355. The d.s.c. measurements were made by both a scanning method and by an enthalpic or intermittent heating, method. The molar heat capacities Cₚ,m determined by d.s.c. agreed with the values obtained by adiabatic calorimetry within the usual error associated with d.s.c., about 0.01 Cₚ,m. No anomalies or transitions were observed up to 350K. Thermodynamic functions from these values are tabulated at selected temperatures.

Pub. in Jnl. of Physical Chemistry 93, n17 p6268-6270 1989.

Keywords: *Silicon hydrides, *Electronic states, Two photon ionization, Detonium compounds, Free radicals, Rydberg states, Visible spectra, Reprints, *Silicon radicals, Multiphoton ionization.

A previously unreported electronic state of the silyldyne radicals, SiH and SiD, was observed by resonance enhanced multiphoton ionization spectroscopy. The state is assigned to a Rydberg state appearing at the lower wavelength interval between 426 and 430 nm. The shape of the spectrum was determined by two photon absorption which prepared the F (4p) Rydberg state for the 4700/cm transition to the third laser photon ionized the radicals.

Adsortion of Solution on Hydroxyapatite: Role of Hydrogen-Bonding. Final rept.
President, American Dental Association Health Foundation, Chicago, IL.

Keywords: *Hydrogen bonds, *Adsorption, *Surface chemistry of Hydroxyapatites, Dental materials, Molecular structure, Solutions, Solvents, pH, Substrates, Solutes, Reprints.

The study of the surface and adsorptive properties of apatites has many applications in agricultural, industrial, biological and ecological fields. In the presentation adsorption of various solutes from solution on hydroxyapatite is reviewed. The hydroxyapatite, which contained between one to two monolayers of ambient physisorbed water, was used directly without any pre-conditioning. The reversibility and orientation of adsorbed carbamates on the hydrated apatite depends upon the interplay of hydrogen-bonding characteristics of the solute, solvent and substrate and upon the presence of hydrophobic moieties or groups in the adsorbate molecules. The adsorption of solutes possessing hydrogen-bonding groups adsorbed from non-aqueous solution on hydroxyapatite is reviewed. The sorption is likely to be reversible if the solvent has hydrogen-bonding capability; otherwise, if the solvent cannot hydrogen bond, the adsorption is likely to be irreversible. The role of the hydrated apatite in the adsorption process is reviewed. The adsorbate molecule may be oriented in a manner to interact effectively with the substrate or the substrate. Adsorption rarely occurs on a molecular level from aqueous solutions where the pH of the solution closely matches that of the substrate. Adsorption may also be achieved from multiple layers of different concentrations e.g., calcium and phosphate, play a very important role.

Keywords: Potassium chloride, KCl, Surfaces, Desorption, Chlorine, Potassium, Atoms, Emissivity, Surface, Excitons, Reprints, Electron stimulated desorption.

Composition changes of a (100) KCl surface bombarded by He ion electrons have been studied by Auger electron spectroscopy. Intense ratios of characteristic alkali and halogen Auger lines were monitored as a function of target temperature and beam current density. In addition, for the first time angle-resolved energy distributions of electron desorbed K and Cl atoms were measured using mass-analyzed time of flight techniques. For temperatures higher than about 100°C, a near-stoichiometric surface composition was obtained and a significant non-thermal component was observed in the kinetic energy distributions of Cl atoms emitted normal to the (100) surface. These results can be interpreted in terms of new concepts regarding the excitation mechanism of electron stimulated desorption (ESD).


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Keywords: Radiometers, Water, Radio, Robots, Specific heat, Polychloroformate, Solubility, Urinary calculi, Thermodynamic properties, Density, Mass, Volume, Chemistry, Calcination, (Chemistry), Cranes, (Hosts), Photodiodes, Calcium hydroxide hexadrate.

Contents: A radiometer for precision coherent radiation levels; ITS-90 density of water formulation for water vapor pressure and temperature calibration; Heat capacity and thermodynamic properties of polychloroformate (PCF) from 2.5 to 620 K; Precipitation and solution of calcium hydroxide hexadrate; The NIST SPIDER, a robot crane.


Included in Jnl. of Research of the National Institute of Standards and Technology, v97 n3 p335-340 May/Jun 92.

Keywords: Water, Thermodynamic properties, Density, Mass, Volume, Calibration, (Chemistry), Table, Database, Standards, Volumetric standards.

A new formulation of the density of air-saturated water as a function of temperature on the 1990 International Temperature Scale is presented. A (T90-90) is presented for calculating isothermal compressibility as a function of temperature on ITS-90 was developed. The equations were used to calculate the density of water, in the temperature range 5 to 40 C on ITS-90 used in the gravimetric determination of the volume of volumetric standards.


Keywords: Poly(chlorotrifluoroethylene), Specific heat, Temperature dependence, Calorimetry, Thermodynamic properties, Phase transformations.

Heat capacities and thermodynamic properties of a number of poly(chlorotrifluoroethylene) samples subjected to various thermal treatments, to achieve crys- tillines ranging from approximately 10 to 90%, have been studied from 2.5 to 370 K by automated adiabatic calorimetry and from 250 to 620 K by differential scanning calorimetry. Small heat capacity discontinuities in the temperature range from 320 to 350 K were observed in all samples with crystallinities greater than 40%. Spontaneous adiabatic temperature drifts asso- ciated with these anomalies were positive (exothermic) for quenched samples and negative (endothermic) for annealed samples. Therefore these anomalies were both associated with a relaxation phenomenon similar to that of a glass transition. For highly quenched low crystallinity films, a much larger heat cap- acity discontinuity of greater than 15% was observed, amidst a crystallization exotherm.


Keywords: Precipitation, Chemistry, Solubility, Phase transformations, Phase diagrams, Urinary calculi, Thermodynamic properties, Uranic acid, Hydrochloric acid, Calcium hydroxide hexadrate.

Solid phases formed in the quaternary system: uric-acid-calcium hydroxide-hydrochloric acid-water aged for 2 months at 310 K were studied to determine condi- tions in which cacitrate depurate hexadrate precipitated as a single solid phase was established. The data are presented in the form of tables and charts. The precipitation of calcium hydroxide hexadrate was determined. The formation of calcium hydroxide hexadrate crystals in uri- nary tract of patients with pathologically high concen- trations of calcium and urates (hypercalciuria and hyperuricosuria) is possible.
CHEMISTRY

Physical & Theoretical Chemistry

Energy Transfer from Vibrationally Excited SF6 to Benzene, Hexafluorobenzene, Fluorobenzene and Toluene.

Final rep.


Keywords: Sulfur hexafluoride, Energy transfer, Molecular relaxation, Lasers, Metastable state, Vibrational states. Aromatic hydrocarbons, Fluorine aromatic compounds, Reprints.

Relaxation of vibrationally excited SF6 by the two distinct processes, V. -> R.T and V. -> W, was studied using the various deactivators, benzene, hexafluorobenzene, fluorobenzene and toluene. Energy relaxation rates were measured using two methods, one sensing changes in the translational energy of gas mixtures, and the other in the internal energy of the deactivating molecule. Collision efficiencies and estimates of accuracy for the V. -> R.T and V. -> W processes were determined through detailed modeling. Results are compared with previous studies in which the time-resolved vibrational temperature was measured but an unambiguous distinction between V. -> R.T and V. -> W processes could not always be made.

200.334

PB92-236611 Not available NTIS National Inst. of Standards and Technology (NLM), Gaithersburg, MD, Chemical Kinetics Div. UV Absorption Spectra and Kinetics of the Self Reactions of CH2ClO2 and CH2F2 in the Gas Phase.

Final rep.


Pub. in International Jnl. of Chemical Kinetics 20, n10 p815-826 1988.

Keywords: Peroxy radicals, Chemical reactions, Reaction kinetics, Photochemistry, Ultraviolet spectroscopy, Temperature dependence. Pressure dependence. Reprints. Absorption cross-section.

The ultraviolet absorption spectra of chloromethylperoxy and fluoromethylperoxy radicals, CH2ClO2 and CH2F2O2, and the kinetics of their respective self reactions in the gas phase were determined using a flash photolysis technique. The absorption spectra for both radicals were quantified over the wavelength range 210 to 420 nm. The reaction rate constants were used to derive the observed self-reaction rate constants (for reactions 1 and 2 over the temperature range 228 - 300K, where X represents Cl or F). The (CH2ClO2 + CH2ClO2) -> Products. (CH2F2 + CH2F2O2) -> Products. The reaction rate constants at 298K were found to be independent of pressure. The reaction rates range from 2 to 10 kmol/cm³ at 1 atm. The reaction is highly dependent on the presence of other molecular species. A close examination of the reaction rates showed that the reaction is roughly first order in CH2ClO2 and second order in CH2ClO2.

200.339


Final rep.


Keywords: Peroxy radicals, Chemical reactions, Reaction kinetics, Photochemistry, Ultraviolet spectroscopy, Temperature dependence, Pressure dependence, Chlorine, Atoms, Reprints. Absorption cross-section.

A flash photolysis technique has been used to measure the gas phase ultraviolet absorption cross-section for the reaction CH3OCH2O -> CH3OCHO + CH2O. The wavelength range 210-290 nm. The reaction (1) was then studied by kinetic absorption spectroscopy. The reaction (1) CH3OCH2O + (CH2)n -> Products. The rate constant was derived using an absorption cross-section of 0.5 x 10 to the 18th power cm³ mol⁻¹ s⁻¹ at 298K. The reaction rate constants were observed to be in the fall-off region over the temperature range 228 to 380 K at pressures below 25 and 800 Torr (using N2) and were fit using the least squares method by least squares. At similar studies for CF2CO2 radicals were hindered by secondary formation of CO2. The experimental observations for the radical formation by thermal means, and their agreement with the occurrence of a rapid reaction between CF2CO2 and CI yielding CO. The CI + CF2CO2 reaction was found to be highly pressure dependent. The氯of the CIO radical recombination reaction at room temperature is

200.336

PB92-236645 Not available NTIS National Inst. of Standards and Technology (NLM), Gaithersburg, MD, Chemical Kinetics Div. Analysis of the nu8 Band of Methanide Fluoride.

Final rep.


Keywords: Infrared spectra, Absorption spectra, Vibrational spectra, Rotation spectra, High resolution, Band spectra, Reprints, Methane, Fluoride, Uranium, infrared spectroscopy.

The high resolution infrared absorption spectrum of the nu8 band of methane fluoride was measured using a BOMEM DA 3.002 Fourier spectrometer in the region 1400-1465 cm⁻¹. More than 900 transients were averaged in this consistent series at 1435.6355 cm⁻¹. The data have been combined with the upper state microwave measurements in a 1D potential model to obtain potential constants for the upper state resulting in an overall standard deviation of 0.0004 cm⁻¹.

200.337

PB92-236652 Not available NTIS National Inst. of Standards and Technology (NLM), Gaithersburg, MD, Chemical Kinetics Div. Methyl Cation Affinities of N, O, and C, Lone-Pair Donors.

Final rep.


Keywords: Affinity, Organic ions, 'Gibbs free energy, Chemical activity, 'Cations, Reaction kinetics, 'Nitriles, Chemical reactions, Reprints, Methane affinity.

Methyl cation transfer equilibria were measured using pulsed-field gradient NMR mass spectrometry. A ladder of deltaG(sup o)(sup 600) values relative methyl cation affinities (MCs) for several cyanides, ethers and aldehydes, spanning a range of 15 kcal/mol. The ladder is anchored to an estimated MCA(H2CO)(3) = 93 kcal/mol, giving the following MCA values: CH3CN 140 kcal/mol; CH2CN 125 kcal/mol; H2O 105 kcal/mol; CH3CHO 104 kcal/mol; H2O 98 kcal/mol; CH3OH 95 kcal/mol; CH2O 31 kcal/mol.

200.338

PB92-236619 Not available NTIS National Inst. of Standards and Technology (NLM), Gaithersburg, MD, Thermodynamics Div. Correlation of Aqueous Henry's Constants from 0°C to the Critical Point.

Final rep.


Pub. in AIChE Jnl. 36, n4 p539-546 Apr 90.

Keywords: 'Gases, Solubility, 'Aqueous solutions, Temperature dependence, 'Henry law, Critical temperature, Thermodynamic properties, Water, Heavy water, Reprints, Nonpolar gases.

Recent theoretical results (Japav and LeVell Sengers, 1989) for the temperature dependence of Henry's constant of the solvents critical point are used to derive a linear expression which, for aqueous solutions of nonpolar gases, fits experimental Henry's constant data reasonably well. The correlation is useful for predicting solubility at temperatures near the critical point. The solubility of water is also included.

200.340

PB92-237015 Not available NTIS National Inst. of Standards and Technology (NLM), Gaithersburg, MD, Chemical Thermodynamics Div. Enthalpy of Combustion of 1,4-Dimethyl Dicarbonylate.

Final rep.


Pub. in Jnl. of Chemical Thermodynamics 21, n11 p1105-1113 1989.

Keywords: Hydrocarbons, Esters, Heat of combustion, Calorimetry, Thermodynamic properties, Reprints, 'Cubane dicarbonyl/dimethyl, Strain energy.

The energy of combustion of crystalline 1,4-dimethyl dicarbonylate was measured in the NIST aneroid manometer calorimeter. The measured enthalpy of combustion at 298.15 K P(2) = 100,000 Pa for the reaction: C12H12O4(cr) + 13 O2(g) = 12 CO2(g) + 6 H2O(l) is (6518.09 ± 0.12) kJ/mol. The derived enthalpy of formation for crystalline 1,4-dimethyl dicarbonylate is (218.99 ± 0.14) kJ/mol. Using group-contribution values. The corresponding strain energy is 590.7 kJ/mol.
average polarizability with the number of atoms is qualitatively different in the two types of clusters, and may lead to different stress preferences for Cs clusters interacting with surfaces.

200.345

PB92-124245, PB92-124323, PB92-124621 and PB92-217637

Keywords: Spectroscopy, Photoemission, Calibration, Level Determination, New Wavenumber Calibration Tables for Heterodyne Frequency Measurements, Spectroscopy, Calibration, Instrumentation, New Wavenumber Calibration Tables for Heterodyne Frequency Measurements, Spectroscopy, Calibration, Instrumentation, New Wavenumber Calibration Tables for Heterodyne Frequency Measurements, Spectroscopy, Calibration, Instrumentation.

200.344
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PB92-124245, PB92-124621, PB92-124323, PB92-217637


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Keywords: Spectroscopy, Photoemission, Calibration, Level Determination, New Wavenumber Calibration Tables for Heterodyne Frequency Measurements, Spectroscopy, Calibration, Instrumentation, New Wavenumber Calibration Tables for Heterodyne Frequency Measurements, Spectroscopy, Calibration, Instrumentation, New Wavenumber Calibration Tables for Heterodyne Frequency Measurements, Spectroscopy, Calibration, Instrumentation.

200.344
PB92-124245, PB92-124621, PB92-124323, PB92-217637


Keywords: Spectroscopy, Photoemission, Calibration, Level Determination, New Wavenumber Calibration Tables for Heterodyne Frequency Measurements, Spectroscopy, Calibration, Instrumentation, New Wavenumber Calibration Tables for Heterodyne Frequency Measurements, Spectroscopy, Calibration, Instrumentation, New Wavenumber Calibration Tables for Heterodyne Frequency Measurements, Spectroscopy, Calibration, Instrumentation.
Final rept. M. Collinson, and L. W. Siock. 1990, 4p


At 580-680K, the proton transfer reaction $\text{t-C4H9}^+ + \text{NH}_3 \leftrightarrow \text{NH}_4^+ + \text{t-C4H9H}_3^-$ is in equilibrium in mixtures containing ammonia and isobutene. In the same mixtures $t\text-C4H9\text{NH}_3^-$ is also formed reversibly and kinetic experiments identify the addition/thermal conversion equilibrium $\text{NH}_4^+ + \text{t-C4H9H}_3^-$ as a slow step. The temperature coefficient $T$ to the -0.10K power. Equilibrium studies of the proton transfer reaction yield a standard enthalpy of $-12.5$ kcal/mol and a standard entropy of $-6.1$cal/mol K. For the addition reaction, the equilibrium studies yield a standard enthalpy and entropy of $-34.9$ kcal/mol and -$39.2$ kcal/mol K.

#### 200.361
PB93-125425 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Chemical Kinetics Div.
Gas Phase Reactions of Hydroxyl Radicals with a Series of Nitroalkanes Over the Temperature Range 240-400 K.

Keywords: *Reaction kinetics, *Hydroxyl radicals, *Nitrogen organic compounds, Chemical reactions, Alkanes, Vapor phases, Photoysis, Flashing, Fluorocarbon temperature, Experimental design, Arhythmic equation, Reprints, Methane/nitro, Ethane/nitro, Alkylnitro, Butane/nitro, Pentane/nitro.

Absolute rate constants were determined for the gas phase reactions of OH radicals with a series of nitroalkanes by the flash photolysis-resonance fluorescence technique. Experiments were performed at total pressures from 25 to 50 torr using Ar as a diluent gas. Experiments were performed over the temperature range 240-400 K for nitroethane, 1-nitropropane, 2-nitropropane, 1-nitrobutane, and 1-nitropentane were used to derive the Arrhenius expressions.

200.352
PB93-125482 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Thermophysics Div.
Comparison of Rotational Relaxation Rate Laws to Characterize the Ramon O-Branch Spectrum of CO at 295 K.

Keywords: *Carbon monoxide, *Raman spectra, *Room broadening, Room temperature, Scaling laws, width, Reprints.

We test the ability of the Energy Corrected Sudden (ECS), Modified Exponential Gap (MEG) and the Statistical Power-Exponential Gap (SPEG) collision rate law models to describe the continuous line broadening and line interference in the CO O-branch at 295 K. All three rate law models fit the experimental linewidth data. The ECS rate law is found to be unphysical as it predicts too much spectral collapse. The MEG and SPEG rate law models both adequately fit all of the data, both linewidth and line mixing data, but with different implications about the relative importance of dipolar and quadrupolar symmetry forces in the CO line broadening. From the semiclassical calculations of CO linewidths based on realistic potentials, we argue that the SPEG rate law with a quadrupolar collisional selection rule provides the most physically correct description of the CO system.

200.353
PB93-125557 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Thermophysics Div.
Modeling Macromolecular Diffusion Through a Porous Medium.
Final rept. R. A. MacDonald. 1992, 1p


The diffusion of large spherical molecules through a porous medium is studied by means of a two-dimensional computer model developed previously. For two different pore size distributions, a random walk procedure is used to determine the diffusion under several conditions of wall-molecule interaction, represented by a residence time, and pore connectivity, or tortuosity. To simulate a driving force on the molecules, a constant bias in one direction is imposed in the random walk. The unbased case is also studied. Pore sizes are chosen either at random from each distribution or from one distribution at a time to form a 3D picture. The selectivity of the diffusion with respect to molecular size is monitored. The wall-molecule interaction and the molecule size both have an important effect on diffusion, as expected. The arrangement of the pore size distributions, whether in layers or at random, has only a small effect.

200.354
PB93-125797 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Thermophysics Div.
Binary Gas-Liquid Systems Classification.
Final rept. P. H. E. Meijer. 1986, 6p
Pub. in Proceedings of International Symposium on Supercritical Fluids, Nice, France, October 17-18, 1988, p239-244.

Keywords: *Binary mixtures, *Gases, *Liquid, *Phase transformations, Critical point, Phase diagrams, Interactions, Thermodynamic properties, Reprints.

Phase separation may be understood by following the changes in the fluid-gas diagram. Only in exceptional cases do these lines connect the critical points of the pure solvent with the critical point of the pure solute. The actual behavior are much more complicated, even if the presence of the solid phase is ignored. The observed diagrams are usually grouped into three topologically different classes, following Scott and van Konynenburg. This work shows that each of the four essentially different cases can be considered to emanate from one special degenerate case. This case is related to a special set of interaction parameters, whose values were determined by van der Waal for the van der Waal's equation of state for binary mixtures. The corresponding point in the space of the interaction parameters is characterized as being both a critical double point and a tricritical point. This point will be referred to as the van Luear point.

200.355
PB93-126050 Not available NTIS National Inst. of Standards and Technology (NPL), Boulton, UK. National Physical Laboratory.
Characterization of Triplet States in Doubly Charged Positive Ions: Assignment of the (3P)(sub u) - (3Sigma)(sub u) + Electronic Transition in N2(+).
Pub. in Jnl. of Physical Chemistry 95, n8 p2122-2124 1991.

Keywords: *Nitrogen ions, Electron transitions, Positive ions, Excited states, Rotational spectra, Photodissociation, Triplet, Lifetimes, Reprints, Molecular vibrations.

The first direct spectroscopic evidence and characterization of triplet states in a molecular dicarbon is reported. The triplet state is in the range +e(3P)(sub u) - (3Sigma)(sub u) +) electronic absorption between excited states of N2(2+). It is reported by ion-electron beam photoionization, represented by a residence time, and pore connectivity. To simulate a driving force on the molecules, a constant bias in one direction is imposed in the random walk. The unbased case is also studied. Pore sizes are chosen either at random from each distribution or from one distribution at a time to form a 3D picture. The selectivity of the diffusion with respect to molecular size is monitored. The wall-molecule interaction and the molecule size both have an important effect on diffusion, as expected. The arrangement of the pore size distributions, whether in layers or at random, has only a small effect.

200.356
PB93-129229 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Chemical Kinetics and Thermodynamics Div.
Modeling the Reaction of Iodine, Ammonium, and Hydroxyl Radical with Cyanide.


At 580-680K, the proton transfer reaction $t\text-C4H9^+ + \text{NH}_3 \leftrightarrow \text{NH}_4^+ + \text{t-C4H9H}_3^-$ is in equilibrium in mixtures containing ammonia and isobutene. In the same mixtures $t\text-C4H9\text{NH}_3^-$ is also formed reversibly and kinetic experiments identify the addition/thermal conversion equilibrium $\text{NH}_4^+ + \text{t-C4H9H}_3^-$ as a slow step. The temperature coefficient $T$ to the -0.10K power. Equilibrium studies of the proton transfer reaction yield a standard enthalpy of $-12.5$ kcal/mol and a standard entropy of $-6.1$cal/mol K. For the addition reaction, the equilibrium studies yield a standard enthalpy and entropy of $-34.9$ kcal/mol and -$39.2$ kcal/mol K.
Static Secondary Ion Mass Spectrometry of Self-Assembled Alkanethiol Monolayers on Gold.

Final rept.


Keywords: *Thiols, Adsorption, Gold, Surface Chemistry, Molecular Films, Mass Spectroscopy, Spectrum analysis, Molecular ions, Reprints, *Alkanethiols.

We report a static secondary ion mass spectrometry (SSIMS) study of self-assembled monolayers (SAMs) of alkanethiols (CH(3)CH(2)SH, wherein n = 7, 9, 11, 15, 17) adsorbed on Au. A rich variety of molecular secondary ions is observed. In the SSIMS spectra including (M-H)(+), (M+H)(+), (M+H2)(+), and (M+H2)(+)(1) and (M+H2)(+) are observed. The SSIMS spectra of SAMs that have been atmosphere exposed for some time, however, are strongly affected by species that are not detected from samples that are handled properly.

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CHEMISTRY

Physical & Theoretical Chemistry

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Not unusual in the context of molecular structure, the effect of the metal is on the liquid phase is obtained in the same way as in the solid state. The well-defined monolayers have been successfully obtained on gold to detect surface reaction of the liquid phase.

Ten resistance thermometers were tested as point sensors for detecting the liquid-liquid interface in liquid nitrogen and liquid hydrogen. Test results showed that the magnitude of the liquid surface heat and lead orientation can be important. A silicon resistive sensor had the fastest response and produced the greatest signal change.

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200.367
PB93-135473 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramic Divs.

Physical and Thermodynamics of Lithium Aluminates.

Final rept.

J. P. Pelle, and L. P. Cook. 1990, 17p

Keywords: *Lithium inorganic compounds, *Aluminates, *Vapor pressure, Knudsen flow, Mass spectrosopy, Thermodynamics, Chemical reactions, Reprints.

Vapor pressure measurements were made using the custom Knudsen effusion method coupled with a modulated beam, quadrupole mass spectrometer. Two solid state reactions were studied: (5/4) Li2O+CO2 to (5/4) Li2O2 and (5/4) Li2O2 to (5/2) Li2O3. Second and Third Law analysis of the data yield results in reasonable agreement with literature values. Literature data for Li3O4 are questionable, however, as the reported Li pressures appear to exceed those over pure Li2O.

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200.366
PB93-135507 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramic Divs.

Neutron Scattering Study of Cs-Ammonia Intercalated Graphite.


Keywords: *Ammonia, *Intercalation, Rotational states, Room temperature, Neutron scattering, Excitation, Graphite, Phonons, Cesium, Cesium complexes, Clatheires, Reprints.

Neutron scattering is an ideal tool for the study of the dynamics of alkali-ammonia graphite intercalation compounds. Previous work on the K-N3 system has shown a hybridization of the (in brackets: OOL) longitudinal acoustic phonons with a mode of the (g) intercalate layer at an energy of about 7 meV. To date three different models for this extremely anharmonic mode have been proposed. The first is that it is a libration of the ammonia molecule about its three-fold symmetry axis. Monte Carlo simulations of the room temperature in-plane scattering, as well as recent quantum-entropy reconstructions of the c-axis scattering density profile, indicate that this C3 symmetry axis lies in the basal plane. Results lead to the conclusion that the ammonia molecule is undergoing classical 'free' rotations along a (b) axis. Monte Carlo rotational excitation could not hybridize with the phonons in the rather harmonic manner observed for K-MoS2. While it could be argued that results obtained in the solid intercalate phase are not applicable to the room-temperature liquid phase, it is extremely unlikely that the activation energy would increase upon melting of the intercalate layer. Therefore, it seems that some other excitation must be capable of coupling to the (in brackets: OOL) longitudinal phonons.

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200.365
PB93-135566 Not available NTIS National Inst. of Standards and Technology (PL), Gaithersburg, MD. Molecular Physics Div.

Parallel Bands of Cyclopane in the 3.2mm Region.

Final rept.

See also PB91-237016.

Keywords: *Cyclopane, *Infrared spectra, Intermolecular forces, Rotational spectroscopy, IR absorption, Band spectra, Perturbation, Reprints, Color center lasers.

The extremely perturbed parallel band system occurring in the infrared spectrum of cyclopane between 2000 and 3000 cm⁻¹ has been resolved with effective resolution of less than one-half of the Doppler width using a difference-frequency laser spectrometer. A strong C-H stretch band on the strong O branches near 3101/cm has also been measured with a color center laser and opothermal detection in a molecular beam adiabatically cooled to about 10 K. Three distinct sequence of parallel subbands are observed belonging to the antisymmetric C-
Physical & Theoretical Chemistry

H-stretching vibration rule(s) of species A(2) in anharmonic plus J-type C-40 interactions with two perturbing states. A five-level Hamiltonian model has been used to interpret the observed spectrum and to adjust spectroscopic constants for the states involved and for their interactions. Additional local perturbations are observed in the spectrum.

Polymer Chemistry

200369
PB92-145226 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Protonation of Dyes in Ferroelectric Copolymer of Vinylidene Fluoride and Trifluoroethylene.
Final rept.
T. Samatoua, C. F. Majkrzak, 1991, 4p


The paper presents an investigation of changes in the u.v.-visible spectra of the dyes, 4-dimethylamino-4'-nitrostilbene and 4-amino-4'-nitroazoanobenzene dissolved in a copolymer of 70 mol% vinylidene fluoride (VDF) and 25 mol% trifluoroethylene (TFE) as a result of electrical poling or pulsed laser irradiation. The original absorption diminishes and a distinct new absorption appears. This new absorption was identified as due to the protonated form of the dyes suggesting that poling liberates HF from VDF-TFE copolymer. Subsequent thermal stability of the protonated dyes is discussed. A cascade reaction from a ruby laser produces comparable changes in spectra but in contrast to the changes imposed by poling, the original spectrum is recovered within 24 h.

200369
PB92-145325 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Neutron Reflectivity Study of a Polymer-Solid Interface.
Final rept.


The density distribution in a polymer melt in the vicinity of a solid surface was probed using neutron reflectivity measurements. Preliminary measurements were conducted on poly(vinylidene fluoride) in contact with a silicon single crystal. A significant difference in reflectivity was observed between the free silicon surface and the polymer-silicon interface. This difference can be attributed to the polymer density fluctuation near the interface. Dramatic changes in the reflectivity were observed as the sample temperature decreased below its melting temperature. A qualitative interpretation of the results based on surface enhanced crystallization of the polymer is presented. The work demonstrates that neutron reflectivity is a promising technique for probing polymer structure near a solid surface.

200370
PB92-154020 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Phase Transitions in Complex Polymer Systems. Final rept.
R. M. Birner, and B. J. Bauer. 1991, 2p

Keywords: *Phase transformations, *Polymers, *Reprints.
Recent studies on phase transitions in polymer mixtures are described.
field. A two-dimensional CCD array detector is used for quantification of anisotropic scattering patterns which commonly develop from shared samples. The authors describe results obtained from an 8% solution of a polystyrene polystyrylamine blend (50-50 in dioctyl phthalate). The sample has been examined previously and has demonstrated shear-induced microbubbles. The steady shear results obtained are consistent with the previous investigation. The authors also measure the kinetics of phase separation following cessation of a steady shear. The kinetics results are much different in the directions parallel and normal to the original flow direction. The authors believe this is the first report of anisotropic behavior in the phase separation kinetics of a polymer blend.

200.377
PB92-159939
Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.

Rigid-Rod Derived Amorphous Polydiacetylenes.
Final rep.
M. A. Schen, K. Kolowski, and J. Clin. 1991, 8p
Keywords: Polymerization, Polymers, Amorphous structure, Liquid crystals, Reprints, Diacetylene.

During the authors' investigations of diacetylene monomers that exhibit thermotropic liquid-crystal phase behavior, it was demonstrated that samples exhibiting rapid thermal polymerization of the isotropic monomer melt take place with some of the compounds examined. In run, the samples containing symmetrically substituted 4-oxymethylene-4-nor-cyclopropane (NOBOA) side-groups attached to a butadiene core via a polystyrene segment are the only liquid crystals that are seen in the lower groups of the series yet form polycrystalline in the isotropic monomer melt is observed only in the lower members of the series. The compound 10BOA is believed to be rod-like in structure. It can be a microstructure that is believed to be responsible for imparting this unique combination of polymerization and polymer properties. Traditionally, molecularly flexible diacetylene monomers and the resulting polymers in the NOBOA series do not show such facile melt-phase reactivity and do not allow the synthesis of purely amorphous conjugated polymer films.

200.378
PB92-159946
Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.

Dielectric Relaxation Studies of X(2)-Dye Containing Polystyrene Films.
Final rep.
M. A. Schen, and F. I. Moges. 1991, 11p
Keywords: Dielectric properties, Polymers, Azo dyes, Basic dyes, Relaxation losses, Polystyrene, Thin films, Activation energy, Reprints, Nonlinear optical polymers.

The dielectric relaxation characteristics of narrow molecular weight distribution polystyrene (PS) films containing the second order nonlinear optical dyes, 4-(N,N-dimethylamino)-4-nitrostilbene (DANS) and 4-NNaphthyl-2,5-nitrostilbene (DR1), at a level of 0.19 mole percent, are reported using time domain dielectric spectrometry. Measurements ranging from 10Hz to 1010Hz have allowed the authors to closely examine sub-Tg dipolar losses that are associated with the dye. It is seen that the frequency is near 100Hz for DR1 and for DANS the relaxation time activation energies are 13kJ/mol and 79kJ/mol for DANS and DR1 respectively. The dye relaxation amplitudes do not follow a power law decay. The observed broad dispersion curves imply a broad distribution of relaxation times. With physical aging, little change in beta amplitude was observed. The amplitude of the relaxation time distribution function seems to occur.

200.381
PB92-170829
Not available NTIS National Inst. of Standards and Technology (MISE), Gaithersburg, MD. Reactor Radiation Div.

Neutron Reflectivity Studies of the Surface-Induced Ordering of Diblock Copolymer Films.
Final rep.
See also DE9000546. Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review Letters 62, n16 p1852-1855, 17 Apr 89.
Keywords: Polystyrene, Poly(methyl methacrylate), Surface properties, Thin films, Copolymers, Reflectivity, Neutron radiation, Neutrons, Reprints, Multilayers.

Neutron reflectivity from annealed thin films of polystyrene-b-deuterated-methylmethacrylate, PS-(b-DMM), reveals the formation of a multilayered morphology parallel to the film surface. This polymer forms so that PS locates, preferentially, at the air/co-polymer and DPMAA at the substrate/copolymer interfaces with layer thicknesses at these interfaces one-half that found in the bulk. IPS-(b-b-MMA) of lower molecular weight shows the first evidence of surface-induced ordering of copolymers in the phase-mixed state achieved by an exponentially damped cosine function.

200.382
PB92-170959
Not available NTIS National Inst. of Standards and Technology (MISE), Gaithersburg, MD. Polymers Div.

Torsional Dilatometry of Polymer Networks in Equilibrium.
Final rep.
R. S. Duran, and G. B. McKenna. 1989, 1p
Pub. in Abstracts of Papers of the American Chemical Society 199, p217 Sep 89.
Keywords: Torque, Volume, Epoxy resins, Viscoelasticity, Dilatometry, Glass transition temperature, Temperature dependence, Deformation, Reprints.

Torsional dilatometric measurements were performed on a series of model end-linked epoxy networks. Torque, normal force, and volume were measured as a function of time during and after torsional deformation. All measurements were made in the vicinity of the glass transition temperature on samples which had been aged to their equilibrium volume. The specific volumetric changes in the network were noted before as well after torsional deformation, then relaxed back towards equilibrium. The volume change for a given torsional strain was found to be temperature dependent. Volumetric behavior as a function of temperature and deformation was reported.

200.383
PB92-170901
Not available NTIS National Inst. of Standards and Technology (MISE), Gaithersburg, MD. Polymers Div.

Structure in Rigid Rod Liquid Crystalline Polymers with Flexible Aliphatic Side Chains.
Final rep.
Pub. in Abstracts of Papers of the American Chemical Society 197, p159 Apr 89.
Keywords: Liquid crystals, Crystal structure, Polymers, Aliphatic hydrocarbons, X-ray diffraction, Polyesters resins, Hydroquinones, Polymerization, Optical microscopy, Thermo-mechanical analysis, Shear transformations, Reprints, Bicyclooctane dicarboxylic acid.

Liquid crystalline structure in several chemically similar rigid rod liquid crystalline polymers was determined by X-ray diffraction, DSC, and optical microscopy. A series of polymers of 2,5-dialkohydroquinones and terphenyl acid polymers were melt condensed and having side chain lengths of sixteen carbons showed a disordered smectic mesophase. Polymers formed from bicyclooctane-1,4-dicarboxylic acid and 2,5-dialkoxyhydroquinone did not show a mesophase. Polyes-sters substituted on both the hydroquinone and terphenyl acid residues formed disordered smectic phases when each residue contained different side chain lengths.

200.384
PB92-172485
PC A03/MF A01 National Inst. of Standards and Technology (MISE), Gaithersburg, MD. Polymers Div.

Development of Characterization Techniques for Polyurethanes I. Characterization of SRM 1480, a Low Molecular Weight Polyurethane for SEC Calibrations.
Keywords: Polyurethane, Molecular weight, Calibrating standards, Tetrahydrofuran, Organic solvents, Intrinsic viscosity, Chromatographic analysis, Light scattering, Concentration/Composition. Standard reference materials, "SRM 1480, Size exclusion chromatography.

The characterization of a polyurethane standard reference material, SRM 1480, is described. The weight average molecular weight of SRM 1480 by light scattering was determined to be 78.0 g/mole. The intrinsic viscosity of SRM 1480 in THF was also measured and
Crystal Structure of Polytetrafluoroethylene Homopolymers and Copolymers in the High Pressure Phase

Final rept.
R. K. Eby, E. S. Clark, B. L. Farmer, G. J. Pieramici, and J. D. Block. 1990, 10p
See also PB95-123915
Pub. in Polymer 31, n2 p2227-2237 1990.

Keywords: *Crystal structure, Copolymers, X-ray diffraction, Pressure tests, Fluorine organic compounds, Molecular rotation, Phase transformations, Entropy, Order disorder transformations, Reprints, Poly(tetrafluoroethylene), Homopolymers, Molecular correlation.

X-ray diffraction measurements are reported for 27 deg, pressures to 5 GPa and concentrations of CF3 units to 0.05 CF3/CF2. These show both the ortho-bond and the monoclinic structures to exist under high hydrostatic pressure. It is proposed that shear stress generated at elastic inhomogeneities in the sample lead to the monoclinic phase. Energy calculations are consistent with the idea. They also indicate that conformational and rotational disorders raise the entropy of the high pressure phase III. Perfluoromethyl branches increase the volume of phase III more than that of the low pressure phase I. At high CF3 concentration and pressures, both phases become metacellularly hexagonal. The volume of transition decreases at a concentration near 0.05 CF3/CF2 and no transition is seen at a pressure of 5.2 GPa. There appears to be a critical point near 27 deg C, a CF3 concentration of 0.05 and a pressure of 3.5 to 5 GPa.

General

200,394
PB92-149764
Polymers, Copolymer systems.
H. Benoit, M. Benmoula, and W. L. Wu. 1990, 7p

Keywords: *Polymers, Copolymers, Elastic scattering, Comparison, Solutions, Mixtures, Random phase approximation, Correlations, Reprints.

In a first part the intensity scattered by polymer solutions and bulk mixtures with the same number of components are compared. General equations valid for three polymers A, B, C and a copolymer A-B are given in the presence of a fourth component which can be either a solvent or another polymer. An application is given on the effect of the interactions between ordinary and deuterated polymers in blends with another polymer.
CIVIL ENGINEERING

Construction Equipment, Materials, & Supplies


Keywords: *Construction, *Tests, *Cement paste, *Cement paste-aggregate interface zone. The study investigated the effects of mineral admixtures on the cement paste-aggregate interface zone. The results showed that mineral admixtures can significantly influence the properties of the cement paste-aggregate interface zone, which is crucial for the durability and performance of concrete structures.

200,401

PB92-183654 PC A03/MF A01 National Inst. of Standards and Technology (BFRF), Gaithersburg, MD. Portland Cement Clinker Characterization by X-ray Diffraction Analysis of Three Port- land Cement Reference Material Clinkers. P. E. Stutzer. Apr 92, 26p NISTIR-4785 See also PB91-147397.

CIVIL ENGINEERING

Construction Equipment, Materials, & Supplies

Errors, Aggregates, Mathematical models, Numerical analysis, Construction materials

Regression analysis was performed on published data from nondestructive and cylinder compressive strength testing of concrete. The nondestructive tests investigated were: hammer, probe penetration, pulse velocity, pullout, and break-off. Regression analysis accounted for the error in both the nonde- structive and destructive measured data and their constant coefficient of variation. Data for each nonde- structive test were grouped by coarse aggregate type and aggregate size. The results of the regres- sion analysis are given, along with the parameters required to estimate compressive strength from subse- quent nondestructive tests. A common format for the analysis and reporting of nondestructive-destructive regression experiments is suggested.

200.402
PB92-227107  PC A04/MF A01
National Inst. of Standards and Technology, Gaithers- burg, MD.

Development of a Technique for In situ Measurement of Water at the Asphalt/Model Siliceous Ag- geregate Interface.

Final rep.
Sponsored by Strategic Highway Research Program, Washington, DC.

Keywords: *Aggregate, Pavement tests, Interfaces, Moisture content, Spectroscopy, Asphalts, Field-infrac- tor, Transport properties, Diffusion, Spectrum analysis, Water content, Absorption, Test methods, Road materials, Forcertain on site, Infrared spectroscopy, Mul- tiplex internal reflection spectroscopy

A description of a technique for the measurement of water in situ at the interface between an asphalt and a model siliceous aggregate is presented. The technique is based on Fourier transform infrared spectroscopy in the multiple internal reflection mode. The technique re- quired the coating of an asphalt layer of a known thick- ness on an internal reflection element, which served as an optical guide to obtain an infrared spectrum.

Highway Engineering

200.403
PB92-159193  Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Structures Div.

Behavior of 1/6-Scale Model Bridge Columns Subjected to Inelastic Cyclic Loading.

Final rep.
See also PB87-152245. Sponsored by National Sci- ence Foundation, Washington, DC, Federal Highway Administration, Washington, DC, and California State Dept. of Transportation, Sacramento, CA.

Keywords: *Columns(Supports), *Bridge(Structures), *Cyclic loads, *Reinforced concrete, *Model tests, Elastic properties, Ready mixed concrete, Loads(Forces), Displacement, Gravel, Aggregates, Bridge design, Structural design, Mechanical proper- ties, to perform ordinary, at laboratories,

Circular, spirally reinforced concrete bridge columns were subjected to cyclic inelastic loading in the laboratory. The bridge columns were one-sixth scale models of prototype columns designed in accordance with current California Department of Transportation specifications. A total of six models were tested. Three of the models were constructed with microconcrete and three were constructed with ready-mixed concrete using pea gravel. Variables included the aspect ratio, magnitude of cyclic loads, and use of microconcrete versus ready-mixed. The models were subjected to slow reversed cyclic lateral displacement with the axial load held constant. Results from the tests are present- ed in the form of load displacement curves and energy absorption plots.

200.404
PB92-159482  Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.

Measuring the Rate of Corrosion of Steel in Concrete.

Final rep.
E. Escalante, and S. Ito. 1990, 17p
See also PB90-170848. Sponsored by Federal High- way Administration, McLean, VA.

Keywords: *Reinforced concrete, *Bridge decks, *Rein- forcing steels, *Corrosion, Chlorine, Chemical attack, Oxidation, Steels, Corrosion resistance, Field tests, pH, Reprints

A study on the relationship of pH, chloride concentra- tion, and reinforcement corrosion shows that a driving cycle, which locally concentrates chloride and oxygen, initiates the corrosion of steel in concrete. Once cor- rosion begins, the pH at the anodic areas increases thereby allowing corrosion to proceed more easily. Oxygen controls the rate of corrosion, but chloride affects the corrosion rate. Measurements were taken of the resistance media, the corrosion of steel in concrete was measured in the laboratory. The portable system was then used to measure the rate of corrosion measurements on reinforcing steel in three bridge decks in Frederick County, Maryland.

Combustion & Ignition

200.405
PB92-191865  PC A03/MF A01
National Inst. of Standards and Technology, Gaithers- burg, MD.


Workshop rep.
L. J. Kaetzel, and J. R. Clifton. Oct 91, 40p SHRP-C- UWP-91-521
Sponsored by Strategic Highway Research Program, Washington, DC.

Keywords: *Expert systems, *Concrete pavements, *Concrete structures, *Knowledge based systems, Design, Road materials, Concrete construction, Management systems, Concretes, Pavement condition, Data bases

The report is the result of a survey of expert/knowl- edge-based systems applications and development methods related to concrete pavements and struc- tures. It is the initial step in the development of expert systems for the SHRP C-206 (Task 3 project). The report focuses on the following subjects: (1) the poten- tial for the application of expert systems for concrete mix design and diagnostics, repair, and rehabilita- tion; (2) a description of inference procedures that are being evaluated for representing the concrete pavement and structure knowledge domain; and (3) recent expert/knowledge-based systems activities.

200.406
PB92-226323  PC A05/MF A01
National Inst. of Standards and Technology (BFRU), Gaithersburg, MD.

Application of Inelastic Damage Analysis to Double-Deck Highway Structures.

J. Gross, and S. K. Kunnath. Aug 92, 80p NISTIR- 4857
Contract USGS-9900-0247
Prepared in cooperation with University of Central Flor- ida, Orlando. Sponsored by Geological Survey, Reston, VA.

Keywords: *Earthquake damage, *Elastic properties, *Damage assessment, *Concrete structures, *Vad- ucts, Finite element analysis, Dynamic structural analysis, Earthquake engineering, Displacement, Cyclic loads, Computation simulation, Seismic waves, Dynamic analysis, Loads(Forces), Mathematical models, Moments, Loma Prieta earthquake

The Loma Prieta earthquake of October 17, 1989, caused extensive damage to many highway structures and particularly to double-deck structures. The most notable was the collapse of the Cypress Viaduct (Inter- state 280) in California. The paper undertakes an effort to use computer-based analysis methods, causes of structural failure of elevated highway structures result- ing in the Loma Prieta collapse. The study reveals the potential for collapse of some structures natively. The IDARC analysis program, developed at the University of Buffalo, was used in the inelastic seismic analysis. Features of the program and enhancements incorporated to model the Cypress Viaduct structure are described. To accurately determine beam and column moment-curvature relationships, separate computer analyses were conducted. In addi- tion, a smeared-crack approach finite element analysis was employed to determine the lateral load-deforma- tion relationship of the pedestrian regions. The model of the Cypress Viaduct was subjected to the Oakland Outer Harbor Wharf ground acceleration record in the plane of the bend. The analysis was calibrated using static lateral load tests, ambient and forced vibra- tion tests, and observed performance.

200.407
AD-A244 496/6  PC A03/MF A01
National Inst. of Standards and Technology, Gaithers- burg, MD.

Spectroscopy of Reaction Intermediates in Nitrame Decomposition and Combustion.

Final rep. 20 Apr 88-19 Apr 89
M. E. Jacobson. Jun 91, 25p ARO-25664-Ch
Contracts MIPR-126-86, MIPR-117-89
MIPR-120-90.

Keywords: *Free radicals, Carbon, Chemistry, Combustion, Decomposition, Dimers, Environments, High energy, Infrared detection, the formation of nitrogen, oxygen, ions, Isolation, Low pressure, Materials, Matrix theory, Models, Molecular ions, Molecules, Near infra- red radiation, Neon, Nitramine, Nitrates, Photodecom- position, Response, Sampling, Solids, Spectroscopy, Vapor pressure, *Dimer ions, *Infrared spectrum, *Ni- tramine decomposition, Matrix isolation, Monomethyl- nitramine, Near infrared spectrum, Water-catalyzed

The infrared spectra of a number of free radicals and molecular ions which are expected to be important in nitramine decomposition and combustion have been obtained in solid neon. The near infrared ion studies resulted in the first infrared spectral detection of dimer ions in a non-reactive environment. The ions chosen for study are important in the lower ionosphere and in combustion and high energy processes involving carbon- and nitrogen-containing materials. Other stud- ies used monomethylnitramine (MMN) as a model compound for elucidating the chemistry of nitramine decomposition. The infrared spectrum of MMN isolated in solid neon was obtained using a manifold de- signed for matrix isolation sampling of low vapor pres- sure materials. Supporting evidence was obtained for a mechanism recently proposed by Melius for water- catalyzed nitramine decomposition. The photo-decom- position of matrix-isolated MMN was studied. Evidence was obtained supporting initial detachment of NO2 and subsequent formation of nitrate in a solid environment. Infrared and near infrared studies of other free radicals are briefly described.

200.408
DE92015587  PC A03/MF A01
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Chemical Technology.

Effect of Swirl on the Structure of a Pressure-atom- ized Spray Flame.

Contract A010-86CE90213
International symposium on combustion (23rd), Ore- lbs (France), 22-27 Jul 1990. Sponsored by Depart- ment of Energy, Washington, DC.

The effect of combustion air swirl on the structure of fuel sprays and spray flames has been investigated, using laser velocimetry (LV) and laser sheet beam photography. Highly-accurate droplet and radial velocity distributions have been obtained in a pressure-atomized kerosene spray under nonturning and burning conditions. Combustion air swirl influences the spray structure only at positions downstream of the fuel nozzle, where fuel-air mixing is initiated; the spray region immediately downstream of the nozzle exit is unaffected by the swirling air. The combustion air swirl creates a strong toroidal recirculation zone which enhances mixing and thus results in significant increased droplet velocities, while the droplet number densities are much reduced, especially near the spray axis. The spray effects of the two types of swirl have been studied. The reduction in the number densities makes the LV measurements sensitive to the data acquisition rate, especially at the periphery of the swirl. The air swirl is also found to lead to bi-modal velocity distributions near the spray boundary, where recirculated droplets and droplets arriving directly from the nozzle coexist. Interpretation of droplet transport processes is required to determine detailed information on velocity and size distributions, in addition to the mean and rms properties, in order to provide an understanding of the structure of spray flames.

200.409
PB92-156777
PC A03/MF A01
National Inst. of Standards and Technology (NIST), Gaithersburg, MD
Computing Radiative Heat Transfer Occurring in a Zone Fire Model
G. P. Formwalt, 91, 50p NSTIR-4709
See also PB99-218366.


Radiation, convection and conduction are the three mechanisms which a zone fire model must consider when calculating the heat transfer between fires, wall surfaces and the surrounding gas. Radiation dominates the other two modes of heat transfer in rooms where there are fires or hot smoke layers. The computational requirements of a radiation code can also dominate the work required to calculate other physical submodels in a zone fire model. The report presents algorithms which solve the radiative heat exchange between four-wall surfaces, several fires and two interior gases. A two-wall and a ten-wall radiation model are also discussed. The structure of the radiation model is exploited to show that only a few configuration factors need to be calculated directly (two rather than 16 for the four-wall model and eight rather than 100 for the ten-wall model) and matrices needed to solve for the net radiative flux striking each surface are shown to explain the appropriate transformation matrix, taken to be diagonally dominant. Iterative methods may then be used to solve the linear equations more efficiently than with the exact forms of the Gauss elimination.

The radiation exchange algorithms are implemented as FORTRAN subroutines named RAD2, RAD4, and RAD10. An example of a single step with a test driver are available from the author.

200.410
PB92-159011
Not available NTIS
National Inst. of Standards and Technology (NTEL), Gaithersburg, MD, Fire Science and Engineering Div.
Transient Combustion in a Turbulent Eddy
Final rept.
H. R. Baum, R. G. Rehm, and J. P. Gore, 1990, 8p 821-4-560-100-12-04
Contract NID 192-86

Sponsored by Air Force Office of Scientific Research, Balch ABF, DC.


A mathematical model of a local transient diffusion flame generated by a turbulent eddy is presented. It is intended ultimately as a computational ‘molecule’ to be embedded in numerical simulations of large scale industrial fires. The objective of the present analysis is to account explicitly for the modification of the local velocity field induced by the heat generated by the eddy. This “interaction” can also easily describe reaction model and a model treating the effects of real chemistry within the laminar flamelet approximation are considered. The convection diffusion equation for the mixture fraction and the mass conservation equation are substituted for the transport-reactions equations. The observation that specific volume is a piecewise linear function of mixture fraction. A Cole-Hopf transformation is used to reduce the convection-reaction-diffusion equation to a form of a new "pseudo mixture fraction" which can be related to all scalar properties using measured or identified state relationships. Seven different fuels have been studied. Sample results for two of these are presented.

200.411
PB92-159185
Not available NTIS
National Inst. of Standards and Technology (NTEL), Gaithersburg, MD
Numerical/Experimental Study of a Buoyant Jet Diffusion Flame
Final rept.


The paper describes the initial results of a joint numerical and experimental investigation of the structure of a 10 cm/s, 50/50 mixture by mass of propane and nitrogen jet diffusion flame, stabilized on a 22.5 mm diameter tube. The measurements between the flame and the vortex motions, which are crucial in any attempt to understand buoyant jet flames, is examined. Numerical solutions of the time dependent Navier-Stokes equations with a laminar flame sheet model are visualized by means of passive marker particles. The general vortex structures internal and external to the flame surface which interact and move downstream along with flame sheet bulges. The bulges are believed to account for one type of flame flicker. Another type of flicker in which the outer vortices periodically cut the tip of the flame, is also predicted. The predicted flicker frequency of 11 to 15 Hz is the same as that measured experimentally. When the gravitational acceleration is set to zero in the computation, the outer structure disappears and the flame no longer flickers (has bulges). The structures bear close resemblance to those observed experimentally using the Reactive Mie Scatter- ing (RMS) laser sheet-lighting technique. SIC filaments are used to measure the nearly instantaneous radial profiles of temperature at five axial locations in the flame. The experimental and numerical results are compared near two of these locations.

200.412
PB92-159334
Not available NTIS
National Inst. of Standards and Technology (NTEL), Gaithersburg, MD
Preliminary Results of a Numerical-Experimental Study of the Dynamic Structure of a Buoyant Jet Diffusion Flame
Final rept.


The paper describes the initial results of a joint numerical/experimental investigation of the structure of a 10 cm/s, 50/50 mixture by mass of propane and nitrogen jet diffusion flame, stabilized on a 22.5 mm diameter tube. The nature of the unsteady interactions between the flame and the vortex motions, which are crucial in any attempt to understand buoyant jet flames, is examined. Numerical solutions of the time dependent Navier-Stokes equations are performed for a single jet model are visualized by means of passive marker particles. The numerical results show counterrotating vortex structures internal and external to the flame surface which interact and move downstream along with flame sheet bulges. The bulges are believed to account for one type of flame flicker. Another type of flicker in which the outer vortices periodically cut the tip of the flame is also predicted. The predicted flicker frequency of 11 to 15 Hz is the same as that measured experimentally. When the gravitational acceleration is set to zero in the computation, the outer structure disappears and the flame no longer flickers (has bulges). The structures bear close resemblance to those observed experimentally using the Reactive Mie Scattering (RMS) laser sheet-lighting technique. SIC filaments are used to measure the nearly instantaneous radial profiles of temperature at five axial locations in the flame. The experimental and numerical results are compared near two of these locations.

The effects of initial molecular weight and thermal stability of different samples on ignited, horizontal flame spreading, and heat release rate were studied by comparing results between two polystyrene samples with different initial molecular weights and between two poly(methyl methacrylate) samples with different thermal stability and initial molecular weights. The results of this investigation were obtained using a flat plate of the same size as the base and flame front and the flame spreads steadily. However, the sample with low initial molecular weight forms molten polymer and the opposed slow fluid flow molten polymer along the inclined degrading surface against the traveling flame significantly affects flame spreading behavior and its rate.

200.416
Smoke plumes from Crude Oil Burns. 

R. J. Rehml, J. A. Bauman, M. H. Mulholland, and W. D. Lozier. 1989, 22p

Published by the American Society of Mechanical Engineers, New York, NY.

The problem of the report is the study of the plume behavior of smoke from a fire in a confined area. The report describes the experimental setup, the data collected, and the analysis of the results.

COMBUSTION, ENGINES, & PROPELLANTS

Combustion & Ignition

Smoke plumes from Crude Oil Burns.

D. Evans, H. Baum, G. Mulholland, N. Byerly, and G. Forney. 1989, 22p

Published by the American Society of Mechanical Engineers, New York, NY.

The problem of the report is the study of the plume behavior of smoke from a fire in a confined area. The report describes the experimental setup, the data collected, and the analysis of the results.

200.419

PB92-171088 Not available NTIS

National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Fire Science and Engineering Div.

Investigation of Radiative Effects on the Burning Rate in Liquid Pool Fires.

S. J. Fischer and T. Kashwag. 1989, 4p


Keywords: *Burning rate, Combustion, Heat flux, Mass flow, Heat transfer, Radiation, 

A summary of the work done to date on a mass burning rate study of a 36 cm diameter heptane pool fire is given. The pool fire radiation was made into a 5 concentric rings 77, 152, 229, 303 and 381 mm in diameter so that the mass burning rate at different radial positions can be determined. The radiative properties of the smoke and soot particles are also discussed. Based on data taken so far the thermal output of the fire is estimated to be 220 kW with a maximum radiative flux of 0.047 kg/s m² and maximum incident heat flux on the surface of the pool of 22.7 kW/m² occurring for the inner ring of the fire.

200.419

PB92-172006 PC A03/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD.

Finite-Rate Diffusion-Controlled Reaction in a Vortex: A Report.


See also PB97-176622 and PB97-210266.

Keywords: *Combustion, Flames, Mathematical models, Turbulent diffusion, Reaction kinetics, Asymptotic theory, Two-dimensional, Chemical reactions, Convection, Flames, Nonequilibrium, Vortices.

A two-dimensional model of a constant-density diffusion-controlled reaction with finite reaction-rate chemistry occurring between un mixed species initially occupying adjacent half-spaces is formulated and analyzed. The chemical reaction term is taken to be approximated by an isothermal, baroclinic flow reaction for simplicity. An axisymmetric viscous vortex field satisfying the Navier-Stokes equations winds up the interface between the two half-spaces.

The diffusion rates for the two species are assumed constant and equal so that mixture fraction or Shub-Zel'dovich variable can be used. The resulting equations for the mixture fraction is linear and can be solved by noting that a Lagrangian coordinate system removes the convection and that the equations permit a global similarity solution. The single nonlinear equation for one species is also analyzed in a Lagrangian coordinate system. Asymptotic and numerical results show the structure of the region region and the competing influences of reaction, diffusion and convection.

200.419

PB92-172970 PC A03/MF A01

National Inst. of Standards and Technology (BFR), Gaithersburg, MD.


G. P. Forney, and W. F. Moss. Mar 92, 45 p NISTIR-4768

See also PB98-175559, PB98-213636 and DE85008493. Prepared in cooperation with Clemson Univ., SC. Department of Mathematical Sciences.


In order to design robust and stable zone fire modeling algorithms, the numerical properties of computer arithmetic and the modeling differential equations must be understood. The report examines some of these properties and provides tools for their analysis. Many sets of equations have been developed which can be solved by the use of conservation of mass and energy. A comparison between various possible formulations is made of the physical properties of one property that many formulations possess is the presence of multiple time scales. Pressures equilibrate much faster than the flames. Numerically, the property is known as stiffness. Stiffness, in the context of fire modeling, and numerical methods for handling it are discussed.

200.420

PB92-175447 Not available NTIS

National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Process Measurements Div.

Laser Induced Fluorescence of OH for Non-Intrusive Temperature Measurements in Combusting Flames.

R. G. Jollik. Feb 92, 4p


Keywords: *Combustion, Flames, *Temperature measurement, Laser induced fluorescence, Hydroxyl radicals, Optical fibers, Reprints.

Temperature measurements using thermally assisted laser induced fluorescence of OH in both premixed and non-premixed flames have been demonstrated with an accuracy of 100 K accuracy. The apparatus employed optical fibers to transmit the laser radiation and fluorescence to and from the probe volume. This limited the laser energy delivered to the sample volume to 25 micro J, which resulted in a 3sigma uncertainty of +/- 0.5 % (400 laser shots) at temperatures around 2000 K.

200.421

PB92-175694 Not available NTIS

National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Applied and Computational Mathematics Div.

Buoyant Convection in an Inclined Enclosure.


Keywords: *Fire, *Convective flow, *Enclosures, Boussinesq, asymptotic analysis, Navier Stokes equations, Three dimensional flow, Convection, Computational fluid dynamics, Reprints.

Equations for a Boussinesq model describing transient buoyant convection driven by a heat source in a rectangular enclosure are presented and solved by finite difference methods. Gravity is allowed to have an arbitary magnitude. The equations are solved with the enclosure inclined to horizontal. Computational results for three-dimensional dissipation-free flows and for two-dimensional flows with and without dissipation are presented. The hydrodynamics is based directly on the time-dependent Euler or Navier-Stokes equations. No turbulence model or other empirical parameters are introduced. The previous algorithms had been verified by comparisons with exact solutions to the equations in simple, special cases, and overall predictions of the Rayleigh number. Conduction solutions are zero have been compared with experimental results. The use of Lagrangian particle tracking allows one to visualize the flow patterns. The effects of a fire-induced pressure in a corridor, and a standwall (or escalator) are examined.

200.422

PB92-181056 PC A07/MF A02

California Univ., Berkeley. Dept. of Mechanical Engineering.

Ignition and Flame Propagation Studies over a Flat Fuel Surface.


Grant NABD7373

See also COM-75-50574 and DE9100261. Sponsored by National Inst. of Standards and Technology (BFR), Gaithersburg, MD.

Keywords: *Fire propagation, *Ignition, Combustion, Combustible flow, Diffusion flames, Surface temperature, Radiation, Fuels, Temperature distribution, Burning rate, Mathematical models.

Numerical studies are performed which show the evolution of a premixed flame front above a flat fuel surface subjected to an external source of radiation. Ignition is caused either by the high temperature of the fuel surface or by the fuel vapor over the fuel surface. The surface is assumed to be either in a zero gravity, initially stagnant air environment or in a stagnant atmosphere. Regardless of the source of ignition considered or the type of the flow field, the same sequence of events is predicted. The sequence of events begins with a pre-ignition, radiation dominated phase in which the surface fuel surface. After ignition occurs, there is a period of weak chemical reaction, which is followed by a stronger reaction in which a premixed flame front develops. Before dying out the premixed flame front separates the fuel from the oxygen and leaves behind a diffusion flame. The ignition and radiation processes are shown to have a large effect on the flow field in the stagnation point flow field cases. For the case in which ignition is caused by gas phase absorption, the radiation required to cause ignition is so high that an opposed jet flow is created. In the case in which ignition is caused by the hot surface, the radiation is lower and the boundary layer remains almost intact. For both types of ignition the premixed flame fronts produced heat fluxes and temperatures that the gas is able to drive the incoming flow back from the fuel surface. After the premixed flame front dies out leaving the diffusion flame the incineration now dominates and a boundary layer reappears.

200.423

PB92-181253 PC A04/MF A01

National Inst. of Standards and Technology (BFR), Gaithersburg, MD.


G. P. Forney, and W. D. Davis. May 92, 57p NISTIR-4825

See also PB92-144104 and PB92-156751.

Keywords: *Computational fluid dynamics, *Blowdown, Flame propagation, Fires, Military facilities, Computational fluid dynamics, Fire propagation, Numerical programs, Three dimensional flow, Mathematical models, *194 Fire Fighting Trainer.

The purpose of the report is to document a series of numerical experiments performed to analyze strategies for eliminating the blow-down phenomenon occurring in the Navy's 194 fire fighting trainer. The first strategy involves the use of a fence in the way fences are used as trenches. The second strategy involves the use of fans to pressurize the space below the propane burners. Numerical simulations were performed using various fence heights, fence and burner spacings, and both the platform and fan volume flow rates. These tests confirmed that flame blow-down occurs when no action is taken to prevent it and predicted that blow-down will be reduced with the use of a fence and a fan.

200.424

PB92-197987 Not available NTIS

Smoke plumes from Crude Oil Burns.

D. Evans, H. Baum, G. Mulholland, N. Byerly, and G. Forney. 1989, 22p

Published by the American Society of Mechanical Engineers, New York, NY.

The problem of the report is the study of the plume behavior of smoke from a fire in a confined area. The report describes the experimental setup, the data collected, and the analysis of the results.
**COMBUSTION, ENGINES, & PROPELLANTS**

**Combustion & Ignition**

National Inst. of Standards and Technology (BFRIL), Gaithersburg, MD. Fire Measurement and Research Div.


Keywords: *Fire tests, Combustion products, Calorim- eters, Carbon monoxide, Methane, Propane, Smoke, Douglas fir wood, Reprints.*

A modified cone calorimeter with an enclosure has been developed to determine the yield of combustion products including CO and smoke under specified conditions. The CO yields of methane, propene, PMMA, ABS, polyethylene, and Douglas fir are found to increase with increases in the air ratio by a factor of 10. Ambient temperature of the order of 100, 425, or 200°C is shown to be effective for increasing the CO yield. For ambient conditions, the CO yields for the solid samples are about a factor of 2.3 smaller than the smoke yields for all the solid materials studied.

RB92-236249 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Fire Measurement and Research Div.


Keywords: *Fire hazards, Assessments, Combustion prod- ucts, Toxicity, Fire tests, Combustion, Smoke, Fires, Fire safety, Numerical analysis, Re- prints.*

Detailed mathematical methods have recently become available for performing a complete fire hazard analy- sis. Because of their complexity, they are used primar- ily for research purposes. For many design evalua- tion uses, however, a need is seen for simpler analysis techniques. One such need is for the assessment of the toxic hazard component of fire hazard. Such a technique must be able to place in correct context at least the toxic potency and the burning rate variables. A simple method is developed for demonstrating the capability for performing toxic fire hazard analysis using available test data and not requiring the use of a computer. The method is illustrated with test data on a number of products obtained from the NBS Combustion Toxicity Test and from the Cone Calorimeter.

RB93-113678 PC A03/MF A01 National Inst. of Standards and Technology (BFRIL), Gaithersburg, MD.


Keywords: *Smoke, Heat flow meters, Test methods, Calorimeters, Heat transmission, Standards, Heating equipment, Test facilities, Mathematical models, Calibration, Thermal measuring instruments.*

Improvements of the heater and the heat flux detector used in the FAA's Smoke Chamber test protocol are described. Heater designs were evaluated and two heaters were selected for this report. This report covers various aspects of analysis and gives details on the heater that may provide a more uniform radiation test condition. The use of a small back gauge, similar to the one used in the OSU calorimeter, in the smoke box for measuring the heat flux is dis- cussed. A lateral adjustment of this gauge allows one to use the measurement of the radiation field at the center of the target specimen to infer the average radiation field over the specimen is presented.

**Rocket Engines & Motors**

RB92-159961 Not available NTIS National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.


Sponsored by National Aeronautics and Space Admin- istration, Huntsville, AL. George C. Marshall Space Flight Center.


Keywords: *Space shuttle main engine, Flowmeters, Vortex shedding, Gas flow, Performance, Tests, Re- prints.*

Vortex shedding flowmeters can be used to measure flow at the much higher than conventional rates in the ducts of the space shuttle main engines. Water flow tests simulating liquid oxygen (LOX) flow velocities and density have shown that a vortex shedding vane in- secting the ducts produces more ideal data pairs. Standard instruments report will measure flow to the maximum duct velocity of 30 m/s in ducts to 58.4 mm (2.3 inch) diameter. No upstream flow conditioning is required even though the meters are in short straight sections between multiple bends. Since the 1986 conference, the authors have improved the test with more ideal data pairs. The meter performance differed little from the water test results even though the Reynolds number attained was eight times larger. Water flow tests of 28 mm (1.1 inch) bore meters, the smallest required, have shown that flow in this size duct can be measured also. In a continuing effort to improve the system, additional and inductive position sensors have been successfully used. Available position sensors require modification of the requirements for service in high pressure LOX environment.

RB93-12923 Not available NTIS National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.

Coefficient of Sliding Friction of 440C as a Function of Temperature. Final rept. A. J. Slifka, J. D. Siegrist, L. L. Sparks, and D. Choppin. 11p

Sponsored by National Aeronautics and Space Admin- istration, Huntsville, AL. George C. Marshall Space Flight Center.


53
Rocket Engines & Motors


An understanding of the effects of temperature on the coefficient of friction is important to the study of the wear performance of the bearings in the High Pressure Oxygen Turbopump (HPTOP) of the Space Shuttle Main Engine (SSME). Measurements of the coefficient of friction of 440C stainless steel have been made at the National Institute of Standards and Technology (NIST) in Boulder, CO. The measurements have been performed over a range of load from 133 to 531 ksi (0.515 to 3.660 GPa), a range of speed from 1,64 to 6.56 ft/s (0.5 to 2.0 m/s), and a range of temperature from -220 to 652 F (-350 to 350 C). The average coefficient of friction decreases as temperature increases, but the initial coefficient of friction does not appear to be affected by temperature.

COMMUNICATION

Common Carrier & Satellite

200.432 FIPS PUB 162 PCS9.00 National Inst. of Standards and Technology (CSL), Gaithersburg, MD, 1,200 Bits Per Second Two-Wire Duplex Modems for Data Communications Use on Telephone-Type Circuits; Category: Telecommunications Standard; Subcategory: Modems. Final rept.

S. M. Radack, 2 Apr 92, 7p Supersedes FIPS PUB 136. Prepared in cooperation with National Communications System, Arlington, VA. Office of Technology and Standards. Three ring vinyl binder also available; North American Continental price $7.00; all others write for quote.


Modems are used to modulate digital data into a form that can be transmitted within the voice-band frequencies passed by telephone-type circuits, and to demodulate the information back to digital data at a destination. The modem described by the standard is based upon the International Telegraph and Telephone Consultative Committee (CCITT) Recommendation V.22, which was based on the Western Electric Company model 212 modem. In addition to operation at 1,200 bits/s, an optional 600 bits/s capability is described. The standard supersedes FIPS PUB 136 (former Federal Standard 1008) in its entirety.

200.433 FIPS PUB 163 PCS9.00 National Inst. of Standards and Technology (CSL), Gaithersburg, MD, 2,400 Bits Per Second Two-Wire Duplex Modems for Data Communications Use on Telephone-Type Circuits; Category: Telecommunications Standard; Subcategory: Modems. Final rept.

S. M. Radack, 2 Apr 92, 7p Supersedes FIPS PUB 136. See also FIPS PUB 164. Prepared in cooperation with National Communications System, Arlington, VA. Office of Technology and Standards. Three ring vinyl binder also available; North American Continental price $7.00; all others write for quote.


Modems are used to modulate digital data into a form that can be transmitted within the voice-band frequencies passed by telephone-type circuits, and to demodulate the information back to digital data at a destination. The modem described by the standard is based upon the International Telegraph and Telephone Consultative Committee (CCITT) Recommendation V.23bis. The standard and FIPS PUB 164 supersede FIPS PUB 133 (former Federal Standard 1005A) in its entirety.

200.434 FIPS PUB 164 PCS9.00 National Inst. of Standards and Technology (CSL), Gaithersburg, MD, 1,200 Bits Per Second Two-Wire Duplex Modems for Data Communications Use on Telephone-Type Circuits; Category: Telecommunications Standard; Subcategory: Modems. Final rept.

S. M. Radack, 2 Apr 92, 6p Supersedes FIPS PUB 133. See also FIPS PUB 163. Prepared in cooperation with National Communications System, Arlington, VA. Office of Technology and Standards. Three ring vinyl binder also available; North American Continental price $7.00; all others write for quote.


Modems are used to modulate digital data into a form that can be transmitted within the voice-band frequencies passed by telephone-type circuits, and to demodulate the information back to digital data at a destination. The modem described by the standard is based upon the International Telegraph and Telephone Consultative Committee (CCITT) Recommendation V.22. The standard and FIPS PUB 165 supersede FIPS PUB 134-1 (former Federal Standard 1006A) in its entirety.

200.435 FIPS PUB 165 PCS9.00 National Inst. of Standards and Technology (CSL), Gaithersburg, MD, 6,400 Bits Per Second Four-Wire Duplex and Two-Wire Half-Duplex Modems for Data Communications Use on Telephone-Type Circuits; Category: Telecommunications Standard; Subcategory: Modems. Final rept.

S. M. Radack, 2 Apr 92, 6p Supersedes FIPS PUB 166, 92, 96. Prepared in cooperation with National Communications System, Arlington, VA. Office of Technology and Standards. Three ring vinyl binder also available; North American Continental price $7.00; all others write for quote.

Keywords: *Telecommunications, *Modems, *Requirements, Federal information processing standards, Telephone, Circuits, Recommendations, Communication equipment, Demodulation, Coding, Modulation, Digital data.

Modems are used to modulate digital data into a form that can be transmitted within the voice-band frequencies passed by telephone-type circuits, and to demodulate the information back to digital data at a destination. The modem described by the standard is based upon the International Telegraph and Telephone Consultative Committee (CCITT) Recommendations V.22 and V.27. The standard and FIPS PUB 166 supersede FIPS PUB 134-1 (former Federal Standard 1006A) in its entirety.

200.436 FIPS PUB 166 PCS9.00 National Inst. of Standards and Technology (NCSL), Gaithersburg, MD, 9,600 Bits Per Second Four-Wire Duplex Modems for Data Communications Use on Telephone-Type Circuits; Category: Telecommunications Standard; Subcategory: Modems. Final rept.

S. M. Radack, 2 Apr 92, 6p Supersedes FIPS PUB 136. Prepared in cooperation with National Communications System, Arlington, VA. Office of Technology and Standards. Three ring vinyl binder also available; North American Continental price $7.00; all others write for quote.


Modems are used to modulate digital data into a form that can be transmitted within the voice-band frequencies passed by telephone-type circuits, and to demodulate the information back to digital data at a destination. The modem described by the standard is based upon the International Telegraph and Telephone Consultative Committee (CCITT) Recommendation V.29. The standard and FIPS PUB 166 supersede FIPS PUB 135 (former Federal Standard 1006) in its entirety.

200.437 FIPS PUB 167 PCS9.00 National Inst. of Standards and Technology (CSL), Gaithersburg, MD, 9,600 Bits Per Second Four-Wire Duplex Modems for Data Communications Use on Telephone-Type Circuits; Category: Telecommunications Standard; Subcategory: Modems. Final rept.

S. M. Radack, 2 Apr 92, 6p Supersedes FIPS PUB 135. Prepared in cooperation with National Communications System, Arlington, VA. Office of Technology and Standards. Three ring vinyl binder also available; North American Continental price $7.00; all others write for quote.

Keywords: *Telecommunications, *Modems, *Requirements, Federal information processing standards, Telephone, Circuits, Communication equipment, Demodulation, Digital data, Recommendations.

Modems are used to modulate digital data into a form that can be transmitted within the voice-band frequencies passed by telephone-type circuits, and to demodulate the information back to digital data at a destination. The modem described by the standard is based upon the International Telegraph and Telephone Consultative Committee (CCITT) Recommendations V.22 and V.27. The standard and FIPS PUB 166 supersede FIPS PUB 134-1 (former Federal Standard 1006A) in its entirety.

200.438 FIPS PUB 168 PCS9.00 National Inst. of Standards and Technology (CSL), Gaithersburg, MD, 12,000 and 14,400 Bits Per Second Four-Wire Duplex Modems for Data Communications Use on Telephone-Type Circuits; Category: Telecommunications Standard; Subcategory: Modems. Final rept.

S. M. Radack, 2 Apr 92, 6p Supersedes FIPS PUB 166, 92, 96. Prepared in cooperation with National Communications System, Arlington, VA. Office of Technology and Standards. Three ring vinyl binder also available; North American Continental price $7.00; all others write for quote.

Keywords: *Telecommunications, *Modems, *Requirements, Federal information processing standards, Telephone, Circuits, Recommendations, Communication equipment, Demodulation, Coding, Modulation, Digital data.

Modems are used to modulate digital data into a form that can be transmitted within the voice-band frequencies passed by telephone-type circuits, and to demodulate the information back to digital data at a destination. The modem described by the standard is based upon the International Telegraph and Telephone Consultative Committee (CCITT) Recommendations V.29. The standard and FIPS PUB 166 supersede FIPS PUB 135 (former Federal Standard 1006) in its entirety.

200.439 FIPS PUB 169 PCS9.00 National Inst. of Standards and Technology (CSL), Gaithersburg, MD, 12,000 and 14,400 Bits Per Second Four-Wire Duplex Modems, Federal Information Processing Standards Publication 169, Telecommunications Standards. Final rept.

S. M. Radack, 2 Apr 92, 6p Prepared in cooperation with National Communications System, Arlington, VA. Office of Technology and Standards. Three ring vinyl binder also available; North American Continental price $7.00; all others write for quote.

Keywords: *Telecommunications, *Modems, *Requirements, Federal information processing standards, Telephone, Circuits, Communication equipment, Demodulation, Digital data, Recommendations.
COMMUNICATION

Common Carrier & Satellite


Modems are used to modulate digital data into a form that can be transmitted within the voice-band frequencies passed by telephone-type circuits, and to demodulate the information back to digital data at a destinatation. The error correction techniques described by the standard are based upon International Telegraph and Telephone Consultative Committee (CCITT) Recommendation V.42.

200.44

PB92-145036

Keywords: "Communication networks, "Computer architecture, Local area networks, Standards, Protocols, Reprints, "BISDN(Broadband Integrated Services Digital Network), Metropolitan area networks, ATM("Asynchronous Transfer Mode)."

The report explores the use of the two current architectures for broadband integrated services digital networks (BISDN) as being defined in IEEE P802.6 (local and metropolitan area network) and ANSI(Telecommunications D1 T1.15 standard. The current standard defines protocols for the median access control (MAC) layer and includes provisions for upper layer services. The report uses the two services defined by the adaptation layer, namely messaging and streaming, to compare their relative performance. It is shown that many conditions are necessary for streaming to out-perform messaging. It then simulates the performance of the two architectures and chooses the one required for the isochronous services of IEEE P802.6 to determine end-to-end delay. This allows the authors to extend such predictions to the use of IEEE 802.6 as a backbone for concatenated Local Area Networks (LANs)."
COMMUNICATION

Common Carrier & Satellite

The paper reports the performance of a typical commercially available implementation of the lower four layers of the Open System Interconnection (OSI) Reference Model: Transport, Network, Data Link and Physical. One-way delay measurements are reported for the Intel 310 microcomputer system running the INAI960 implementation of OSI Transport over an IEEE 802.3 CSMA/CD local area network. The minimum one-way delay versus message size for various combinations of the lowest four OSI layers is shown. These results show the advantages of delay associated with increased protocol services. The maximum throughput for the transport class 4 service is reported in terms of the main factors affecting it. The maximum throughput is captured in a set of equations that are applicable to many implementations of transport protocols.

Microprocessors are now commonly found in consumer products such as cameras, stereo systems, televisions, and automobiles. They do things automatically that one used to have to do themselves, and make these products smaller, lighter, cheaper, and more reliable. Indeed, most of these changes extend to the calibration laboratory, with the advent of the automated calibration system. These systems offer many benefits. They are easy to use and learn, and increase the lab’s productivity. In keeping with this trend, NIST has offered an automatic frequency measurement system. The paper discusses the design philosophy behind the system, what it does, how its works, and some way the system can be enhanced in the future.

Policies, Regulations, & Studies

200.449
PB92-149756 PC A03/MF A01
National Inst. of Standards and Technology (MSEL), Gaithersburg, M.D. Polymers Div.
Synthesis of Non-Ionic and Ionic Resins for BEP Intaglio Inks Curing by Electron Beam Radiation.
Final rep.
See also PB91-144345 and PB91-194456. Sponsored by Bureau of Engraving and Printing, Washington, DC.

The inks currently used to print US postage stamps on web presses are dried by heat evaporation of solvents, Emission of solvents into the atmosphere is governed by Local and Federal Government Regulations. Reduction of these emissions to acceptable levels can be accomplished by either of two methods available to the BEP. The work was part of a continuing effort to produce resins for use in formulating inks for the printing of postage stamps and security documents. The inks are to be cured by exposure to an electron beam from a high energy electron accelerator. It is a known fact that inkers are often coated onto a roller and wiped blade by washing the blade with neutral water or with caustic water. Laboratory scale work on the urethane/polyethylene oxide/methacrylate resin has demonstrated that information on the synthesis has been provided to BEP for patenting and scaleup. Some effort on nonionic resins continued into FY88.

200.450
PB92-149822 PC A04/MF A01
National Inst. of Standards and Technology (MSEL), Gaithersburg, M.D. Polymers Div.
FY 91 Syntheses of Liquid Prototype Air Dry Resins for use in BEP Intaglio Inks.
Annual rep.
See also PB90-112343. Sponsored by Bureau of Engraving and Printing, Washington, DC.

The objective of the work described in the report was to design and synthesize air-drying resins at the National Institute of Standards and Technology (NIST) for intaglio cylinder-wrap inks to be used in printing curren-
currency. The Bureau of Engraving and Printing (BEP) Tung oil fatty acids were used in alkyd syntheses to improve the rate and extent of air-dry of inks made from these alkyd resins so that the resistance to aqueous alkali solutions would be improved to the point of becoming satisfactory. Because Tung oil fatty acids are not commercially available, the synthesis procedure was more involved than the relatively simple synthesis of alkyds based on linseed oil fatty acids. Moreover,

the tung oil fatty acid-containing resins were not better than the linseed oil containing alkyl resins. Linseed oil fatty acid-containing alkyl resins which passed labora-
tory tests for washing (ability to emulsify in Deilar solution) and chemical resistance were successfully de-
signed and synthesized. The key was to increase the average molecular size of the alkyl resin molecules. At least three of the resins produced inks which are promising candidates for production intaglio inks. Be-
cause of the small numbers of the alkyd resins are designed to be above the 200, 450 and 4754 levels, solubilizing amine are needed. Because of the designed viscosity of the resins, no solvent is needed. Therefore, the resins should meet the requirements of air pollution regulations for the foreseeable future.

200.454
PB92-170810 PC A04/MF A01
National Inst. of Standards and Technology (PL), Boul-
der, CO. Conference on Frequency Transfer Accuracy with the NIST Ionospheric Measurement System.
Final rep.
Keywords: *Frequency measurement, *Time measurement, *Atomic clocks, Frequency standards, Time standards, Metrology, Reviews, Reprints, Frequency distribution.

The paper reviews some of the highlights of time and frequency metrology, makes recommendations for some needed standardization, and calls attention to certain unresolved problems.

200.455
PB92-165315 PC A04/MF A01
National Inst. of Standards and Technology (PL), Boul-
der, CO. Frequency Measurements: An Integrated Perspective on Signal Processing Theory and Practice
Final rep.
Keywords: *Global positioning system, Ionosphere, Time delay measurement, Accuracy, Reprints, *Time transfer, NIMS System, Ionospheric delay.

The NIST Ionospheric Measurement System (NIMS) uses the GPS P-code on L1 and L2 without decoding them to measure the ionospheric delay on L1. Data are available every 15 s for all satellites in view. 15 min linear fits to this data are available via modem. The NIMS will also automatically correct time measurements from an NBS/GPS type receiver for the measured ionospheric delay. The accuracy is shown to be a few ns by comparison with the Faraday rotation measurements from the COES-2 satellite and by computing a time closure around the world with GPS data correcting for ionospheric measurements. The stability of the measurements is about 1 ns at 15 s, and they integrate as white noise phase to about 16 min.

200.456
PB92-165851 PC A04/MF A01
Not available NTIS National Inst. of Standards and Technology (PL), Boul-
der, CO. Time and Frequency Div.
Laboratory Automation: The Design Philosophy of the Time and Frequency Measurement Service.
Final rep.
M. Lombardi. 1991, 11p See also PB92-122537. Pub. in Proceedings of National Conference of Standards Laboratories Workshop and Symposium, Albu-
Keywords: *Frequency measurement, *Time interval counters, Computer applications, Oscillators, Calibration, Reprints, *Laboratory automation, Computer software, US NIST.

With solar activity near maximum, the single largest error in the use of GPS for time transfer is correction for ionospheric delay. The paper describes the hardware and software development of a "codeless" ionospheric calibration receiver that recovers the GPS P-code clock on L1 and L2 and uses the phase difference to compute the L1 ionospheric delay. Major features of the hardware include dual violete antennas on a single receiver, very low noise front end, and alternate L1-L2 phase sampling through a common IF channel. S/N of the recovered P code clocks is typically positive by several dB in a 100 GHz bandwidth. Signals are processed as b bit data, with all satellites in view being individually (and simultaneously) tracked in real time to recover the ionospheric delay values. All processing is with an internal 8 bit CMOS microprocessor.

200.457
PB92-175017 PC A04/MF A01
Not available NTIS National Inst. of Standards and Technology (PL), Boul-
der, CO. Time and Frequency Div.
Recent Progress in Frequency Comparisons and in the Future
Final rep.
Keywords: *Atomic clocks, Global positioning system, Frequency standards, Frequency stability, Time standards, MetroLOGY, Comparison, Accuracy, Reprints, Time transfer, Syntomization.

Time metrology has moved from milliseconds to picoseconds in the last four decades, and frequency me-
trology has moved from nine significant digits to six-
ten. The frequency clock has improved and is now considered to be a national standard. The next improvement is to be made in the frequency clock. It is expected that the frequency clock will now be transferred to remote sites for use in the future. GPS's selective availability, in intention of the US government, will adversely affect the usefulness of GPS time and frequency transfer for the average civilian user. The paper reviews views on this topic, the status of the process, and the future of these systems. An Appendix of definitions is provided to support the concepts developed.
Characterization of Frequency Stability in Precision Frequency Sources.

Final rept.

R. E. Drullinger, 1990, 6p


Keywords: *Frequency standards, Optical pumping, Technology, Reviews, Reprints.

The use of optical state preparation and detection in atomic or ion frequency standards offers tremendous potential for improved short term stability, evaluation and control of accuracy-limiting systematic errors. The paper reviews optical pumping as it pertains to primary frequency standards. The potential benefits and limitations are discussed as is present work on the technology.

200.457
PB92-175231 Not available NTIS National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.

Preliminary Investigations with the NIST Optically Pumped Primary Frequency Standard.
Final rept.


Keywords: *Cesium frequency standards, *Frequency standards, Optical pumping, Reprints.

An optically pumped, cesium beam, primary frequency standard has been constructed at NIST. The atomic beam tube is essentially complete but the lasers and electronics remain areas of active research. The authors have presented a system to demonstrate a solution to the problem of coherence trapping of population that could otherwise limit clock performance. The authors have also presented short spectra taken of the system and draw conclusions about the beam tube construction and operation.

200.458
PB92-175504 Not available NTIS National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.

Final rept.


Keywords: Global positioning system, Error analysis, Ephemerides, Accuracy, Coordinates, Reprints, *Time transfer.

Over intercontinental distances the accuracy of Global Positioning System (GPS) time transfers ranges from 10 to 20 ns. The principal error sources are the broadcast ionospheric model, the broadcast ephemerides and the local antenna coordinates. At present, ionospheric measurement systems of the type designed by the National Institute of Standards and Technology (NIST) operate on a regular basis at the NIST in Boulder (Colorado) and at the Observatory Paris (OP) in Paris (France), and systems of the type designed by the Communications Research Laboratory (CRL) operate at the CRL in Tokyo (Japan). Broadcast ephemerides are currently recorded in Mojave (California, USA) and at the IPFM (France). The GPS antenna coordinate information required by the local computer is derived from a Digital Optical ERS Terrestrial Frame. In the paper, the authors realize for the first time the time circle around the world obtained by the combination of time transfers OP/NIST, NIST-CRL and CRL-OP after reduction of the three major error sources. It gives the evidence of improvement in accuracy for GPS time transfer with using precise ephemerides, measured ionospheric delays and accurate antenna coordinates.

200.463
PB92-190453 PC A03/MF A01 National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Compatibility.

Final rept.
M. T. Ma, May 92, 35p NISTIR-3989

See also PB89-170472.

Keywords: *Electromagnetic compatibility, *Standards, Electromagnetic interference, Electrical measurement, Electric fields, Magnetic fields, Regulations, Reviews, US NIST.

Important current regulations and standards regarding electromagnetic compatibility (EMC) measurements are reviewed. These regulations and standards have been either enforced by U.S. government agencies such as the Federal Communications Commission and Department of Defense, or incorporated in voluntary industrial practice. The specific methods and configurations required in some of these standards are assessed from a technical basis to see whether or not they are adequate and appropriate. Technical deficiencies and potential problems, if any, are pointed out together with recommendations of alternative and better methods of measurements. Conclusions and proposals are detailed in a report intended to give NIST and other interested parties the current state of the art in EMC measurements.

200.462
PB92-236215 Not available NTIS National Inst. of Standards and Technology (NML), Boulder, CO. Time and Frequency Div.

In Search of the Best Clock: An Update.
Final rept.
D. W. Allan, 1989, 6p

See also PB90-117367.

Keywords: *Time standards, Optical locking, Laser cooling, Clocks, Reprints, Time and Frequency Div.


Because of the increased need for better clock performance than is currently available, the paper addresses some fundamental questions regarding clock behavior and laser cooling. The authors focus on improving the clocks to meet the increased need. Though this is fundamental, it shows that significant gains are also available through the algorithms (computation methods for optimizing the clock) which process the readings of the clocks and through observational comparisons now available via satellite. Proper algorithms for processing seem to be more important than the proportionate attention given them. In short, the only way we have been able to investigate some of the outstanding time predictability in long-term of the millisecond pulsar, PSR 1937+21, is by using such optimization algorithms.

200.461
PB93-129203 Not available NTIS National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.

Final rept.
M. A. Weiss, 1988, 2p


Keywords: *Global positioning system, *Time measurement, Diurnal variations, Time standards, Clocks, Reprints, Time and Frequency Div.

Measurements of clocks aboard Global Positioning System (GPS) satellites as well as GPS system time are made many times per day at time standards laboratories around the world according to a tracking schedule issued by the Bureau International des Poids et Mesures (International Bureau of Weights and Measures). We compute Kalman smoothed estimates of clocks in the standards labs to define a global time base, then compute Kalman smoothed estimates of GPS clocks against this time base. Biases in measurements repeated once per sidereal day produce apparent diurnal effects in the data. A composite time and frequency Kalman estimator is used here. This allows updates of clocks at time intervals less than one day while aliasing diurnal variations.

200.465
PB93-129286 Not available NTIS National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.

Study of the NBS Time Scale Algorithm.
Final rept.

See also PB93-174072.

Pub. in CPEM '88 Digest, Proceedings of Conference on Precision Electromagnetic Measurements, Tsukuba, Japan, June 7-10, 1988, p113-114.

Keywords: *Time standards, Global positioning system, Frequency modulation, Frequency stability, Kalman filters, Random walk, Clocks, Reprints, Time and Frequency Div.

Since 1968 the NBS time scale algorithm has been generating a clock which is theoretically better than any of the individual clocks in its ensemble. In the last few years thanks to the Global Positioning System, we have been able to measure the time difference between the NBS time scale algorithm and the other time standards. The paper focuses on the ability to study the long term stability of the order of years, and short term stability of the order of days. We have now estimated fractional stability at Horifeleto, most work has focused on a year of about 1 x 10^-14 (sup-14). This paper studies the behavior of the algorithm from a theoretical point of view, characterizing its performance.
COMMUNICATION

Frequency and Time Stability of GPS and GLONASS Clocks.

Daly, P. D., and F. W. Allan, 1989. 6th International Conference on Time and Frequency, Gaithersburg, Maryland.


Keywords: Speech, Databases, Database management, Standards, Optical disks, Magnetic tape transport, Magnetic storage devices, Prototypes, Format, Reprints, CD-ROM.

Radio & Television Equipment

PB92-135499 Not available NTIS National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.

PB92-502087 CD-ROM 250.00 National Inst. of Standards and Technology, Gaithersburg, MD. Automated Speech Recognition Group.

NTIMIT Telephone Network Acoustic-Phonetic Continuous Speech Corpus (on CD-ROM).

Data file.

PB93-179398 (documentation booklet for PB91-505065). Includes user instructions.

The datafile is on two 4.7 inch CD-ROM discs.

PB93-131535 Not available NTIS National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Advanced Systems Div.


D. S. Piatet, 1992. 4p

PB92-050065 CD-ROM National Inst. of Standards and Technology, Gaithersburg, MD. Automated Speech Recognition Group.

NTIMIT Telephone Network Acoustic-Phonetic Continuous Speech Corpus (on CD-ROM).

PB93-179398 (documentation booklet for PB91-505065). Includes user instructions.

PB92-050065 CD-ROM National Inst. of Standards and Technology, Gaithersburg, MD. Automated Speech Recognition Group.

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NTIMIT Telephone Network Acoustic-Phonetic Continuous Speech Corpus (on CD-ROM).

PB93-179398 (documentation booklet for PB91-505065). Includes user instructions.
and Technology to develop a methodology to predict optical disk life expectancy values. In the research accelerated aging tests were run on small sets of disks and the quality parameter (the byte error rate) was periodically measured during aging cycles. Tests were used with a mathematical prediction model to develop a testing methodology. The report presents the results obtained. The need for standard test methods for predicting life expectancy and for measuring media characteristics is apparent. Life expectancy extrapolations derived from the experiments produced a range of values depending upon the method used for deriving the quality parameter. Recommendations are made about the implementation of a testing methodology for life expectancy predictions, and what information to include in a life expectancy specification.


Keywords: *Computer networks, *Standardization, Communication networks, Protocols, Tests, Conformity, Reprint ISDN.*

The paper seeks to place the North American ISDN Users' Forum (NIU-Forum) in context and adopt a deliberate ISDN and North American viewpoint. It gives the authors' perspective on the role of the NIU-Forum. The NIU-Forum is intended to be the single Forum to address unresolved ISDN implementation issues which require a consensus among the ISDN community.


Keywords: *Magnetic recording, Scanning tunneling microscopy, Imaging techniques, Magnetic films, Metal films, Nickel, Gold, Reprints, *Magnetic force microscopy, Hard disks, Floppy disks.*

Tunneling stabilized magnetic force microscopy (TSFM) has been successfully demonstrated to be a useful test tool to generate maps of magnetic records with sub-micrometer resolution. The authors found that the coated, Ni-film tips made from a free-standing 0.5 micron-thick Ni film can be used as an noninvasive probe for imaging magnetic bit patterns on the surfaces of computer hard and floppy disks, and computer tape. This variant of scanning tunneling microscopy shows promise as a viable tool for diagnostic use in the magnetic recording industry.


Keywords: *Magnetic storage devices, *Magnetic recording, Scanning tunneling microscopy, Imaging techniques, Magnetic films, Metal films, Thin films, Iron, Tracks, Reprints,*Hard disks, Magnetic force microscopy, Surface magnetism.*

A scanning tunneling microscope (STM) for surface magnetic imaging or measurements on thin-film magnetic storage media has been adapted. The usual rigid Pt tip of the STM was replaced by a flexible Fe tip. The images of a hard disk showing bit tracks written by a feritively held in a computer disk drive are present-

ed. The images shown are comparable to images of the bit tracks on textured surfaces using either ferrofluid decoration or other magnetic force microscopy (MFM). The tunneling current of the Fe tip was such that the influence on the image due to magnetic forces was larger than the influence due to sample surface topography.


Keywords: *Computers, *Computer software, Information systems, Systems engineering, Computer security, Technology transfer, Computer networks, Computer architecture, Telecommunications, Federal information processing standards, Computer Systems Laboratory.

The Computer Systems Laboratory Annual Report - 1991 describes the annual computer and related telecommunications activities and accomplishments of the Laboratory. Following the Director's Foreword, an overviewing of the Laboratory is presented, including a current CSL Organization Chart and selected staff accomplishments. Overviews of CSL's five technical divisions are followed next, followed by the section on Technology Transfer which details the vehicles CSL uses to disseminate research and information to the public and Technical Communities. Also included is a list of Federal Information Processing Standards (FIPS) and FIPS order information concludes the annual report.


Keywords: *Magnetic recording, Scanning tunneling microscopy, Imaging techniques, Reprints, *Magnetic imaging, Bit patterns, Tunneling stabilized magnetic force microscopy, Floppy disks, Hard disks.*

Tunneling stabilized magnetic force microscopy (TSFM) is a variant of scanning tunneling microscopy (STM) where the usual rigid STM tip is replaced with a flexible magnetic tip. The method contrasts with other magnetic force microscopes based on optical or capacitance detection due to magnetic forces. Instead, the position of the flexible tunneling tip depends on both topography and magnetic forces acting on the tip. The z-motion of the piezoelectric translator fixes the tip to balance the magnetic force so that the end of the tip remains in a fixed tunneling distance from the sample surface. The authors present a review of some TSFM images showing the recorded bit patterns on hard disk, floppy disk, and tape surfaces. The images were taken in an environment using STM tips made from free-standing Fe and Ni films about 1 micrometer thick. The image resolution of TSFM is routinely in the nanometer range. The authors conclude that the simple modification of STM will be a valuable diagnostic tool in the magnetic recording industry.


Keywords: *Computer architecture, *Pattern recognition, Highly parallel processors, Neural nets, Character recognition, Computer vision, Machine learning, FAUST (Feed-forward Association Using Symmetrical Triggering).*

A new architecture is presented for multi-map, self-organizing pattern recognition which allows concurrent massively parallel learning of features using different maps for each feature type. The method used is similar to the multi-map structures known to exist in the vertebrate sensory cortex. The learning used to update memory locations uses a feed-forward mechanism and is self-organizing. The architecture is described by the acronym FAUST (Feed-forward Association Using Symmetrical Triggering). As a demonstration of the effectiveness of FAUST, a character recognition program has been constructed on a massively parallel computer which can perform 99% accurate character recognition on medium-quality machine printed digits at a speed of 2.4 ms/digit, and 98% on multiplewriter hand print with a 2.3% substitutional error rate.


Keywords: *Computer systems performance, *Chips(Electronics), Very large scale integration, Computer systems hardware, Multiprocessors, Computer software, Computer network, Integrated circuits, CMOS, *MIMD computers, *MULTIKRON chip.*

The single-chip MULTIKRON design replaces the authors' earlier event trace (uTRAMS) and resource utilization (uREMS) performance instrumentation chips. It incorporates a longer timestamp, more bits of user-event timestamp, processor, and sense interface which are achieved by using 64-bit processor bus, though the design allows simple modification to a 32-bit bus. The collection network output has a width of eleven bits (eight data, one parity, and two control), and can transfer up to 25 million data bytes per second.


The publication describes the test system design and operation for the calibration of the NIST Standard Reference Material (SRM) 3202 Secondary Standard Reference Tape for 16-track, parallel, and 36-track, parallel, sequential, 12.65 mm (0.5 in.), 1491 cpm (37871 cpi) magnetic tape cartridge. The standard reference material for this magnetic tape cartridge will promote data interchange among computer installations. Reliable interchange requires that the media be designed and manufactured in the best way, namely, to a known and acceptable standard reference medium.

Computer Software

200.480 AD-A243 452/0 PC A05/MF A01 National Inst of Standards and Technology (CSL), Gaithersburg, MD. Information Systems Engineering Div.

Keywords: Standardization, Test and evaluation, *Compilers*, *Ada Programming language*, "Validation summary report", Computer program verification.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A and FIPS PUB 119. This report explains all technical terms used within it and reports the results of testing of the Ada Compiler. The Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard and any independent option or dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies—for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. Some of the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing and from the Ada compiler vendor. The validation process includes submitting a suite of standardized test data, the AVC, as inputs to an Ada compiler and evaluating the results.

Three ring vinyl binder also available; North American Continent price $7.00; all others write for quote.


The standard is a redesignation of ANSI X3.144-1988. It announces the adoption of the American National Standard Computer Hierarchical Interactive Graphics System, ANSI X3.144-1988, as a Federal Information Processing Standard (FIPS). The standard specifies the control and data interchange between an application program and its graphic support system. It provides a set of functions and programming language bindings (or toolboxes package) for the definition, display, and modification of two-dimensional (2D) or three-dimensional (3D) graphical data. In addition, the standard supports high interactive processing and geometric articulation, multi-level or hierarchical graphics data, and rapid modification of both the graphics data and the relationships between the graphical data. The purpose of the standard is to promote portability of graphics applications programs between different installations. The standard is for use by implementors of the reference authority in developing graphics software systems; and by other computer professionals who need to know the precise syntactic and semantic rules of the standard.

Three ring vinyl binder also available; North American Continen price $7.00; all others write for quote.

Keywords: *Software, *Interactive system, *Standards, Specifications, Computer aided design, Computer animation, Programming languages, Display devices*, "Federal Information processing standards, Archive file, American National Standards Institute."

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Final rep. D. R. Benigni, c1989, 46p

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are also possible using SQL updates on the object representation in the database to trigger corresponding HyperCard updates on the objects themselves. It describes a prototype implementation and presents several example queries and updates to motivate this approach. These techniques, although demonstrated here specifically using HyperCard and Oracle for Macintosh, are generally applicable to a wide range of hypertext systems and relational databases.


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1. The data management reality:
   - The road map for CASE implementation:
     - The impact of a new architecture:
       - Data modeling:
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             - Managing information across multiple CASE tools:
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The emphasis on "open systems" in the past few years has led to the development of interface standards in almost all areas of computing: operating systems, data communications, graphics, programming languages, and databases. These standards can solve many integration problems, the architecture of applications can significantly affect the degree of success of systems integration. The paper presents an approach to application development that helps use software standards to the best advantage in systems integration.


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COMPUTERS, CONTROL & INFORMATION THEORY

Computer Software

200.510
PB92-154031 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Systems and Network Architecture Div.


Recent events such as the computer virus on the Internet have heightened awareness of the need for integrated network management systems. The basis for these systems of the future is noted in international standards which specify the functions, services, protocols, and the structure of the management information to be exchanged. The standards, however, are only the tools that make it possible for vendors to build interoperable integrated systems. It will be many years before the process is completed.

200.511
PB92-164508 PC A99/MF E11 National Inst. of Standards and Technology, Gaithersburg, MD.


Special pub. (Final), T. Boland. Mar 92, 86p. NIST/SP-500-202 Also available from Suppl. of Docs. as SN93-015-00000-0. Supersedes PB91-171967.

Keywords: *Protocols, Computer networks, Local area networks, Message processing, Data processing security, File management systems, Data bases, Access control, *OSI (Open Systems Interconnection), ISDN (Integrated Services Digital Network).

The document records current Stable Agreements for Open Systems Interconnection (OSI) Protocols among the organizations participating in the OSI Implementors’ Workshop Series.

200.512
PB92-172725 PC A03/MF A01 National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Database and Graphics Georeferencing Guide for Specifying and Building CITIES with Data Management Standards.


Keywords: *Data management systems, *Standards, Specifications, File systems, Data base management processing standards, Data dictionaries, Data base management systems, Computer networks, Data access, Data integrity, Distributed data bases, Testing, Procurement, *CITIES (Computer Integrated Technical Information Service), ANSI (American National Standards Institute), ISO (International Organization for Standardization).

The paper complements the military specification for a Contractor Integrated Technical Information Service (CITIES) when that service is to be provided in an environment which supports several other federal government data management systems. It presents the current status of existing and emerging International Organization for Standardization (ISO), American National Standards Institute (ANSI), and Federal Information Processing Standard (FIPS) standards for database management and file systems, specifically Database Language SQL, Remote Database Access (RDA), and Information Resource Dictionary System (IRDS). It also describes some of the other federal government data management standards and indicates how these standards may be specified or used to meet the requirements of federal levels of service and functional requirements of CITIES. It concludes by identifying the benefits of data management standards in the CITIES architecture. The Appendices describe the semantic content of each data management standard and discuss its applicability and availability. Where appropriate, they also address the availability of conformance.

Information Processing Standards

200.506
FIPS-PUB-171 PC E16 National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Financial Institution Key Management (WHOLE), X.9.17

tion with American National Standards Inst., New York, Accredited Standards Committee on Financial Security (X9), and American Bankers Association, Washing-
ton, DC.

Three ring vinyl binder also available: North American Continent price $7.00; all others write for quote.

Keywords: *Data processing security, *Computer security, *Federal information processing standards, Manuals, Procedures, Cryptology, Management, Data Encryption (DEA).

The standard specifies a particular selection of options for the automated distribution of key material by the Federal Government when using the protocols of ANSI X9.17, ANSI X9.17 defines procedures for the manual and automated management of keying material and contains a number of options. Systems which are built to conform to all options of ANSI X9.17 are likely to be complex and expensive. The options selected speci-
cified in the standard will allow the development of cost effective systems which will, in addition, increase the likelihood of interoperability.


Keywords: *Computer graphics, *Standards, *Computer programs, Document Integrity, Interactive User manuals, Computer programs, *PHIGS (Programmers Hierarchical Interactive Graphics System), Conformance testing.

The catalog lists and briefly describes code sets that are in wide use in the United States that might be useful to Federal data systems. The purpose of the catalog is to assist Federal agencies and other organiza-
tions in the selection of appropriate code sets and in the avoidance of duplication of effort. The standard format that describes each code set listed specifies code set, language, agency, source document, and other pertinent data. The revision sup-
ersedes FIPS PUB 19-1 in its entirety.

PB92-149830 PC A03/MF A01 National Inst. of Standards and Technology (NCT), Gaithersburg, MD. Office Systems Engineering Group.

Interchangeability of SGML and ODA.

C. K. Nichols, and L. A. Welsch. Jan 92, 33p NISTIR-4781 See also DE95000986 and FIPS PUB 152.

Keywords: *Standards, *Documents, Translator routines, Conversion, SGML (Standard Generalized Markup Language), ODA (Office Document Articu-

The Standard Generalized Markup Language (SGML) and the Office Document Architecture (ODA) are inter-
national standards for the markup and interchange of electronic documents. These standards are incom-
patible, in the sense that United States standard might be using SGML cannot be used directly in an ODA-based system, and vice versa. The authors first describe the two standard's structures, and how a bridge between the two standards could be evaluated. They then evaluate the Office Document Language (ODL) SGML and SGML respectively, and ODA documents, with respect to these criteria. They then describe a translation program that converts SGML documents to ODA and back.

PB92-149871 PC A04/MF A01 National Inst. of Standards and Technology (NCT), Gaithersburg, MD.


R. Aronoff, K. Brady, M. Chernick, J. Fox, and K. Hwang. Jan 92, 33p NISTIR-4651 See also PB91-120113 and PB91-171967.

Keywords: *Federal information processing standards, Protocols, Syntax, Semantics, Computer networks, Communication network architecture, Network management control, Testing, Specifications, *GNMP (Government Network Management Profile).

The Government Network Management Profile (GNMP) is the standard reference for all Federal Gov-
ernment agencies to use when acquiring Network Management (NM) functions and services for comput-
er networks. The GNMP specifies the structure of the services and the data of the information exchange that is required to provide support and control of network and system components and their resources. Version 1 GNMP also includes optional methods of au-
thentication. These optional authentication methods are provided for intern use in the absence of standard approaches to network management security.

200.512
PB92-154031 National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Systems and Network Architecture Div.

gineers) Spectrum 26, n4 P39-42 Apr 89.

Information Processing Standards

Perceptual activity for exploration, probing and searching is very important in computer vision. For the purpose of intelligently controlling the sensor's motion and parameter for different sensing strategies and the way sensory data is integrated, an active camera system is often used. An active camera system is also usually used for vision-based guidance. In order to perform accurate control, it is necessary to obtain the relation between the camera and the manipulator, the active camera system must be calibrated. In this paper, the authors introduce a modified Denavit-Hartenberg kinematic model and develop a new technique to calibrate an active camera system. The main contributions of the paper are: the camera and base-to-world calibrations are all included. The method employs four ideas: (1) The camera poses, joint angles, and link frames are all related to the world frame, therefore the camera-to-manipulator and base-to-world calibration is very straightforward; (2) The intrinsic camera parameters, the manipulator motion is obtained from the camera poses; (4) The joint poses are obtained, the link frames can be defined for any kinematic model. In conclusion, the whole procedure is simple, flexible, accurate and efficient. Two experiments are performed to verify the accuracy of the new technique.

Pattern Recognition & Image Processing

An active parallel character recognition system has been presented. The system is designed to study the feasibility of the recognition of handwritten text in a loosely constrained environment. The system consists of eight functional components. The loading of the image into the system and storing the recognition results from the system are I/O components. In between are components responsible for image processing and recognition. The image processing to load and isolate 34 fields on a scientific workstation takes 900 seconds. The same processing takes only 11 seconds using a massively parallel array processor. The image processing components, including the time to load the image, takes 4% of the time of the system. The segmentation time is 15 ms per character and the segmentation accuracy is 89% for handwritten digits and alphas. Character accuracy is 99.6% on the handwritten digits, the recognition accuracy is 96% and recognition speeds of 10,000 character/second can be realized. The limiting factor in the recognition portion of the feature set is feature extraction, which occurs at 806 characters/second. Through the use of a massively parallel machine and neural recognition algorithms, significant improvements in both accuracy and speed have been achieved.
The report presents results of training neural networks for optical character recognition on a large realistic pattern set containing 2000 training and 1434 testing exemplars. Each pattern is composed of 32 Gabor coefficients obtained from a 32 by 32 pixel binary image of a handwritten digit segmented from the National Institute of Standards and Technology (NIST) Handwriting Image Database. These sets are believed to have approximately 1% segmentation errors. Comparative results for Moller’s scaled conjugate gradient method and for standard back propagation are presented for such pattern sets running on a scientific workstation and a highly parallel computer. Typical training on a network with 32 inputs, 32 hidden nodes, and 10 output nodes gives a 96.1% to 99.6% correct recognition for the training set and 95.6% to 99.6% for the test set. Training with conjugate gradients requires fewer than 200 iterations; times are about 20 to 30 minutes on a scientific workstation and 6 minutes on the highly parallel computer. Testing (classification) is done at the rate of 600 and 1600 patterns per second on the two machines and in 3-D on the highly parallel computer respectively. These results suggest that commercial hand-written character recognition systems with great economic potential are feasible.

The paper deals with machine perception of flat surfaces. For example, when an object in translational motion in parallel to a planar surface, it is shown that a nonlinear function of optical flow produces the same value as the gradients of a mapping of the optical-flow based invariant for all points that lie on a flat surface. It discusses some potential uses of the invariant.

The interoplation of frames into a video stream is a problem common to the design of video compression techniques and of conversion schemes for the transfer between various video standards and formats, such as frame rate conversion and de-interlacing. The study considers the metrics which are used for assessing these methods. It has been suggested that the linear 1 norm is a preferred metric in the comparison of images. The authors apply their proposed approach to the problem of converting 2 norms to video, processed according to each of two interpolation schemes. These norms were compared for their ability to minimize interpolation error. The linear 2 norm discriminates between low and high levels of interpolation error more effectively than the linear 1 norm. The results are summarized and interpreted in a way to provide a comparison. The study is carried out on a realtime video supercomputer, the Princeton Engine.

The paper suggests several iconic image ‘warping’, or remapping, which facilitate computationally extensive image registration tasks, such as moving a 3-D surface from one position to another. Assuming translational motion of the camera, where the optical axis coincides with the direction of motion, and a stationary scene, points on the surface that lie on a particular 3-D surface produce a constant value for some nonlinear function of the optical flow. The function need not be computed after the image is formed, but rather can be implemented by hardware at the retinal level. Four sets of different surfaces are introduced and each set is mapped using a optical flow based constant value for each surface. These values are called ‘invariants’. For each invariant a logarithmic retina is defined which will cause optical flow on the surfaces to have identical values. The process of image remapping, called ‘normalization’, is defined for four 1-D parameterizations of space: range, depth, location, and orientation. Accuracy of the new suggested retinex normalizes the optical flow with respect to each one of the parameterizations.

Two reject mechanisms are compared using a massively parallel character recognition system implemented at the National Institute of Standards and Technology (NIST). The technique is designed to study the feasibility of automatically recognizing handwritten text in a loosely constrained environment. The first mechanism uses an optical-flow analysis on the output activation of the winning node from the character classifier network. The second mechanism uses a neuron for each set of all outputs from the character classifier network to accept or reject assigned classifications. The neural network rejection method was expected to perform with greater accuracy than the scalar threshold method, but this was not supported by the test results. The scalar threshold method, even though arbitrary, is shown to be a viable reject mechanism for use with neural network character classifiers. Upon studying the performance of the neural network rejection method, analyses show that the two neural networks, the character classifier network and the rejection network, perform very similarly. This can be explained by the strong non-linear function of the character classifier network which effectively removes most of the correlation between a pattern and its reconstruction, even if that reconstruction is better than the winning activation. This suggests that any effective rejection network must receive information from a system which has not been filtered through the non-linear classifier.

Additional recent advances in neural networks application development for real life problems have drawn attention to network optimization. Most of the known optimization methods rely heavily on a weight sharing concept for pattern separation and recognition. The work presented in this paper is a first work for a number of extraneous weights which may play a minimal role in pattern separation and recognition. The authors have implemented a set of neural networks with connections in the network eliminated with little or no change in the network performance. Topological separation is the organization of the interconnections of the network. It is important to control the number of connections as secondary method of optimization. The findings indicate that for large networks, topological optimization, in addition to the reduction in network size that is more suitable for very large scale integration (VLSI) implementation. Topological separation is based on the use of knowledge and the use of constraints in the interconnections of the network. As each, it is an economical way of size reduction which leads to overall optimization. The differential equation of the neurons is based on the weight contents rather than number of connections. The training error may vary with the topological dynamics but the fluctuations between the set of inputs and the output rate decreases to a minimum. Topological separation reduces the size of the network by changing its architecture without degrading its performance.

Keywords: Optical character recognition, Massively parallel processors, Neural nets, Handwriting, Image processing, Classification, National Institute of Standards and Technology.

Two reject mechanisms are compared using a massively parallel character recognition system implemented at the National Institute of Standards and Technology (NIST). The technique was designed to study the feasibility of automatically recognizing handwritten text in a loosely constrained environment. The first mechanism uses an optical-flow analysis on the output activation of the winning node from the character classifier network. The second mechanism uses a neuron for each set of all outputs from the character classifier network to accept or reject assigned classifications. The neural network rejection method was expected to perform with greater accuracy than the scalar threshold method, but this was not supported by the test results. The scalar threshold method, even though arbitrary, is shown to be a viable reject mechanism for use with neural network character classifiers. Upon studying the performance of the neural network rejection method, analyses show that the two neural networks, the character classifier network and the rejection network, perform very similarly. This can be explained by the strong non-linear function of the character classifier network which effectively removes most of the correlation between a pattern and its reconstruction, even if that reconstruction is better than the winning activation. This suggests that any effective rejection network must receive information from a system which has not been filtered through the non-linear classifier.
Pattern Recognition & Image Processing

The First Census Optical Character Recognition (OCR) System Conference tested a number of systems developed by different commercial, educational, and government organizations in the OCR of segmented hand-printed digits, upper case letters, and lower case letters. This report discusses the results, conclusions, and open questions of the Conference.

200.530
PB93-113561 PC A03/MF A01
National Inst. of Standards and Technology (CSL), Gaithersburg, MD, Advanced Systems Div.
Comparison of Massively Parallel Hand-Print Segmenters.
R. A. Winston, and M. D. Garris. Sep 92, 14p
NISTIR-4923.

Keywords: "Optical character recognition, "Handwriting, "Parallel processing, "Histograms, Comparison, "Handwriting. Segmentation, Blob coloring.

NIST has developed a massively parallel hand-print recognition system that allows components to be interconnected. Using this system, three different character segmentation algorithms have been developed and studied. They are blob coloring, histogramming, and a hybrid of the two. The blob coloring method uses connected components to isolate characters. The histograms mean the number of pixels, of both the slanted, to segment the hybrid. The method is an augmented histogram method that incorporates a Laplacian filter to detect local maxima. When a histogrammed item is too large and applies blob coloring to further segment the difficult item. The hardware configuration is a serial host computer with a 1024 processor SIMD computer attached. With a 1024 processor SIMD computer attached, the system can function with 2000 characters per second. Running the massively parallel system across the 2010 forms, blob coloring required 2.1 seconds per form with an accuracy of 97.5%, histogramming required 14.4 seconds per form with an accuracy of 95.5%, and the hybrid method took 13.2 seconds with an accuracy of 95.4%. The results of this comparison show that the blob coloring method of a SIMD architecture is superior.

200.531
PB93-113587 PC A03/MF A01
National Inst. of Standards and Technology (CSL), Gaithersburg, MD, Robot Systems Div.
Optimal Estimation of Optical Flow, Time-to-Contact and Depth.
H. Lau, T. H. Hong, and M. Herman. Sep 92, 47p
NISTIR-4919.
Sponsored by Maryland Univ., College Park. Dept. of Electrical Engineering.

Keywords: "Obstacle avoidance, Autonomous navigation, "Least squares method, Optimization, "Algorithms, Depth, "Optical flow, Robot vision.

Extraction of the optical flow field, time-to-contact and depth from an image sequence is a vitally important problem in many contexts. Many robotic applications, e.g., obstacle avoidance, autonomous navigation, can benefit from this information. In this report, the problem is formulated under a least squares minimization of the Euclidean distance, under the condition that the like, can benefit from this information. In this report, the problem is formulated under a least squares minimization of the Euclidean distance, under the condition that the instantaneous optical flow field and time-to-contact simultaneously. It does not utilize knowledge of camera movement or any other camera parameters. Nevertheless, additional information can be recovered if prior information is incorporated into the algorithm. It is shown that it can be computed at a consistent camera motion as well as some other methods. The proposed solution is simple, effective, and easy to implement, which enhances the possibility of hardware realization for real-time applications. In the experimental results, both the synthetic and real, are included to show the performance of the algorithm and to verify its robustness against random noise perturbation.

200.532
PB93-114163 PC A03/MF A01
National Inst. of Standards and Technology (CSL), Gaithersburg, MD, Robot Systems Div.
Real-Time Smooth Pursuit Tracking for a Moving Robot.
D. Coombs, and C. Brown. Apr 92, 26p NISTIR-4826
Grants NSF-IR98-03582, NSF-CAAE-25274
Prepared in cooperation with Rochester Univ., NY, Dept. of Computer Science. Sponsored by National Science Foundation, Washington, DC, and Office of Naval Research, Arlington, VA.

Keywords: "Target acquisition, Binocular vision, Tracking cameras, Real time, Pursuit tracking, Robot sensors, "Robot vision, "Robotic tracking. Computer vision.

The paper examines the problem of a moving robot tracking a moving object with its cameras, without requiring the robot's head to suffer from distracting surroundings. A novel aspect of the approach taken is the use of controlled camera movements to simplify the visual processing necessary to keep the cameras locked on the target. A gaze holding system implemented on a robot's binocular head demonstrates this approach. Even while the robot is moving, the cameras are able to track an object that rotates and moves in three dimensions. The key observation is that visual fixation can help separate an object of interest from distracting surroundings. Camera vergence produces an horyzer (surface of three disparity in the scene). Binocular features, with no disparity can be extracted with a simple filter, showing the object's location in the image. Similarly, an object that is being tracked will be imaged near the center of the image. The combination of visual processing helps concentrate on the target. Instead of requiring a way to recognize the target, the system relies on the fact that converging movements and binocular fixation segmentation.

200.535
PB93-120707 PC A04/MF A01
National Inst. of Standards and Technology (CSL), Gaithersburg, MD, Advanced Systems Div.
NIST Scoring Package Release 1.0

Keywords: "Character recognition, "Computer software, "Performance evaluation, Computer applications, "Image processing, "Image data bases, Handwriting, "Scoring, String processing, "File structures, "Optical processing, Algorithms.

The National Institute of Standards and Technology (NIST) Scoring Package is a reference implementation of the draft, Standard Method for Evaluation the Performance of Systems Intended to Recognize Handwritten Characters from Images. Scoring Forms, which has been submitted to American National Standards Institute (ANSI) X3.4. The document presents the concept of scoring forms, processing systems and character classifiers, discusses the concepts and algorithm used for dynamic string alignment, defines the rules and formats required as input to the Scoring Package, and describes how the Scoring Package software is installed and invoked.

General

200.538
PB92-144138 Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD, Robot Systems Div.
Control and Information Theory.
J. S. Albus. 1991, 37p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Computer, 24, n.8, 1991.

Keywords: "Intelligence, "Artificial Intelligence, "Robotics, "Machine vision, "Sensors, "Feedback control, "Feedback, "Intelligence, "Artificial Intelligence.

Intelligence is defined as that which produces successful behavior. Intelligence is assumed to result from natural selection. A model is proposed that integrates knowledge from both natural and artificial systems, and combines the best features of both. The model of a hierarchical system architecture wherein: (1) control bandwidth decreases as an order of magnitude at each higher level, (2) perceptual resolution of spatial and temporal patterns contracts about an order-of-magnitude at each higher level, (3) goals expand in scope and planing becomes obvious in space and time due to an order-of-magnitude at each higher level, and (4) models of the world and memories of events expand their range in space and time by about an order-of-magnitude at each higher level. At each level, functional modules perform behavior generation (task decomposition, planning and execution), world modeling, sensory processing, and value judgment. Sensory feedback control loops are closed at every level.

200.535
PB92-148261 PC A05/MF A02
National Inst. of Standards and Technology (CSL), Gaithersburg, MD, Sample Statements of Work for Federal Computer Security Services: For Use In-House or Contracting Out.
Final rep.
D. M. Gilbert, and N. Lynch. Dec 91, 67p NISTIR-4749
See also PB91-107540.


Each federal organization is fully responsible for its computer security program whether the security program is performed by in-house staff or contracted out. Time constraints, budget constraints, availability or access to hardware and software, and the potential knowledge gained by the organization from the experienced contractor are among the reasons a federal organization may wish to get external assistance for some of these complex, labor intensive activities. An interagency working group of federal and private sector security specialists developed the document. The document presents the ideas and experiences of those involved with computer security. It supports the operational field with a set of Statements of Works (SOWs) designed as significant computer security activities. While not a substitute for good computer security management, organization staff and government contractors can use these SOWs as a basis for a common understanding of each described activity. The sample SOWs can foster easier access to more consistent, high-quality computer security services. The descriptions apply to contracting for services or obtaining them from within the organization.

200.536
PB92-172022 PC A03/MF A01
G. Qimel. Mar 92, 29p NISTIR-4774
See also AD-A207905.


Several United States and European documents describing criteria for specifying and evaluating the trust of computer products and systems have been written. The report reviews five of these documents and discusses the approach each one uses to provide criteria for specifying and evaluating the trust of computer products and systems.

200.537
PB92-172030 PC A04/MF A01
A. W. Clark, and D. N. S. Walrath. Feb 92, 55p NISTIR-4734
Grant NANN-112737
Sponsored by National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Computer Security Div.

The National Research and Education Network (NREN) is an integral part of the planned High-Performance Computing and Communications infrastructure that will extend throughout the scientific, technical and education communities. The problem of computer and network information security is an important issue that is complicated by the diversity of users and interconnecting networks in the NREN environment. One major impediment to improved security in computer and network systems is the lack of a clearly stated security policy for general computing. In order to establish an appropriate framework for securing such a policy for the NREN, the report traces the evolution of a national network in the U.S., reviews the fundamental concepts of information security and policy, and identifies the need for developing a policy. A security policy is then proposed for the NREN; one that is intended to provide a mechanism for the development, management and further development. The draft policy identifies responsibilities of all major network constituents: end users, local system administrators, management at all levels, vendors, system development, service providers, and a national council. It is abstractly stated in order to remain independent of current technologies and organization-specific practices.

200.540
PB92-205418 PC A03/MF A01 National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Computer Security Div.
Optimization of Neural Network Topology and Information Content Using Bit-2-Bit Processors, C. L. Wilson, and O. M. Omdivar. Feb 92, 13p NISTIR-4766
Published in cooperation with District of Columbia, Univ., Washington.
Keywords: Neural nets, *Boltzmann equation, *Optimization, Topology, Character recognition, Pattern recognition, Conjugate gradient method, Iteration, Temperature, Graphs.

Reduction in the size and complexity of neural network applications are the driving force behind the current research in network optimization. Most of the known optimization methods are not effective in securing training concepts for pattern separation and recognition. The method used in the research focuses on network topology and information content for optimization. The authors have studied the change in the network topology and its effects on information content dynamically during the optimization process. The results show that the network topology were achieved by altering the number of weights. The primary optimization was located conjugate gradient and the secondary method of optimization a Boltzmann method. The findings demonstrate that for a difficult character recognition problem, the number of weights in a fully connected network can be reduced by 90.3% with a temperature of 0.55 while achieving training and testing of identical accuracies.

200.541
PB92-205442 PC A11/MF A03 National Inst. of Standards and Technology, Gaithersburg, MD.
Computer Security Training and Awareness Course Compendium. K. Everest. May 92, 230p NISTIR-4846
Keywords: *Computer security, *Training, *Curricula, Directories, Government agencies, Government policies, Planning, Management, Personnel development, Computer viruses, UNIX(Operating system.), Data processing security, Auditing, Local area networks.

The training and awareness courses in the compendium are published by the National Institute of Standards and Technology (NIST), which has produced a comprehensive set of computer security training course content areas for each category. These categories, in turn, are further defined by the course content for each category: 1) Computer Security Basics, 2) Security Planning and Management, 3) Computer Security Policy and Procedures, 4) Contingency Planning, and 5) Systems Life Cycle Management. The level of training required in each area will vary depending on how sensitive the systems are. The course content is expressed in the form of a table for each category: 1) Computer Security Basics, 2) Security Planning and Management, 3) Computer Security Policy and Procedures, 4) Contingency Planning, and 5) Systems Life Cycle Management. The level of training required in each area will vary depending on how sensitive the systems are. The course content is expressed in the form of a table for each category: 1) Computer Security Basics, 2) Security Planning and Management, 3) Computer Security Policy and Procedures, 4) Contingency Planning, and 5) Systems Life Cycle Management.

200.542
PB92-236256 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Scientific Computing Div.
Keywords: *Expert systems, *Ordinary differential equations, Computer systems that process sensitive information.

An expert system can be defined as "bottom up" as a software package that uses a knowledge base and inference engine, or 'top down' as one that attempts to simulate the reasoning of a human expert. PLOD, a package that the authors have been developing for solving systems of ordinary differential equations satisfies the second form of the definition but not the first. The paper describes the major features of the package, and how they have been forced to reinvent the notion of a "special purpose computer". Certain standard building blocks are described in the hope that these can be developed for use in other systems.

200.543
PB93-113553 PC A03/MF A01 National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Computer Security Div.
Keywords: Computer security, Information systems, Federal agencies, Manuals, Electronic bulletin board systems, NIST(National Institute of Standards and Technology).

The Computer Security Act of 1987 assigned to the National Institute of Standards and Technology (NIST) the responsibility for providing federal agencies with advice and assistance in the area of computer security. To accomplish a portion of this task the NIST Computer Security Division maintains an electronic bulletin board system (BBS) which focuses on the application of NIST. NIST Computer Security BBS makes available to federal agencies and the public a wide variety of computer security information and advice, in the hope that users and managers protect their data and systems. The document describes the BBS and provides detailed instructions on how to use the many features.

200.544
PB93-120699 PC A03/MF A01 National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Computer Security Div.
Contract AVAL-W4366-3111, Sponsored by White Sands Missile Range, NM, Vulnerability Assessment Lab.

Keywords: *Computer security, Worms, Humans, Sources, Protection, Vulnerability, Assessments, History, *Computer viruses, Malicious code, Phone phreak.

Today, computer systems are under attack from a multitude of sources. These range from malicious code, worms, and worms, to human threats like hackers and phone phreaks. These attacks target different characteristics of a system. This leads to the possible identification of systems that are most susceptible to certain kinds of attacks. Malicious code, such as viruses and worms, attack a system in one of two ways: the virus has been an internal threat, while the worm, to a large extent, has been a threat from an external source. Human threats are perpetrated by individuals or groups of individuals. These attacks generally target known security vulnerabilities in systems. Many of these vulnerabilities are simply due to configuration errors. The report provides an assessment of the threats associated with malicious code and worms on systems using commercially available hardware and software.

The document provides guidance on including computer security concerns in the system acquisition phase of information resources management. It is intended to help agencies select and acquire computer systems that are secure and to reduce the risk that new systems will create security vulnerabilities in the NREN.

Keywords: *Computer security, *Government procurement, Specifications, Cryptography, Computer architecture, Data integrity, Access control, Acquisition, Guidelines, Requirements, Risk, FIP(Federal Information Processing).

Keywords: *Expert systems, *Ordinary differential equations, Computer systems that process sensitive information.

An expert system can be defined as "bottom up" as a software package that uses a knowledge base and inference engine, or 'top down' as one that attempts to simulate the reasoning of a human expert. PLOD, a...
ELECTROTECHNOLOGY

Antennas


Keywords: Antennas, Computer programs, Experimental data, Theory, Near-field measurement, Spherical near-field scanning. The report documents the evaluation of spherical near-field scanning algorithms and computer code developed at the National Institute of Standards and Technology. The experimental work is primarily a comparison of probe-compensated spherical and planar near-field measurement results for a common test antenna. Theoretical work is largely supportive of the experimental effort, but some peripheral topics are developed. For example, (1) application of spherical near-field measurements to the determination of incident fields in compact ranges; and (2) spherical-wave expansions for the fields of a uniformly excited aperture (to facilitate the creation of the analytic test data).


Keywords: Electrical measurement, Time domain, Reflectometers, Reflectivity, Reflectors, Microwave absorbers. A wideband time-domain reflectometer is used to evaluate the reflection characteristics of RF/microwave absorbbers. The reflectometer uses an array of two identical high-gain antennas, both transmitting and receiving. The method uses the two antennas in a difference mode to remove the undesired signals and enhance differential small reflections. Using this technique, the authors can separate front surface reflections from those which are generated at greater angles. The bandwidth of the pulses is 0.3 MHz to 1000 MHz, and reflection characteristics are measured over the range. The method has been used to characterize the reflectivity of the different types of absorbers placed in an anechoic chamber. The results are reported, together with the measurement accuracy.


As part of an effort to provide improved measurement services at frequencies above 30 Ghz, scientists at the National Institute of Standards and Technology (NIST) have completed development of the first frequency extension of a swept-frequency gain measurement service for the 33-50 Ghz band. The service gives values with an accuracy of +0.03 db. In the paper the authors discuss an example measurement and the associated errors.


Keywords: *Dipole antennas, *Antenna spherical, *Antenna radiation patterns, *Antenna design, *Computer programs, *BASIC programming language, Fortran. A spherical dipole was developed to provide a source that can be characterized both by theory and experiment and integrated into modern automated test systems. The frequency and amplitude of the radiated electromagnetic field are established remotely using a helix antenna, and the dipole as well as other control features are transmitted to and from sphere using fiber optic cable. The field measurements show good agreement with predictions over much of the frequency band.


Keywords: Probes(Electromagnetic), Extremely high frequency, Near-field, *Antenna measurements, Error correction.*

The study was conducted to verify that the probe-position error correction can be successfully applied to real data obtained on a planar near-field range where probe position errors are known. Since probe position error correction is most important at high frequencies, measurements were made at 60 Ghz. Six planar scans at z positions separated by 0.03 lambda were obtained. The correction technique was applied to an error-contaminated near field constructed out of the six scans according to a discretized periodic error function. The results indicate that probe position errors can be removed from real near-field data as successfully as from simulated data; some residual errors, which are thought to be due to multiple reflections, residual drift in the measurement system, and residual probe position errors in all three coordinates, are observed.


Keywords: Probes(Electromagnetic), Spherical configuration, Error functions, Near field, Reprints, *Antenna near-field measurements.*

A recently developed analytic technique that can correct for probe position errors in planar near-field measurements to arbitrary accuracy, is shown to be also applicable to spherical near-field data after appropriate modifications. The near-field range was calibrated successfully to remove probe position errors in the planar near-field, leading to more accurate far-field patterns, even if the maximum error in the probe’s position is as large as 0.2(lambda). Only the error-contaminated near-field measurements and an accurate probe position error function are needed to be able to implement the correction technique. It is assumed that the probe position error function is a characteristic of the near-field range, and that it has been determined to the best of-the-art method, error-contaminated near-field, laser positioning and precision optical systems. The method also requires the ability to obtain derivatives of the error-contaminated near field defined on an error-free regular grid with respect to the coordinates. In planar geometry the derivatives are obtained using FFFTs, and in spherical coordinates one needs to compute derivatives of Hankel functions for radial errors, and derivatives of the spherical electric and magnetic vector basis functions for errors in the theta and phi coordinates. Efficient computer codes have been developed to accomplish this.


Keywords: Probes(Electromagnetic), Extremely high frequency, Computerized simulation, Error functions, Near field, Reprints, *Antenna measurements, Error correction.*

Effects of probe position errors in planar near-field measurements have been significantly reduced at NIST by accurate alignment of the scanner and an analytic error correction. Currently, the near-field range has probe position errors greater than 0.01 cm only at the edges of the 4x4 sq m area, and less than that everywhere else. These errors can be further reduced by a theoretical procedure, which requires only the error-contaminated near field and the probe position data to the points of measurement. All necessary computations can be efficiently performed using FFFTs. An explicit nth-order approximation to the ideal near field can be computed to correct the error-free near field. Computer simulations with periodic error functions show that the error-correction technique substantially reduces the effects, even if the errors are as large as 0.2(lambda), thereby making near-field measurements at frequencies well above 60 Ghz more practicable.


Keywords: *Phased arrays, Error analysis, Near field, Certification, Performance, Tests, *Antenna measurements.*

The National Institute of Standards and Technology (NIST) has written a certification plan to ensure that a proposed planar near-field range is capable of measuring high-performance phased arrays. Generally for a complete plan, one must evaluate many aspects including scanner alignment, near-field probe alignment, alignment of near-field coordinates, error correction, position errors, path variations, the receiver’s dynamic range and linearity, leakage, probe-antenna multiple reflections, truncation effects, aliasing, system drift, room multipath, insertion loss measurements, noise, and software verification. In the report, the au-
Electrotechnology

Antennas


Keywords: *Antenna arrays, Phased arrays, Computerized simulation, Near field, Alignment, Graphics/Charts, Antenna measurements, Merged spectrum technique. The report describes the initial phase of a NIST study of the merged-spectrum technique for determining the accuracies of measurements of phased-array antennas. Excitation data are used in adjusting phase shifters to meet design specifications. Measurement uncertainties, steering errors, and various analytic approximations will all introduce errors into the alignment. The study is intended to quantify, to the extent of these errors, to more fully understand the merged-spectrum technique, and to recommend possible improvements. The presentation of a developed support evaluation of the merged-spectrum technique and gives simulation examples illustrating calculation of near fields from array factor and element patterns.


Keywords: *Comparator circuits, *Resistance bridges, *SQUID devices, Cryogenic equipment, Direct current, Feedback control, Resistors, Standards, Comparison, Standards development, Reprints. *The design and performance of a pair of highly isolated ramping and reversing direct-current sources for use with a cryogenic current comparator resistance bridge and dc superconducting quantum interference device (SQUID) detector are described. The current sources are floating and isolated from one another, and are internally combined to reverse the output current while maintaining the SQUID feedback control system in lock. The sources are designed to have low zero offset in order to limit the change of the current ratio in the reversal sequence. Sources have been constructed with full-scale current ranges from 0.65 to 100 mA and have been used in the comparisons of precision standard resistors at the 0.01 ppm level.


Keywords: *Network analyzers, *Calibration, Redundant components, Error analysis, Standards, Accuracy, Repeatability, Reprints, TRL method. The paper presents a new method for the calibration of network analyzers. The essential feature is the use of multiple, redundant transmission line standards. The additional information provided by the redundant standards is used to optimize the effects of random errors, such as those caused by imperfect connector repeatability. The resulting method exhibits improvements in both accuracy and bandwidth over conventional methods. The basis of the statistical treatment is a linearized error analysis of the TRL (thru-reflect-line) calibration method. The analysis, presented herein, is useful in calibrating network analyzers. It also yields new results relevant to the choice of standards.


Keywords: *Phase meters, *Phase angle, Time interval analyzers, Phase measurements, High frequency, Calibration, Time interval counters, Reprints, Heterodyne interferometer, Phase standards. Counter-timers capable of measuring the delay between two signals at frequencies up to 20 MHz have been developed and are being characterized with applications in heterodyne interferometry. A scheme for calibrating these instruments both statically and dynamically with the phase delay changing as fast as 10°/microsec is described.


Keywords: *Computational grids, *Soldered joints, *Electronic circuits, *Finite element method, Reliability, Thermal propagation, Soldering, Welding, Stress analysis, Nondestructive tests, X-ray stress analysis, Reprints, *Surface mount technology. The ultimate goal of this work is an improved method to assess the significance of anomalies in surface mount technology (SMT) component points, by relating them to field performance and reliability. The fitness-for-purpose approach can be applied to SMT solder joints by using finite element calculations incorporating various in-process joint characteristics to predict the effect of individual solder joints to their likelihood of failure, through finite element analysis. An effort is underway to extend the use of finite-element techniques to the actual solder joints by generating meshes from optical and X-ray inspection data in the form of thousands of surface mount components. Two major programs have been performed to convert these surface points to finite element meshes. Two trial data sets have been meshed, one from an X-ray tomography system and one from a machine vision system.


Keywords: *Josephson junctions, *Coherent radiation, Extremely high frequency, Phase locked systems, Microwave oscillators, Two dimensional, Arrays, Reprints, *SIS/Superconductors. Coherent emission has been generated by two-dimensional arrays of SIS Josephson junctions and detected in a junction coupled to the array through a dc-blocking capacitor. The detected function exhibits Shapiro steps at frequencies corresponding to the voltage across single array junctions and ranging from 60 to 210 GHz. The maximum power coupled to the detector junction occurs at 150 GHz and is estimated to be 0.04 microW, based on simulations of the detector circuit. Possible mechanisms for coherent emission from two-dimensional arrays are discussed.


Keywords: *Radiofrequency amplifiers, Electromagnetic interference, Electromagnetic noise, Design, Reprints, Phase Noise. The information required to do good low-phase-noise design is, for the most part, already in the literature under different titles. Low-noise audio design is concerned with optimizing amplitude signal-to-noise ratio. Instrumentation amplifier design isolates the desired signal, using bridge configurations (control of common mode rejection). A radio frequency (RF) isolation amplifier will be used to illustrate the concepts. The author will discuss component selection and circuit details. The differences with these affect both AM and phase noise (PM) performance.


Keywords: *Power meters, *Calibration, Interlaboratory comparisons, Audio frequencies, Electrical measurements, Scientific, Metrology, Electrical measurements, Superlow frequency, Wattmeters, Reprints. The results of an intercomparison of low audio-frequency power meter calibrations conducted in 1989 among the National Research Council, Canada; the National Physical Laboratory, United Kingdom; and the National Institute of Standards and Technology, USA, are described. A time-division wattmeter, developed at the National Research Council, United Kingdom, and used as the transfer standard. The measurements were made at 120 V, 5 A, power factors of 1, 0 load, and 0 lag and at frequencies from 5 kHz. Agreement with the NPL and NRC laboratories was better than 96 ppm in the 60-1600 Hz range, and better than 74 ppm between NIST and NRC in the 50-4000 Hz range.


Keywords: *Gates/Circuits, *Logic circuits, Superconducting devices, Medium scale integration, Large scale integration, Monte Carlo method, Josephson junctions, Superconductors, Reprints. Simulations are used to optimize the design of simple rapid single float quantum flux (RSQF) logic gates and to determine their margins. Optimizations based on maximizing the smallest (critical) margin result in critical margins in the range of 19-50%. A Monte Carlo approach is used to illustrate the relationship between margins and process yield. Based on gate simulation results, the shows results that 1-sigma parameter spreads of less than + or - 5% will be required to make medium or large scale integrated RSQF logic circuits. Finally, a single-bit full adder using two RSQF
Circuits

gates and a local self-timing network is simulated with discrete components. The full adder used 2000 A/s gates, and a specific capacitance of 0.04 pF/sq micrometer and had a logic delay of 87 ps and a worst-case margin of ±10%. A small margin reduction results from loading which is not present in the individual gate simulations.

200.563
PB92-156901 Not available NTIS National Inst. of Standards and Technology (EIEEL), Boulder, CO. Electromagnetic Fields Div.
Performance Criteria for Power-System Compatibility.
Final rept.
F. Matzloff, 1992, 6p
Keywords: Electromagnetic compatibility, Reliability(Electronics), Power supplies, Electric power, Performance, Reprints.

Power electronics create an opportunity for better use of electric power but can become a source of problems if the electromagnetic characteristics (immunity and emissions limits) of the equipment are not compatible with the environment (avoidable and unavoidable disturbances) of the power supply. Well-defined equipment performance criteria can help end-users obtain better compatibility, reliability, and cost-effectiveness of the equipment - power supply combination.

200.564
PB92-166230 Not available NTIS National Inst. of Standards and Technology (EIEEL), Boulder, CO. Electromagnetic Fields Div.
Application of Radiometry to the Accurate Measurement of Amplifier Noise.
Final rept.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement 40, n2:p433-437 Apr 91.
Keywords: Electromagnetic noise, Radiometry, S-parameter, Calibration, Measurement, Reprints, Amplifier noise, US NIST.

In response to the requirements of the microwave community which the authors serve, a calibration service for amplifier noise is under development at the National Institute of Standards and Technology (NIST). The paper includes a review and makes certain extensions to the associated theory from the scattering matrix approach used in the commercial implementation of the commercial NIST radiometers to the measurement a proposed NIST radiometers to the measurement system is then outlined, and a preliminary assessment of the probable accuracy is given.

200.565
PB92-169119 National Inst. of Standards and Technology (EIEEL), Gaithersburg, MD. Center for Computing and Applied Mathematics.
Computer Program POWNOR for Fitting the Power-Normal and -Lognormal Models to Life or Strength Data from Specimens of Various Sizes.
W. Nelson, and N. Doganmaks. Mar 92, 33p
NISTIR-4760
Sponsored by National Science Foundation, Washington, DC, and American Statistical Association, Alexandria, VA.
Keywords: Data analysis, Life(Durability), Microcircuits, Reliability, Fatigue life, Service life, Maximum likelihood estimates, Confi"dence limits, Covariance, Computer applications, *POWNOR computer program, *Electromigration, Power-normal distribution, Power-lognormal distribution, Series-system model.

The report presents the power-normal and -lognormal models, which describe the effect of stress on the size on the distribution of life or strength of a product or material. Such a model arises when any specimen can be regarded as a series system of smaller portions, where portions of a certain size have a normal or lognormal life (or strength) distribution. Also, the report documents the first computer program that fits the model to data (including censored and interval life data) from specimens of various sizes. The program employs maximum likelihood fitting and provides approximate confidence limits, as well as estimates, for model parameters, distribution percentiles, and other quantities of interest. How to run the program is explained with an analysis of data on time to electromigration failure of aluminum conductors for microcircuits.

200.566
PB92-171166 Not available NTIS National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Fields Div.
Dynamic Calibration of Waveform Recorders and Oscilloscopes Using Pulse Standards.
Final rept.
W. L. Gans, 1990, 6p
Keywords: Oscilloscopes, Calibration, Transfer functions, Standards, Pulses, Reprints, Waveform recovery.

The purpose of this presentation is to convince the reader/listener of two key points. The first is that virtually no one calibrates oscilloscopes/waveform recorders completely and completely at present. The second is that, in most cases, the tools are only available to perform these complete and complete calibrations when the application requires it. After a brief introduction describing the current methods used to calibrate oscilloscopes, the problems associated with these methods are discussed and illustrated. The solutions to these problems are then described.

200.567
PB92-171179 Not available NTIS National Inst. of Standards and Technology (EIEEL), Gaithersburg, MD. Electricity Div.
Linear Error Modeling of Analog and Mixed-Signal Devices.
Final rept.
Submittal PB91-149301.
Keywords: Analog to digital converters, Analog circuit, Mathematics models, Error analysis, Test methods, Optimization, Reprints.

Techniques are presented for developing linear error models for analog and mixed-signal devices. Methods for choosing parameters and assessing the models are complete and well-conditioned, are included. Once established, the models can be used in a comprehensive approach for optimizing the testing of the subject devices.

200.568
PB92-50586 Not available NTIS National Inst. of Standards and Technology (EIEEL), Boulder, CO. Electromagnetic Fields Div.
Two Dimensional Arrays of Josephson Junctions as Voltage-Tunnel Devices.
Final rept.
S. P. Benz, and C. J. Burroughs, 1991, 7p
Keywords: Microwave oscillators, Superconducting devices, Josephson junctions, Phase locked systems, Coherent radiation, Extremely high frequency, Two dimensional, Reprints, SIS( Superconductors), Superconducting arrays.

The authors have detected coherent emission from two-dimensional devices, arrays of superconductor-insulator-superconductor (sion) Josephson junctions, 2D arrays emit coherent radiation over a frequency range of 60 to 210 GHz, when coupled to detector junctions through Drude-like junction arrays. The detector junctions exhibit Shapiro steps at frequencies corresponding to the voltage across single-junction arrays. The maximum power from a 10-by-10 junction array coupled to a detector junction occurs at 150 GHz and is estimated to be 0.04 micro W, based on simulations of the detector circuit. By varying the number of array junctions, the array geometry, the junction critical current, and the coupling circuit, the authors have begun determining the essential conditions for observing coherent emission.

200.569
PB92-175538 Not available NTIS National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electricity Div.
Standard for the 90s: IEEE C62.41 Surges Ahead.
Final rept.
F. D. Matzloff, 1991, 6p

Keywords: "Overvoltage," Surge(s), Standards, Electromagnetic compatibility, Circuit protection, Low voltage, Alternating current, Transients, Reprints.

After 10 years of use as a Guide, a revision has been completed and published as an IEEE Recommended Practice, Surge Voltage AC Power Circuits. The article is to be published in a trade magazine circulated to writers, users, and enforcers of transients. The holiday season is fast approaching, which will give them a preview of the forthcoming IEEE document.

200.570
PB92-181126 Not available NTIS National Inst. of Standards and Technology (EIEEL), Boulder, CO. Electromagnetic Fields Div.
Initial Stage Model Evaluation Using Reflecting S-Parameter Data.
Final rept.
E. M. Kuprawiza, and J. E. Rogers, 1991, 6p

Keywords: Circuit analysis, Microwave circuits, Least squares method, Regression analysis, Nonlinear problems, Dielectrics, Reprints, Circuit models, Parameter estimation.

Nonlinear regression is used to fit S-parameter re- sonance data to a full-circuit model that includes coupling factors and self impedances. This model fits the data of existing devices, the simple O-circle model that can be derived from the full-circuit model, but a systematic pattern in the residuals persists. This pattern indicates a discrepancy between the full-circuit model and the observed data. By looking at parameter estimates calculated from subsets of the original data, the authors demonstrate that the cause of this discrepancy also could introduce significant errors in the model's estimated parameter values.

200.571
PB93-129310 Not available NTIS National Inst. of Standards and Technology (EIEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Multilayer Thin-Film Thermal Converters.
Final rept.
J. R. Kinard, D. X. Huang, and D. B. Novotny, 1992, 2p
Sponsored by Ballantine Labs., Inc., Cedar Knolls, NJ.

Keywords: Electrical measurement, Thin films, Prototypes, Design, Reprints, Thermal converters, Multilayers.

Multilayer, thin-film multijunction thermal converters (MJTC's) are being produced at NIST. This paper describes the thermal and physical designs and materials chosen to reduce ac-dc differences. Experimental results on prototype converters are also given.

200.572
PB93-129328 Not available NTIS National Inst. of Standards and Technology (EIEEL), Gaithersburg, MD. Electricity Div.
Interruption Performance of DC- and PTB, and VSL Thermal Voltage Converters from 100 kHz to 1 MHz.
Final rept.
E. R. Katch, R. D. Knight, P. Marlin, M. Klonz, J. P. M. de Vrede, and J. Dissens, 1992, 2p
See also PB83-129336.

Keywords: Electrical measurement, Interlaboratory comparisons, kHz range 100-1000, International Volt- age, Reprints, Thermal converters, Transfer standards, Intercomparison.

Coaxial, thermal voltage converters (TCV's) were hand-carried between NIST, NPL, PTB, and VSL for intercomparison of ac-dc difference from 100 kHz to 1 MHz. This paper briefly describes the methods and underlying principles on which ac-dc difference determinations are based in each laboratory, describes the
transfer standards used, and gives the results of the intercomparisons.

200.573
PB93-129336 Not available NTIS
National Inst. of Standards and Technology (EEL), Gaithersburg, MD. Electricity Div.
Intercomparison of Thermal Converters at NIM, NIST, PTB, SIRI, and VSL from 1 to 100 MHz.
Final rep.
See also PB93-129328.

Keywords: Electrical measurement, Interlaboratory comparisons, MHz range 01-100, International, Voltage, Reprints, *Thermal converters, Transfer standards, Intercomparison.

Coaxial, thermal voltage converters (TCV's) have been intercompared between NIM, NIST, PTB, SIRI, and VSL in this frequency range from 1 to 100 MHz. The intercomparisons were made from 1988 through 1990. This paper briefly describes the methods and underlying principles. The uncertainties determinations are based in each laboratory, describes the transfer standards used, and gives the results of the intercomparisons.

200.574
PB93-129393 Not available NTIS
National Inst. of Standards and Technology (EEL), Gaithersburg, MD. Electricity Div.
Detection of Leakage Errors in Cryogenic Current Comparator Bridges.
Final rep.
R. E. Elmoquist. 1992, 2p

Keywords: *Resistance bridges, *Comparator circuits, Leakage current, Electrical measurement, Leakage(Electrical), Cryogenic equipment, Ratios, Tests, Reprints, Cryogenic current comparators, Error detection.

Several tests have been developed to detect leakage currents in cryogenic current comparator (CCC) resistance ratio bridges used to measure ratios of 100 1000 ohms and 100 5432.0 ohms. The major advantage of the tests is that they can be performed in situ using the full sensitivity of the CCC bridge. In addition, the test procedures can locate the source of some leakage currents. These test results will be used to reduce the leakage of CCC ratio measurements linking NIST working standards to the quantized Hall resistance (QHR) and to the calculable capacitor experiment.

200.575
PB93-135291 Not available NTIS
National Inst. of Standards and Technology (EEL), Gaithersburg, MD. Electricity Div.
Automatic Impedance Bridge for Calibrating Standard Inductors.
Final rep.
N. M. Oldham, O. Petersons, and B. C. Waltrip. 1992, 2p


An impedance bridge that compares standard inductors to chosen test-point inductors is described. A dual channel digitally synthesized source that is adjustable in amplitude and phase is used to balance the bridge. Uncertainties of less than - or - 100 ppm are possible in low audio frequency range for inductors from 10 microH to 10 H.

200.576
PB93-135549 Not available NTIS
National Inst. of Standards and Technology (EEL), Gaithersburg, MD. Electricity Div.

Results of numerical modeling of short-wavelength, in-band quantum efficiency of silicon photodiodes are presented. The important conclusions are: (1) interpreting the data obtained from oxide-removed experiments with the help of numerical quantum efficiency models will provide higher accuracy than can be obtained from the conventional self-calibration approach, and (2) for high-resistivity Si (100) silicon photo diodes, the spectral shape of the internal quantum efficiency (one minus the quantum efficiency) is virtually independent of the quantum efficiency, but the surface-recombination velocity at the oxide-silicon interface.

200.580
PB92-144674 Not available NTIS
Two-Dimensional Analysis of Microbolometer Arrays.
Final rep.
E. N. Grossman, D. G. McDonald, and J. E. Sauvageau. 1990, 6p

Keywords: *Bolometers, Two-dimensional calculations, Infrared detectors, Thermal radiation, Substrates, Arrays, Reprints, *Microbolometers.

A two-dimensional, time-dependent analysis is made of array-compatible bolometers directly deposited onto a single epitaxial slice. It includes both antenna-coupled and surface-absorbing configurations. Unlike previous spherically symmetric treatments, it allows analysis of thermal crosstalk between closely neighboring detectors, and of the effects of finite substrate thickness. In a closely packed array of surface-absorbing detectors, thermal crosstalk generally degrades the array's resolution more severely than optical (diffraction) crosstalk. Diffraction-limited resolution with surface-absorbing detectors is possible only by sacrificing either thermal resistance, and therefore sensitivity, or filling factor. With a minimum substrate thickness of L(min), a close-poled adjacent interaction-limited array of formal resistance of Z(t) = < 0.08/kappa>L(min), where kappa is the thermal conductivity of the substrate, array of antenna-coupled bolometers is not subject to the limitation since the thermally and optically sensitive areas need not be equal.

200.581
PB92-145176 Not available NTIS
National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Technology Div.
Analysis of Linear Birefringence in Single-Mode Fiber Coils: Application to Optical Fiber Current Sensor
Final rep.
See also PB93-223858 and PB93-101431.
Pub. in Jnl. of Lightwave Technology 9, n8 p1031-1037 Aug 91.


Annealing procedures that greatly reduce linear birefringence in single-mode fiber coils are described in detail. These procedures have been successfully applied to coils ranging from 5 mm to 10 mm in diameter and up to 200 or more turns. They involve temperature cycling of the fiber, with the temperature differential between the fiber and the fiber coil held at approximately 850 C. The residual birefringence and induced loss are minimized by proper selection of fiber. The theoretical analysis of these coils is optical fiber current sensors, where they yield small sensors that are more stable than those achieved by other techniques.

200.579
PB92-144625 Not available NTIS
National Inst. of Standards and Technology (EEL), Gaithersburg, MD. Semiconductor Electronics Div.
Numerical Modeling of Short-Wavelength Internal Quantum Efficiency.
Final rep.
J. Geist, D. Chandler-Horowitz, R. Kohler, A. M. Robinson, and C. R. Jame. 1991, 4p

Keywords: *Photodiodes, Mathematical models, Numerical solution, Quantum efficiency, Silicon diodes, Simulation, Reprints.

200.562
PB92-145309 Not available NTIS
National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Technology Div.

ELECTROTECHNOLOGY
Circuits
Compensation for Temperature Dependence of Faraday Effect in Diamagnetic Materials: Application to Optic Fiber Sensors.

200.582
PB92-159443
Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Radiophysics Device. Linear CTCt Diode.

Final rep.

Keywords: Optical detectors. *Mercury cadmium telluride (HgCdTe) Diodes, Photocurrents, Operation, RepRents.
The basic modes of electrical operation of photonic-diode optical radiation detectors are analyzed. The nonlinear current in "voltage mode" measurements can be eliminated by using "current mode" measurements. A HgCdTe photodiode radiometer has been designed, based on this analysis, which measures the current through a biased detector. A built-in calibrating capability in the circuits of the radiometer makes it possible to eliminate the effects of a long-term drift in the bias voltage, thereby achieving a higher precision.

200.590
PB92-175181

Keywords: Ferrimagnetic materials, Yttrium iron garnets, Garnet adductions, Faraday effect, Magnetotropism, RepRents. *Magnetic field sensors, Fiber optic sensors. The class of ferrimagnetic materials known as substituted iron garnets display characteristics which make them suitable for applications of magneto-optics requiring high sensitivity, high spatial resolution, or high speed. Ferrimagnetic substitution, in which specific iron ions are replaced by diamagnetic ions, reduces the saturation magnetization and increases the sensitivity. The authors find that the sensitivity of a composition of garnet-substituted yttrium iron garnet is six times greater than that of pure yttrium iron garnet. The noise equivalent magnetic field for a sample of the material has been measured as approximately 100 pT/Hz (s/n 1/2).
The authors examine measurement issues which arise in the testing of integrated optical devices subjected to ionizing radiation. Many of these issues are not addressed by measurement procedures developed for optical fibers. The authors outline the complexities involved in the measurement of integrated optics as they relate to size, function, and materials. Pertinent waveform parameters for the attention, changes in refractive index, photorefractive effects, and polarization effects. Optical measurement techniques are reviewed, with particular attention paid to spatial and temporal resolution, dynamic range, and the capacity for remote measurement. Suggestions are made to improve the reliability of testing and allow better comparison between laboratories.

200,562

Keywords: *Voltage measuring instruments, *Bi-silicate germanate detectors, *Temperature sensors, Spacecraft instruments, Aircraft instruments, Alteration current, Thermal stability, Birefringence, Silicon dioxide, Reprints, *Optical fiber sensors.

In the paper the authors describe the development of an optical fiber voltage sensor for aircraft and spacecraft applications. Among the most difficult specifications to meet for the application is a temperature-stable sensor (+ 0 -1% from -65 C to 125 C. The stability requires a careful selection of materials, components, and optical configuration with further compensation using an optical fiber temperature sensor located near the sensing element. The sensor is a polarimetric design, based on the linear electro-optic effect in bulk bismuth germanate (Bi4Ge3O12). The temperature sensor is also polarimetric, based on the temperature dependence of the birefringence of bulk SiO2. The temperature sensor output is used to automatically adjust the calibration of the instrument.

200,592

Keywords: *Electric current meters, *Yttrium iron garnet, *Gallium additions, Faraday effect, Sensitivity, Bandwidth, Reprints, *Optical fiber sensors.

The authors demonstrate an optical fiber current sensor based on the Faraday effect in gallium-substituted yttrium iron garnet that has a measured sensitivity of approximately 3.5 deg/A, a noise-equivalent current of about 500 nA/Hertz(1/2) and a 3 dB bandwidth of approximately 10 MHz. The sensitivity-bandwidth product is about a factor of 40 greater than an all-fiber current sensor with the same diameter.

200,594

Keywords: *Integrated optics, *Polarizers, Optical waveguides, Amorphous silicon, Polarization(Waves), Reprints, *Waveguide polarimeters, Photothermal displacement, Claddings.

The authors have fabricated TE- and TM-pass waveguide polarizers with polarization isolations of 42 dB and 35 dB, respectively. The devices were fabricated by the growth of hydrogenated amorphous silicon clad- dings on (111)-H:Si(1 1 1)-ion-exchanged channel wa- veguides in glass. Cladding thicknesses were accurately tuned to permit optimum coupling of either a TE or TM light to the cladding. The authors have also demonstrated that a waveguide polarizer attenuation as high as 760 dB/cm can be measured by using a photothermal detection technique.

200,595

Keywords: *Integrated optics, *Dielectric waveguides, Optical fibers, Amorphous silicon, Semiconductors, Photodetectors, Polarizers, Attenuation, Optimization, Interactions, Coupling, Reprints, Claddings.

Coupling interactions between the low-loss-modes of semiconductor waveguides and the high-loss modes supported by semiconductor waveguide claddings are of prime importance in the design and fabrication of inte- grated optical photodetectors and polarizers. It is desir- able to maximize energy transfer from dielectric wave- guides to semiconductor claddings in order to improve the optical efficiency and performance of devices. The authors have experimentally verified that the intermo- dal coupling of light from a low-loss dielectric guid- e to a highly absorbing semiconductor cladding region is periodic as a function of cladding thickness. Results were obtained by the in situ monitoring of output intensity during the growth and etching of hy- drogenated amorphous silicon on polarisation-pre- served, D-shaped, optical fiber. Strong correlation exists between theoretical and experimental results for both TE and TM polarizations. In the in situ intensity monitoring technique allows for precise control of at- tronometry in clad-waveguide devices enabling the development of TE and TM polarizers and detectors.

200,600

Keywords: *Electric current, Optical measurement, Aerospace systems, Alternating current, Faraday effect, Optical fibers, Polarmetry, Broadband, Avion- ics, Rebars, Structural monitoring.

A robust, accurate, broadband, alternating current sensor using fiber optics is being developed for space applications at power frequencies as high as 20 kHz. It can also be adapted in low and high velocity aerospace, missile, and space power systems and in 400 Hz aircraft systems. It is intrinsically EMI immune and has the added benefit of excellent detection. The system measures the Faraday effect in optical fiber and standard polarimeter measurements to sense electrical current. The primary compo- nent of the sensor is a specially treated core of single- mode optical fiber, through which the current carrying conductor passes. Improved precision is accom- plished by temperature compensation by means of sig-
nals from a novel fiber-optic temperature sensor embedded in the sensing head. This paper reports on the technology developed in the sensor and also relates the results of precision tests conducted as various temperatures within the wide operating range. It also shows the results of early EMT tests.

Power & Signal Transmission Devices


Keywords: *Transmission lines, *Capacitance, Characteristic impedance, Microwave equipment, Electrical measurement, Metrology, Reprints, *Coplanar waveguides, Monolithic microwave integrated circuits.

The capacitance of coplanar lines is measured with two new techniques, one using the resistance of the line and the other that of a resistor embedded in the line. The results of both measurements agree closely with calculations. A technique for directly comparing the capacitance of two similar transmission lines is also demonstrated. The relevance of these measurements to the determination of characteristic impedances is discussed.


Keywords: *Characteristic impedance, Microwave circuits, Integrated circuits, Transmission lines, Coaxial cables, Electrical reactivity, Reprints.

Although a fundamental parameter of transmission lines, the characteristic impedance is difficult to measure accurately. We suggest a method by which it may be easily determined from a measurement of the propagation constant. The method is based on a rigorous analysis from first principles using explicit and realistic approximations which include the effects of imperfect conductors. Results of numerical studies of lossy coaxial lines and of experiments with coplanar waveguides indicate that high accuracy is possible.


Keywords: *Transmission lines, *Electrical measurement, Coaxial cables, Permittivity, Permeability, Scattering, Optimization, Waveguides, Reprints.

The transmission/reflection and short-circuit-line methods for complex permittivity and permeability determination in transmission line sample holders are examined. New equations for permittivity are presented that eliminate the ill-behaved nature of the commonly used transmission/reflection methods at frequencies corresponding to integer multiples of one-half wavelength in the sample. The equations are also independent of reference plane position. Measurement results and an error analysis are presented. In addition, the scattering equations are solved using an optimization algorithm. The advantages and disadvantages of an optimization approach are discussed.


Keywords: *Transmission lines, Coaxial cables, Maxwell equations, Microwave, Propagation, Reprints, Telegrapher equation.

Exact field equations for a lossy coaxial transmission line with an infinite outer conductor are presented. The comparison of the exact solution is solved to obtain an exact propagation constant from which errors in the usual microwave approximation and an alternative full frequency range approximation are calculated. The calculations show that the microwave approximation, although containing a large relative error at the lower frequencies, is still useful in practical applications.


Keywords: *Transmission lines, Coaxial cables, Maxwell equations, Characteristic impedance, Admittance, Reprints, Distributed systems.

Principal mode field equations that satisfy Maxwell’s equations in first order in the distributed line resistance of the coaxial conductors are presented. The associated characteristic admittance and distributed line parameters are calculated. The distributed line resistance is seen to be significantly different from previous results calculated in the literature.


Keywords: "Electromagnetic shielding, *Transmission lines, Reverberation chambers, Plane waves, Polarization, Aperatures, Correction, 'Coaxial air lines, *TEM cells."

Coupling through circular apertures in the shields of a coaxial cable is studied theoretically and experimentally. Polarizability theory is used to compute the effective dipole moments that excite the transmission line in each successive section of the region. Measurement of the shielding effectiveness of both structures were made in a reverberation chamber over wide frequency ranges. Agreement between theory and measurements is generally within +0 or -10 dB. Recommendations for improvements in the equations and theory are made for achieving closer agreement that would be desirable for accurate standard for shielding effectiveness measurements.

200.810 PB92-205376 PC A06/MF A02 National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Fields Div.

Technical note.
Also available as NIST Special Publs. as SN003-003-03164-0. Also see PB91-171959.

Keywords: *Transmission lines, *Permeability, *Microwaves, *Frequency response, Transmission circuits, Signal quantization, Microwave frequencies, Waveguides, Frequency measurement, Reprints.

The transmission/reflection and short-circuit line methods for measuring complex permittivity and permeability of materials in waveguides and coaxial lines are examined. The complex permeability and permittivity are developed from first principles. In addition, new formulations for the determination of complex permittivity and permeability independent of reference plane position are derived. For the one-sample transmission/reflection method and two-position short-circuit line measurements, the solutions are unstable for frequencies corresponding to integral multiples of one-half wavelength in the sample. For two-sample methods the solutions are unstable for frequencies where both samples resonate simultaneously. Criteria for selecting sample lengths to maintain stability. An optimized solution is also presented for the scattering parameters. The solution is stable over all frequencies and is capable of reducing scattering parameters on materials with higher dielectric constant. An uncertainty analysis for the various techniques is presented with two-sample results are compared. The errors incurred due to the uncertainties in the parameters, length measurement, and reference plane position are used as inputs to the uncertainty models.

Recent results in microwave circuit theory define the exact equivalent circuit parameters of quasi-TEM transmission lines. Here we illustrate how these parameters differ from their conventional counterparts in the model such as field penetration into the conductors. The behavior of the equivalent circuit parameters permits a comprehensive characterization of transmission lines using microwave measurement techniques.

PB93-131407
(Order as PB93-131381, PC A07)
National Inst. of Standards and Technology, Boulder, CO.
General Waveguide Circuit Theory.

Keywords: *Waveguides, Characteristic impedance, Electronic circuits, Microwave circuits, Transmission lines, Traveling waves, Network analyzers, Isotropy, Reciprocity.

The work generalizes and extends the classical circuit theory of microwave waveguides. Unlike the conventional theory, the present formulation applies to all waveguides composed of linear, isotropic material, even those involving lossy conductors, and hybrid modes fields, in a fully rigorous way. Special attention is given to distinguishing the traveling waves, constructed only from the fields of the same mode, from other arbitrary fields, and relationships among them, some newly discovered, are derived. New ramifications of reciprocity are developed. Measurement of various network parameters is given extensive treatment.

PB93-125490
Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Traffic Div.
Dynamic Strength Tests on Electrical Cables Specified for Airport Landing Structures.

Keywords: *Dynamic tests, *Electric wire, *Electric connectors, *Electrical strength, Loads(FoRCes), Mechanical properties, Impact tests, Airports, Air traffic control, Failure, Reprints.

A study was conducted at the National Institute of Standards and Technology (NIST) to develop dynamic strengthabsorption energy absorption characteristics for innovative developed in breaking electrical cables specified for airport landing structures. Dynamic testing was conducted on an aircraft wing impacting an electrical cable at 75 knots (86 MPH), were conducted on four types of cable and break-away connectors. For these dynamic impact tests, a unique testing machine was designed and constructed. The test machine can perform instrumented impact tests on vertically supported cables up to 6.1 meters (20 feet) in length and at varying impact locations. Impactor velocity is monitored prior to impact, and during impact, and fracture of the cable. Load time traces are recorded digitally for the entire loading and fracture sequences, from which peak load and corresponding time to fracture are computed. The dynamic impact test machine is described in this paper, and dynamic test results are given for the cables and break-away connector.

PB92-171065
Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Fracture Behavior of Electronic Ceramics.

Keywords: *Dielectrics, *Fracture properties, *Ceramics, Fractures(Materials), Crack propagation, Ferroelectrics, Low Temperature, Microwave, MIcrostructure, Crackling(Fracturing), Electronic equipment, Reprints.

The paper reviews the fracture behavior, e.g., the strength, fracture toughness and susceptibility to environmentally enhanced crack growth, in electronic materials such as barium titanate, lead zirconate titanate (PZT), capacitor ceramics, and the new, high temperature superconductors. All of these materials are known to exhibit critical fracture toughness, which depends on grain size, chemical composition and crystal structure. The microstructure and the electronic ceramics has a direct effect on both their strength and fracture toughness. The paraelectric to ferroelectric phase transition in barium titanate, PZT, and related ceramics induces internal stresses into the materials which can provide an additional driving force for flaw extension. The magnitude of such stresses calculated from strength data is in good agreement with that predicted by dielectric measurements. Crack-tip interactions in the ferroelectric structure as well as crack deflection, etc., give rise to increased fracture toughness. Finally, crack growth rates in these materials are regulated by the presence of moisture in the environment, which can significantly increase the probability of failure.

PB92-171073
Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.


Keywords: *Capacitors, *Ceramics, *Dielectrics, *Crack propagation, Barium titanates, Crackling(Fracturing), Crack, Fractures, Ceramic Materials, Electrodes, thermal stresses, Reprints.

The paper reviews the brittle fracture behavior of dielectric ceramics such as barium titanate, and describes some of the relationships between defects such as cracks and electrical degradation and failure of multilayer capacitors. Stresses arising from the ferroelectric phase transition in these dielectrics are shown to play a part as a driving force for crack growth. In addition, possible contributions to failure from stresses arising from thermal excursions in crack propagation, electrical stress are discussed. Stresses arising from a short between the electrodes in multilayer capacitors are shown to be related to the growth of cracks. The brittle nature of dielectric can be used to predict the onset of these types of failures based upon fracture mechanics techniques is described. Possible effects of these stresses arising from thermal excursions in crack propagation, electrical stress are discussed.

PB92-198554
(Order as PB92-130430, PC A03)
National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Fields Div.
Evaluation Service for Low-Frequency, Low-Frequency, Frequency, Quality assurance, Error analysis, Uncertainty, Capacitors, US NIST.

The document describes the three-terminal, capacitance calibration service at 100 kHz and 1 MHz at the National Institute of Standards and Technology, Boulder Laboratories. The document discusses the purpose of the service, contact points for initiating the service, what capacitors are appropriate for calibration, the measurement methods used, the instrumentation used for the measurements, and an analysis of the measurement methods and the confidence limits, the calibration uncertainties for the stated frequencies and capacitances. Finally, the document discusses the quality control programs used at NIST to ensure the integrity of the calibration.

PB92-197482
Not available NTIS
National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Fields Div.
Domain Effects in Faraday Effect Sensors Based on Iron Garnets.

Keywords: *Magnetic measurement, Magnetic anisotropy, Magnetic fields, Magnetic domains, Magnetic films, Magnetooptics, Faraday effect, Thin films, Diffraction, Yttrium iron garnets, Reprints, *Fiber optic sensors, Magnetic field sensors.

Domain effects in Faraday effect fiber-optic magnetic field sensors which employ thick films and bulk crystals are outlined. The performance of different designs. Ion-garnet films with uniaxial magnetic anisotropy exhibit domain-induced diffraction which produces a signal and signal even in films for which the net magnetization is exactly linear with the applied field. Fortunately, differential detection eliminates the nonlinearities. Moreover, differential detection applied to these films produces a signal which is linear regardless of the value of the saturation Faraday rotation. The behavior of the field dependence of that of other magnetic materials, which exhibit sinusoidal output signals. Domain effects in bulk crystals, which exhibit three-dimensional domain structure, are less evident than in films.
ELECTROTECHNOLOGY

Resistive, Capacitive, & Inductive Components


Keywords: *Superconducting junctions, Tunneling/Electronics*, Resonance frequency, Resonators, Quasi particles, Extremely high frequency, Reprints, *SIS(Superconductors) quantum susceptance.*

The authors have made the first direct measurement of the quantum susceptance which arises from the reactive part of quasiparticle tunneling in a superconductor-insulator-superconductor junction. The junction is coupled to an antenna and a superconducting microstrip to form a resonator. The resonant frequency is measured from the response of the junction to broadband radiation from a Fourier transform spectrometer. A 10% shift of the resonant frequency, from 73 GHz to 87 GHz, is observed that arises from the change of the quantum susceptance of the junction with dc bias voltage. This shift is in excellent agreement with the Womerther-Tucker theory, which includes the quantum susceptance. This quantum susceptance should exist in all tunnel devices whose nonlinear I-V-characteristics are due to elastic tunneling.


Keywords: *Magnetic measurement, Magnetic anisotropy, Magnetic domain, Magnetic fields, Magnetooptics, Faraday effect, Thick films, Vertical magnetization, Yttrium iron garnets, Reprints, Fiber optic sensors, Magnetic field sensors.*

Thick films of modified Yttrium Iron Garnet (YIG) with unusual magnetic anisotropy can be used in fiber optic magnetic field sensors. Theory and experiments show good sensitivity and upper frequency limits between 1 million and 1 billion Hz.


Sponsored by Defense Nuclear Agency, Washington, DC.

Keywords: *Polymeric films, Dielectric properties. Electrical insulation, Electrical measurement, Electrical breakdown, High voltage, Error analysis, Thin films, Charge amplifiers.*

A generalized method for measuring the dielectric constant of a film at high applied fields is outlined. By using a low output impedance generator and a zero input voltage charge amplifier, a three-terminal configuration becomes possible. This method allows a complete specimen to be measured without removing from the measured parameters any influence of the connecting leads. The measurement advantages of using a charge amplifier are explained. The design for the charge amplifier is given that provides good immunity from any damage if the sample should experience an electrical breakdown(s). The accuracy of the method is reported. Results are presented that show data with an uncertainty of <1% are possible in well defined samples.

200.620 PB93-129325 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.


Keywords: *Electrolavation, Electrical insulation, Adhesion, Static electricity, Silicon dioxide, Mica, Charge transport, Electrical discharges, Reprints.*

Simultaneous measurements of surface force and surface charge demonstrate strong attraction due to the spontaneous charging of electrical charge from one smooth insulator (mica) to another (silica) as a result of some, nonsliding contact in dry nitrogen. The mean attraction charge density is 5 x 10^4 coulombs per square meter after contact. The work required to separate the charged surfaces is typically 6 Reprints per square meter, comparable to the fracture energies of ionic-covalent materials. Observation of partial gas discharges when the surfaces are approximately 1 micrometer apart gives valuable insight into the charge separation processes under strong electrical phenomena in general.


Keywords: *Resistors, Electrical measurement, Calibration, Automation, Reprints, Resistance measurement, Resistance standards, Loss of charge method.*

An automated method for measuring high-valued resistors is described. It is based on a loss-of-charge method, involving the discharge of a standard capacitor through an unknown resistor. The system is intended to calibrate standard resistors ranging from 10(10) ohms to 10(14) ohms.


Keywords: *Electrical resistance, Comparator circuits, Cryogenic equipment, SQUID devices, Reprints, Cryogenic current comparators, Hamon resistors, Transfer standards, Quantum resistance.*

Cryogenic current comparators (CCC's) are being used at NIST to verify Hamon-type resistance scaling techniques from the 1-ohm level to the 100-ohm, 1-k ohm, 6453-20-ohm, and 10-k ohm resistance levels. Measurements comparing the 100/1 ratio of a CCC to that of a Hamon transfer standard agree to within 0.01 ppm - the practical limit of accuracy for a Hamon standard. The higher accuracy ratios and higher sensitivities of CCC bridges will make it possible to lower the uncertainties associated with resistance scaling at NIST by a factor of two or more.


Keywords: *Resonance bridges, Kelvin bridges, Resistor bridges, Electric bridges, Electrical measurement, Voltage dividers, Electrical impedance, Phase angle, Frequency dependence, Automation, Reprints.*

An automated guarded ac Kelvin bridge has been developed for measuring the frequency dependence of precision resistors from the 1-ohm to the 1-M ohm level over the frequency range 10 Hz to 10 kHz. The main features consist of two-stabilized linear inductive voltage dividers. A guard inductive voltage divider drives an RC network to provide a known phase shift in addition to balance the quadrature component of the bridge. A bridge substitution technique is used in which the unknown is compared to a standard of known impedance. The bridge resolution is better than 0.1 ppm for the in-phase and quadrature components.

Semiconductor Devices


Keywords: *Microelectronics, Electromagnetic interference, Signal processing, Optical fibers, Magnetostrictive materials, Millimeter waves, Microwaves, Antennas, Electrical measurement, Electrical power, Progress report, Abstracts.*

This is the twenty-ninth issue of a quarterly publication providing information on the technical work of the National Institute of Standards and Technology, Electronics and Electrical Engineering Laboratory. The issue of the EELE Technical Publication Announcements covers the second quarter of calendar year 1991. Abstracts are provided by technical area for papers published this quarter. Major subject headings include: Fundamental Electrical Measurements; Semiconductors and Diodes; Signal Acquisition, Processing, and Transmission; Electrical Systems; Additional Information, 1992 EELE Calendar; EEL test set; Key Contacts in Laboratory; Laboratory Organization.


Keywords: *Lithography, Scanning tunneling microscope, Aluminum gallium arsenide, Molecular beam epitaxy, Pattern making, Fabrication, Substrates, Masking, Epitaxy, Reprints, Nanolithography, Gallium indium arsenides, Heterostructures.*

Nanometer-scale pattern generation on III-V semiconductor devices in Gaithersburg, MD. relies on combining a scanning tunneling microscope (STM) operating in air. The sample substrates, consisting of arsenic-capped, epitaxial layers of n-doped GaAs, AlxGa1-xAs, and InyGa1-yAs were prepared by molecular beam epitaxy and characterized by time-of-flight secondary-ion mass spectrometry and x-ray photoelectron spectroscopy. The direct patterning of features of width < or = 50 nm on GaAs and In(0.2)Ga(0.8)As surfaces is shown to be the result of the formation of a strong bonding surface oxide induced under high electric field conditions existing between the scan tip and the substrate. The significance of STM pattern generation of nanometer-scale oxide masks for use in the fabrication of low-dimensional heterostructures is discussed.

200.627 PB92-144708 Not available NTIS National Inst. of Standards and Technology (EEL), Gaithersburg, MD. Semiconductor Electronics Div.
Lattice Damage and Atomic Mixing Induced by As⁺ (−++) and In⁺ and Thermal Annealing in AlAs/GaAs Multiple Quantum-Well Structures.

Final rept.
Pub. in Jnl. of Applied Physics 70, n8 p4181-4189, 15 Oct 91.

Keywords: Ion implantation, Radiation damage, Crystal defects, Molecular beam epitaxy, Aluminum arsenides, Gallium arsenides, Arsenic ions, Annealing, Diffusion, Reprints, Quantum wells, Heterostructures.

The lattice damage and the nature of the atomic intermixing of Al and In induced by As⁺ (−++) implantation and thermal annealing in AlAs/GaAs multiple quantum-well structures were investigated. The photoluminescence spectra, which show multiple peaks after implantation and annealing, were analyzed based on the shifts of the excitonic peaks arising from quantum wells located at different depths. The depth profiles of intermixing were obtained using a procedure of successive layer-by-layer chemical etching followed by photoluminescence measurements. The results showed that both direct collisions and interdiffusion are responsible for the atomic mixing. For the samples implanted with ion doses below 10 to the 14th power/0.5 cm and annealed at 650 °C, the optical activation from radiation damage is appreciable. However, the interdiffusion becomes important only at temperatures near and above 800 °C.

202.629
PB92-144765 Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Gas and Particulate Science Div. Kinetics and Structure of Nitride Crystalization in N⁺ (−++) Implanted Silicon.
Final rept.
Pub. in Jnl. of Materials Research 4, n2 p394-398 Mar/ Apr 89.

Keywords: Silicon nitrides, Transmission electron microscopy, Electron diffraction, Optical microscopy, Ion implantation, Nitrogen ions, Crystalization, Microelectronics, Surface Science, Laser induced gallium mass spectrometry, SOI(Semiconductors).

Silicon nitride is used in various ways in microelectronics for dielectric insulation, including insulating layers in silicon-on-insulator technology, to provide passivation layers, and as a diffusion mask. Busted layers of silicon nitride can be synthesized by ion implantation of nitrogen followed by high-temperature annealing. The precise accurate measurement of feature dimensions on photomasks is a concern for microelectronics. Preparing photomask masters of silicon nitride is a current requirement.

200.630
Special pub. (Final).
F. J. Fretz, T. W. Faber, and J. E. Potzick. Jan 92, 52p NIST/SP-260/117
Also available from Supt. of Docs. as SN003-003-00512-6.

Keywords: Integrated circuits, Dimensional measurement, Line width, Optical microscopes, Calibration, Optical measurement, Process control, Photomasks, Control charts, Precision, Accuracy, Uncertainty, Chromium, Standard reference materials.

The precise accurate measurement of feature dimensions on photomasks, such as those used in the production of integrated circuits, becomes increasingly difficult as the dimensions approach the wavelength of the light used to make the measurement. The undesirable effects of optical diffraction obscure the location of the feature edges. Recent standards and antireflecting coatings, along with the uncertainty of the measurement. Standard Reference Material SRM 475 was developed for use in calibrating optical microscopes for measuring linewidths in the range of 0.9 to 18.0 micrometers on antireflecting-chromium photomasks. The SRM, the measurement system, and the procedures used to calibrate the SRM are described.

The algorithm for determining the line edge location uses a threshold criterion derived from analysis of microcscope image profiles. The profiles are predicted by computer modeling based on the theory of partial coherence. One of the SRM is used by different users to calibrate their own microscopes.

200.631
Final rept.
D. L. Blackburn. 1991, 6p
PB92-153998 National Inst. of Standards and Technology (EEL), Gaithersburg, MD. Semiconductor Electronics Div.


Final rept.
D. L. Blackburn. 1991, 6p
PB92-153998 National Inst. of Standards and Technology (EEL), Gaithersburg, MD. Semiconductor Electronics Div.

Failure mechanisms and nondestructive testing of power bipolar and MOS gated devices are discussed. Bipolar transistor failures are initiated at relatively low voltages and temperatures, while MOS-gated devices tend to fail at higher temperatures. Modem MOS gated device failure is initiated at temperatures far in excess of those normally considered to be safe and transfusion nondestructive testing. The key to nondestructive testing is the ability to sense the onset of failure and to then remove all power from the failing transistor before the device temperature rises high enough to cause damage.

200.632
PB92-154160 Not available NTIS National Inst. of Standards and Technology (EEL), Gaithersburg, MD. Precision Engineering Div.

Failure mechanisms and nondestructive testing of power bipolar and MOS gated devices are discussed. Bipolar transistor failures are initiated at relatively low voltages and temperatures, while MOS-gated devices tend to fail at higher temperatures. Modem MOS gated device failure is initiated at temperatures far in excess of those normally considered to be safe and transfusion nondestructive testing. The key to nondestructive testing is the ability to sense the onset of failure and to then remove all power from the failing transistor before the device temperature rises high enough to cause damage.

200.635
Final rept.

Keywords: Film thickness, Dimensional measurement, Ion implantation, Ellipsometry, Oxygen, Models, Errors, Reprints, SIMOX.

The propagation of errors in the model parameters and the physics of the experimental techniques are important. The simulation of non-destructive testing by ion implantation of oxygen structure by using reflection and ellipsometry. Both methods give comparable values for the layer thickness. Both the ratio of convergence and the values of uncertainty tend to be larger with reflectionometry than with ellipsometry.

200.635
PB92-154517 Not available NTIS National Inst. of Standards and Technology (EEL), Gaithersburg, MD. Semiconductor Electronics Div.

The authors report a novel method of GaAs substrate preparation which imparts significantly improved topographical and chemical uniformity to the surface. The procedure, employing an aqueous PB92/(NH4)2SO4 solution, leaves the surface in a highly ordered state and resistant to air oxidation for periods of a day or more without the presence of foreign chemical layer such as sulfur. Surface quality was determined by scanning tunneling microscopy (STM), time-of-flight secondary ion mass spectrometry, reflection high-energy electron diffraction, and x-ray photoelectron spectroscopy. The remarkable stability and smoothness of treated III-V surfaces are illustrated by STM imaging of an Ala0.5Ga0.49As/GaAs superlattice in air. The superlattice consisited of periodic alternating AlGaAs/GaAs layers of various thicknesses from 10 to 1000 nm.

202.629
PB92-154521 Not available NTIS National Inst. of Standards and Technology (EEL), Gaithersburg, MD. Semiconductor Electronics Div. GaAs Test Standards By Field Experience: High-Energy Tests and Varistor Performance.
Final rept.
C. Fenimore, and F. M. Martzloff. 1990, 7p
Sponsored by Department of the Army, Washington, D.C. 20310-5000.

Keywords: Varistors, Surges, Tests, Standards, Failure, Specifications, Electric current, Reprints.

New, high-energy surge tests are emerging in IEEE and IEC (International Electrotechnical Commission) standards. Field experience validates published standards for validating or invalidating proposed standards. A proposal under consideration by the IEC involves so-called "so-called" methods that a variety of test conditions, commonly used in protecting load equipment, if subjected to the test, would almost certainly fail. Yet, reported varistor failure rates do not reflect such a situation. Thus, a re-examination of the premises that led to the proposed test specifications appears necessary. Potential high-energy tests as additional wavetforms in the new version of IEEE C62.41, on the other hand, lead to current and energy levels that do not place typical varistors in immediate jeopardy. Thus, they appear more consistent with field experience.
ELECTROTECHNOLOGY

Semiconductor Devices


Final report.


Keywords: Ion implantation, Microstructure, Annealing, Oxygen, Wafer Reprints, "SOI(Semiconductors), SIMOX.

The final microstructure of silicon-on-insulator material fabricated by oxygen implantation (SIMOX) is dependant on the sum of all of the processing steps used to produce the wafer. There have been many reports on microstructures after implantation or annealing, but there is only limited information on microstructural changes occurring during the intermediate stages of processing, in particular, during the thermal cycling step. In the work, the authors report on the microstructural changes in HT SIMOX at various stages in the ramping process by simulating the thermal treatment with two hour anneals at intermediate temperatures.

200.639
PB92-159542
Not available NTIS
National Inst. of Standards and Technology (EIEE), Gaithersburg, MD. Semiconductor Electronics Div.

Office of Microelectronics Programs at NIST.

Final report.


Pub. in NIST Newsletter 9, n9 p34-Sep 91.

Keywords: "Microelectronics, Line width, Chemical vapor deposition, Electronic packaging, Plasma etching, Ellipsometric measurement, Measurement, Length, Reprints, US NIST.

The NIST linewidth measurement program has produced several photomask linewidth standards. While comparing a development of these standards, the Precision Engineering Division is working on optical overlay measurement, optical modeling, and length standards to be used with scanning electron microscopes.

200.640
PB92-159417
Not available NTIS
National Inst. of Standards and Technology (EIEE), Gaithersburg, MD. Semiconductor Electronics Div.

Analysis for the Characterization of Oxygen Implanted Silicon (SIMOX) by Spectroscopic Ellipsometry.

Final report.


Keywords: Transmission electron microscopy, Ion implantation, Silicon dioxide, Ellipsometry, Thickness, Models, Reprints, "SIMOX.

Samples of SIMOX have been prepared by implantation in a high-current implanter and by annealing at 1300 C for 6 hours. Transmission electron microscopy reveals a structure that is different from the expected SIMOX structure. Spectroscopic ellipsometry has been used to analyze these structures. Ellipsometric measurements were collected at an angle of incidence of 75.5 deg, with photon energies from 1.5 to 5.0 eV, and using a rotating polarization configuration. The measurements were analyzed with three models: a three-layer model, a four-layer model, and a five-layer model. The five-layer model provided the best fit of the three. The model identified a layer of crystalline Si inclusions (a SiO2) layer. A method is presented that provides initial estimates for the thickness of the top three layers to help start the regression analysis.

200.641
PB92-159722
Not available NTIS
National Inst. of Standards and Technology (EIEE), Gaithersburg, MD. Semiconductor Electronics Div.

NIST Linewidth Measurement Program.

Final report.


Pub. in NIST Newsletter 9, n9 p4-5, Sep 91.

Keywords: "Microelectronics, Dimensional measurement, Photomasking, "Line width, "Standards, Scan- ning electron microscopy, Length, Reprints, US NIST.

The NIST linewidth measurement program has produced several photomask linewidth standards. While continuing development of the standards, the Precision Engineering Division is working on optical overlay measurement, optical modeling, and length standards to be used with scanning electron microscopes.

200.642
PB92-159730
Not available NTIS
National Inst. of Standards and Technology (EIEE), Gaithersburg, MD. Semiconductor Electronics Div.

Direct Experimental Evidence for a Dominant Hole Trapping Center in SIMOX Oxides.

Final report.


Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) SOI Technology Conference, Key West, FL, October 2-4, 1990, p164-165.

Keywords: "Hole traps, Electron paramagnetic resonance, Oxides, Reprints, "SOI(Semiconductors), SIMOX.

Results show that a combination of EPR measurements and charge injection sequences has great potential in unraveling the mysteries of trapping in SOI buried oxides.

200.639
PB92-159243
Not available NTIS
National Inst. of Standards and Technology (EIEE), Gaithersburg, MD. Semiconductor Electronics Div.

Measurement of Interface Defects in Gated SIMOX Structures.

Final report.


Contract NNA-158-800


Keywords: "Photoreactors, "Film resistors, Crystal defects, Electron traps, Hole traps, Silicon films, Ion implantation, Thin Films, Photoc conductivity, Annealing, Interfaces, Oxygen, Wafer Reprints, Photoinoduced transient spectroscopy, SOI(Semiconductors), SIMOX.

Defects in gated or ungated thin film resistors have been characterized by photoinoduced transient spectroscopy (PTS). The resistors were fabricated with n- or p-type SIMOX (Separation by Implantation Oxygen) wafers implanted with 200 keV oxygen to 1.8 x 1015/cm2 at 100 keV power/cm2 current total fluence. One wafer used for gated resistor fabrication was implanted at 959 C and sequentially annealed at 1225 C for 4 h in argon (plus 0.5 percent oxygen) followed by 2 h in nitrogen (plus 0.5 percent oxygen). Another wafer used for ungated resistor fabrication was implanted at 959 C and sequentially annealed at 1275 C for 2 h in nitrogen (plus 0.5 percent oxygen). PTS data indicate that electron or hole traps in the lightly doped silicon layer is different at the film-silica interface. The authors estimate the average interface trap density in the SIMOX structure in the 10 to the 11th power/cm2 range.

200.643
PB92-159166
Not available NTIS
National Inst. of Standards and Technology (EIEE), Gaithersburg, MD. Semiconductor Electronics Div.

SIM Study of the Deuterium Distribution in SIMOX Buried Oxides.

Final report.


Keywords: "MOS transistors, "Deuterium, "Hydrogen, Silicon dioxide, Reprints, "SIMOX, Secondary ion mass spectroscopy, Buried oxides.

Hydrogen in SiO2 has been extensively studied and used to create a series of thin layer structures for degradation measurements during hot electron stressing or exposure to ionizing radiation. In the paper, we have used SIMS analysis of various oxide layers grown on Si to investigate the interaction of hydrogen with the buried oxide.

200.644
PB92-165224
Not available NTIS
National Inst. of Standards and Technology (EIEE), Gaithersburg, MD. Semiconductor Electronics Div.

ESR Study of E' Trapping Centers in SIMOX Oxides.

Final report.


See also PB92-165223.


Keywords: Electron spin resonance, Electron traps, Hole traps, Silicon dioxide, Vacuum ultraviolet radiation, Reprints, "SIMOX, Buried oxides.

The authors explore E' trapping centers in separation by implanted oxygen (SIMOX) buried oxides with electron spin resonance (ESR) and capacitance vs. voltage (CV) measurements. Through the use of vacuum-ultraviolet and ultraviolet illumination combined with ESR and CV measurements, they present evidence that E' centers are important in SIMOX trapping, and that thermal oxide trapping and SIMOX ion implantation involve different mechanisms.
Electro Snobber Resonance Study of E Trapping in SIMOX Oxides.

See also PB92-165524.

In IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science 38, n° 6. 1991, 1011-1021.

Keywords: Electron spins, Spin resonance, Vacuum ultraviolet radiation, Electron traps, Hole traps, Silicon dioxide, Reprints.

The authors examine electron spin resonance and capacitance versus voltage measurements with vacuum ultraviolet and ultraviolet light sequences to study E trapping in a variety of SIMOX-buried oxides. The oxides had all been annealed above 1300°C. Their results clearly show that E centers play an important role in determining the trapping behavior of these oxides. This role is considerably different from the role that E centers play in thermal oxides.

200.646

PB92-165257 Not available NTIS National Inst. of Standards and Technology (EEL), Gaithersburg, MD. Semiconductors Devices.

Evaluation of Secco Etch Technique for Determination of Dislocation Densities in SIMOX Wafers.


Keywords: Dislocations, Density measurement, Silicon dioxide, Wafers, Reprints, SIMOX, Secco etch technique.

The greatly improved quality of Separation by Implantation of Oxygen (SIMOX) material now being routinely produced has improved the measurement of dislocation densities by plan-view transmission electron microscopy extremely impractical because of the large areas that must be examined. We report on an extensive study of a Secco etch process for determining dislocation densities that was performed by three different groups using nine SIMOX wafers from the same lot.

200.647

PB92-165596 Not available NTIS National Inst. of Standards and Technology (EEL), Gaithersburg, MD. Semiconductor Devices.

Analytical Modeling of Device-Circuit Interactions for the Power Insulated Gate Bipolar Transistor (IGBT).


See also PB92-165506.

In IEEE (Institute of Electrical and Electronics Engineers) Transactions on Industry Applications 26, n° 5. 1990, 1029-1039.

Keywords: Bipolar transistors, Computerized simulation, Circuit protection, Interactions, Reprints, Insulated gate bipolar transistors, Circuit simulators, Power transistors.

The device-circuit interactions of the power insulated gate bipolar transistor (IGBT) for a series resistor-inductor load, both with and without a snubber, are simulated. An analytical model for the transient operation of the IGBT, previously developed, is used in conjunction with the load circuit state equations for the simulations. The simulated results are compared with experimental results for all conditions. Devices with a variety of base lifetimes and turn-off conditions were simulated. For the fastest devices studied (base lifetime ~ 0.3 microsec), the voltage overshoot of the series resistor-inductor load circuit approaches the device voltage (500 V) for load inductions greater than 1 microH. For slower devices, though, the voltage overshoot is much less, and a larger inductance can therefore be switched without exceeding the device voltage of the series resistor-inductor load circuit.

200.650

PB92-165810 Not available NTIS National Inst. of Standards and Technology (EEL), Gaithersburg, MD. Semiconductor Devices.

Oxygen Bubbles, Formation and Evolution during Oxygen Implantation and Annealing of Silicon-on-Insulator Materials.


See also PB90-187774.


Keywords: Transmission electron microscopy, Integrated circuit fabrication, Ion implantation, Annealing, Bubbles, Oxygen, Reprints, SOI(Semiconductors), SIMOX.

Silicon-on-insulator material fabricated by high dose oxygen implantation is a material increasingly used for higher speed and radiation hard circuits. During implantation a variety of structural changes occur, including the formation of defects, bubbles, precipitates, and amorphous regions. In the presence of bubble formation and evolution has been observed. We report the first observation of spherical, randomly distributed precipitates near the top surface of the silicon layer. El-Ghor et al. further examined these precipitates and proposed that they were cavities filled with oxygen. Mazur confirmed the presence of spherical cavities filled with oxygen in the silicon top surface region in the 1MÅs cm as-implanted samples. In this work, transmission electron microscopy was used to investigate the effect of implantation conditions on the bubble formation and the effect of subsequent annealing conditions on the evolution of bubbles.
ELECTROTECHNOLOGY

Semiconductor Devices

Accuracy of the Charge Pumping Technique for Small Geometry MOSFETs.


Keys: *Field effect transistors, *MOSFETs, Two-dimensional calculations, Mathematical models, Computerized simulation, Electrostatics, Hole traps, Interface states, Reprotraps.

The channel length dependence of the charge pumping current for MOSFETs is investigated using a two-dimensional simulation technique. The dependence of charge pumping signal of MOSFETs of various channel lengths is observed. The results show that the signal charge for MOSFETs with different channel lengths agrees well with the agreement of the shape of the curves. It is found that as the effective channel length decreases, the measured charge pumping current decreases, the effect of charge pumping signal that results when the channel length decreases is due to the nonuniformity of surface potential across the channel caused by source/drain proximity. Using the charge pumping technique to measure inter-related parameters of advanced devices with an effective channel length less than 1 nanometer will result in unacceptable errors.

200.265

Keywords: *Persistent currents, *Photoconductivity, *Silicon films, Electron transfer, Hole traps, Potentials, Reprints, *Silicon resistors, *SIMOX.

Persistent photoconductivity has been seen in thin silicon resistors fabricated with SIMOX material at temperatures between 60 and 220 K. The effect has been attributed to the depletion of carriers near the interface between the top silicon layer and the buried oxide, while the carriers due to the defect concentration has been proposed as a possible channel for the interface. The depletion of carriers is accompanied by a built-in field on the order of 10000 V/cm, which causes a potential barrier that is about a quarter of the energy gap of silicon. The theory of the recombination kinetics of majority carriers with minority carriers trapped at the energy levels found in the interface is described. Both the possibilities of tunneling and thermal activation have been considered. The results show that thermal activation dominates at the temperatures of the authors’ measurements in SIMOX material, while at lower temperatures tunneling would dominate.

200.265

Keywords: *Integrated circuits, *Calibration, Microwave circuits, Network analyzers, Error analysis, Reprints, *Monolithic microwave integrated circuits. A modification of the TRL (through-reflection-line) calibration method provides enhanced network analyzer calibrator for purposes of MMIC measurement. The method uses multiple, redundant transmission line standards and relies on a statistical procedure to reduce the effects of random contact error. The covariance matrix necessary for the application of the procedure are developed as a result of a linear error analysis of the basic TRL method. Simulated and measured calibrations demonstrate that the method is fast and accurate and increases the bandwidth of TRL calibrations.

200.265

Keywords: *Multiprocessors, *Computer performance evaluation, *Very large scale integration, Chips(Electronics), Integrated circuits, Parallel processing, Perturbation, Computer software, Reprints, *MMI.

A hybrid performance measurement tool for MIMM multiprocessors is described. The tool uses software (embedded code) triggers and hardware sampling and, thus introduces a minimal amount of perturbation to the executing program. The perturbation can be as small as a single memory write instruction per measurement sample. The design, implemented on two very large scale integration (VLSI) chips, may require as little as two programmable logic devices (PLDs), for additional calibration and signal selection, to interface to a multiprocessor. The design incorporates a generic interface which provides for a wide range of applicability among many different multiprocessors. The authors also used the tool to provide a user measurement tool for a multiprocessor at a very reasonable cost, size, and implementation technology relative to the machine being measured.

200.265

Keywords: *Bipolar transistors, Mathematical models, Computer simulation, Control, Modules, Reprints, *Insulated gate bipolar transistors, IG-SPICE system, Power transistors, Circuit simulation.

A physics-based model for the Insulated Gate Bipolar Transistor (IGBT) is implemented into the widely available circuit simulation package IG-SPICE. Based on analytical equations describing the semiconductor physics, the model accurately describes the nonlinear junction capacitances, moving boundaries, recombination, and carrier scattering, and effectively predicts the device conduction modulation. In the paper, the procedure used to incorporate the model into IG-SPICE and various methods necessary to ensure convergence are described. The effectiveness of the SPICE-based IGBT model is demonstrated by investigating the static and dynamic current sharing of paralleled IGBTs with different device model parameters. The simulation results are verified by comparison with experimental results.

200.265

Keywords: *Integrated circuits, *Microwave circuits, PIN diodes, Calibration, Standards, Characteristics, Reprints.

A technique for characterizing microwave packages based on active PIN diode standards is discussed. The technique allows packages to be accurately characterized from external reflection coefficient measurements when a single bias-dependent active standard is embedded within it. The frequency characteristics, stability, and linearity of active PIN diode standards are investigated.

200.660

Keywords: *Integrated circuits, *Annealing, Ion implantation, Oxygen ions, Silicon oxides, Nitrogen, Argo, Reprints, *SIMO(Semiconductors), *SIMOX.

In the last decade, oxygen implanted silicon-on-insulator material (SIMOX): Separation by Implantation of Oxygen (SiO₂) has been extensively studied, due to its potential use in high-speed applications. The effect of oxygen implantation on the substrate hardness in integrated circuits. SIMOX material requires two processing steps: first, an implantation of a high dose of oxygen to form a buried oxide layer below a thin, top silicon layer, second, a high temperature anneal in an inert gas atmosphere to remove implantation damage and precipitate oxygen vacancies. These studies investigated the effect of annealing temperature and time, but did not consider the effect of gas ambient. The effect of nitrogen and argon on the oxygen precipitation formation in bulk silicon has been established. Raider et al., found that in annealing of bulk silicon, nitrogen can diffuse to an oxide-silicon interface and increasingly react with silicon forming the nitrogen-diffusion barrier. The nitrogen layer acts as a barrier to further oxidation. Consequently, nitrogen influences the growth kinetics of the hermosilicide while annealing in an argon ambient does not. This should apply to SIMOX as well. The authors have, therefore, investigated the effect of nitrogen and argon ambient on the oxygen-precipitate removal during annealing of SIMOX material.

200.661

Keywords: *Integrated circuits, *Test equipment, Electrical resistivity, Lithography, Line width, Reprints.

The purpose of the work was to extend the design criteria of electrical test structures to the half-micrometer linewidth region. At 0.5 micrometer, process limitations place constraints on the functionality and usefulness of electrical test structures based on conventional design criteria. In particular, small total variations in electrical test structures from linearity, nonuniformity/curvature, and surrounding effects in the patterning of the smallest lines achievable (less than 0.5 micrometer) can result in failure of the test pattern. This was particularly significant when orthogonal voltage taps at minimum design geometries were used. As geometries decrease in size and control over the process and equipment tightens, the intrinsic error in conventional structures increases as a percentage of the total measurement. The design criteria of electrical test structures have been further modified and improved in order to address known lithographic limitations and establish a more process tolerant technique. The resulting measurement precision across modeling these changes is discussed to provide the framework for achieving the highest practical performance, and, therefore, the most favorable from both the test structure and the measurement system.
Anomalously Offset Quantized Hall Plateaus in High-Mobility Si-MOSFETs.

Not available NTIS National Inst. of Standards and Technology (EEEL), Boulder, CO. Electrodynamic Technology Div. Progress Toward MMC In-Wafer Standards.


Keywords: Microwave circuits, Integrated circuits, Progress report, Error analysis, Electromagnetic measurement, Coplanarity, Calibration, Prototypes, Reprints.

Water probe stations, Coplanar waveguides, Systematic errors.

A prototype standard set in coplanar waveguide suitable for the calibration of wafer probe stations has been developed through a cooperative effort between the National Institute of Standards and Technology and a MIMIC Phase 3 team. The coplanar standard set is intended primarily for in-process testing, although the characterization of coplanar waveguide circuits is also possible. In this paper two sources of systematic errors associated with the prototype set standard, the propagation of undesired modes, and the influences of adjacent structures on the electrical connection to the elements of the standard set, will be discussed.

0.206,655
PB92-175090 Not available NTIS National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div. Role of Annealing Conditions on the Radiation Response of Backgate MOSFETs.


Keywords: Field effect transistors, MOSFET, Radiation, Beam, Substrate, Annealing, Reprints, SOI(Semiconductors), Buried oxides, SIMOX.

SIMOX (Separation by Implantation of Oxygen) has developed into a mainstream SOI technology for devices operating in a radiation environment. To assure its suitability for application in the submicron and lower-depleted technology, the radiation response of its dielectric, the beam-synthesized buried oxide (BOX) and its limitations must be understood. In the study, p-MOSFETs were used to determine the role of the SIMOX radiation anneal cycle on the radiation induced effects, Delta V(B). Briefly, in a previously reported capacitor study, the radiation induced flat band voltage was studied. For the anneal cycle used in the annual temperature was increased from 1275 to 1500 C, i.e., the negative Delta V(B) shift was lowered from -22 to -15 V resulting in a 100-150 nV increase for p-MOSFETs. The authors have correlated the silicon microstructure at the interfaces with the radiation induced defects using SEM and TEM. The authors' laboratim furnace, SIMOX substrates were annealed at temperatures between 1250 and 1500 C to complete the formation process and using XTEM compared to a substrate annealed by the manufacturer. The substrate transfer characteristics, ID, (V(G)) were measured before and after irradiation on devices fabricated on these substrates.

0.206,663


Keywords: Microwave circuits, Integrated circuits, Progress report, Error analysis, Electromagnetic measurement, Coplanarity, Calibration, Prototypes, Reprints.

Water probe stations, Coplanar waveguides, Systematic errors.

A prototype standard set in coplanar waveguide suitable for the calibration of wafer probe stations has been developed through a cooperative effort between the National Institute of Standards and Technology and a MIMIC Phase 3 team. The coplanar standard set is intended primarily for in-process testing, although the characterization of coplanar waveguide circuits is also possible. In this paper two sources of systematic errors associated with the prototype set standard, the propagation of undesired modes, and the influences of adjacent structures on the electrical connection to the elements of the standard set, will be discussed.

0.206,664
PB92-175025 Not available NTIS National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div. Voltage-Gradient Structure for High-Frequency Feature Placement Metrology.


Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.


Keywords: * Very large scale integration, * Integrated circuits, * Metrology, Lithography, Alignment, Overlays, Precision, Reprints, Systematic errors, Test structures.

A new, robust, high-sensitivity, electrical test structure based on a systematic approach is described. The new test structure, DSI, was designed using the concept of an output domain, and, for the design of the measurement of the separation of pairs of conducting features, has recently been reported. The earlier work, in which the measured and the experiments had a systematic error in the hundreds of nA. However, after compensating for the error, the individual errors were typically as low as 15 nA. In later work, through further measurements and extensive modeling, the modeling of the systematic error was attributed to two independent contributions of certain imperfections in the replication of the test structure. In the paper, modified test structures are described that contain the model and show how all design rules and substrate-dependent systematic errors can be eliminated. The new test structures are designed for the characterization of high performance coplanar waveguides and other coplanar circuits.

0.206,667
PB92-175450 Not available NTIS National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div. Bond Failures Resulting from Plating Impurities and Oxidation.


Keywords: * Microelectronics, Failure(Engineering), Bonding, Interfacial, Diffusion, Impurities, Reprints, * Wire bonds, Gold films.

Various failure modes of wire bonds to electroplated gold films are reviewed. These results are from plating grain modifiers, hydrogen in the film, or oxygenIZAL metals (Cu, Ni, Au), all diffused from the substrate. Solutions to these problems are given.

0.206,670

Keywords: * Microelectronics, Reliability(Engineering), Tin films, Contamination, Cleaning, Argon plasma, Copper, Copper, Cleaning, Reprints, * Wire bonds, Oxygen plasma.

The methods of molecular cleaning, including oxygen/argon plasma, and UV-ozone are described. They are compared to various solvent cleaning methods as they affect wire-bonding yield and reliability.

0.206,671
PB92-175421 Not available NTIS National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div. Intermetallic Compound and Other Bimetal Interface Problems.


Keywords: * Microelectronics, * Intermetallic compounds, Failure(Engineering), Intermetallics, Copper intermetallics, Corrosion, Reprints, * Wire bonds, Silver intermetallics, Kirkendall voids.

Gold-aluminum intermetallic compound formation and associated Kirkendall voiding have resulted in more documented bond failures than any other problem over the years. However, most present day Au-Al related failures are more properly referred to as impurity driven or corrosion reactions. These are discussed along with recommendations for avoiding failure. Recently, wires and metallizations other than gold and aluminum have been introduced. Therefore, the reliability and bonding of Al-Au, Au-Cu, Ag-Cu, Al-Cu, and Al-Ag metallurgy couples are discussed.

ELECTROTECHNOLOGY

Semiconductor Devices
Semiconductor Devices

on the effects of processing conditions on oxide evolu-
tion and to present new results on: effects of implica-
tions on buried oxide formation, effects of ramping conditions on oxygen bubble evolution and defect formation, and effects of annealing conditions on structure of the buried oxide and its interfaces.

**Keywords:** Microwave amplifiers, "Noise measure-

The National Institute of Standards and Technology (NIST) has a goal of offering an on-water noise parame-
ter special test service for 8-12 GHz amplifiers in 1992. The paper discusses two preliminary stages in the development of the service: the measurement of component amplifier noise parameters, and elementary-
water noise measurements. The measurement procedure approach is described, and the basic relationships for effective input noise temperature are reviewed. Then the measurement system is discussed, and the results are presented. Finally, the preliminary on-water noise measurements are presented.

PC 0A0/MAF 01
National Inst. of Standards and Technology (EEL), Gaithersburg, MD. Semiconductor Electronics Div.

**Keywords:** "Microelectronics," "Microtechnology," Integrated circuits, Dimensional measurement, Electromagnetic interference, Signal processing, Optical fibers, Magnetic materials, Millimeter waves, Microwave, Antennas, Electrical measurement, Electric power, Progress report, Superconductors, Laser radiation, Abstracts.

This is the thirteenth issue of a quarterly publication pro-
vided information on technical work at the National Institute of Standards and Technology, Electronics and Electrical Engineering Laboratory. The issue of the EEL Technical Publication Announcements covers the third quarter of calendar year 1991. Abstracts are provided by technical area for papers published this quarter. Major subject headings include the following: Fundamental Electrical Measurements, Semiconduc-
tor Microelectronics; Signal Acquisition, Processing, Transmission; Electrical Systems; Electromagneti-
cal Interference.

PC 0A0/MF 02
National Inst. of Standards and Technology (EEL), Gaithersburg, MD. Semiconductor Electronics Div.

**Keywords:** "Microelectronics," "Microtechnology," Integrated circuits, Dimensional measurement, Electromagnetic interference, Signal processing, Optical fibers, Magnetic materials, Millimeter waves, Microwave, Antennas, Electrical measurement, Electric power, Progress report, Superconductors, Laser radiation, Abstracts.

This is the thirteenth issue of a quarterly publication pro-
vided information on technical work at the National Institute of Standards and Technology, Electronics and Electrical Engineering Laboratory. The issue of the EEL Technical Publication Announcements covers the third quarter of calendar year 1991. Abstracts are provided by technical area for papers published this quarter. Major subject headings include the following: Fundamental Electrical Measurements, Semiconduc-
tor Microelectronics; Signal Acquisition, Processing, Transmission; Electrical Systems; Electromagneti-
cal Interference.

Paper 92-179374 Not available NTIS
National Inst. of Standards and Technology (EEL), Gaithersburg, MD. Semiconductor Electronics Div.

**Keywords:** "Bi-polar transistors, Open-base, Bandgap ar-
rdenes, Room temperature, Quantum mechanics, Phase shift, Reprinting.

Low-field mobilities and velocity versus electric field relations are among the key input parameters for drift-
diffusion simulations of field-effect and bipolar transis-
tors. The authors have calculated the majority electron and minority hole mobilities in GaAs at 300 K for doping densities between 5 x 10^16 to 1 x 10^19/cm^2 and for the majority hole and minority electron mobi-
ilities for acceptor densities between 5 x 10^16 to 1 x 10^19/cm^2. They have included all the impor-
tant scattering mechanisms for GaAs: acoustic phonon, optical phonon, donor-acceptor pair, piezoelectric, ionized impurity, carrier-carrier, and plasmon scattering. These results are impor-
tant for device modeling because of the need to have reliable values for the minority mobilities and velocity-
field relations.

PC 0A0/MF 02
National Inst. of Standards and Technology (EEL), Gaithersburg, MD. Semiconductor Electronics Div.

**Keywords:** "Electrical resistivity, "Semiconductors, Probes(Electromagnetic), Electric contacts, Spatial resolution, Variations, Silicon, Reprints, Spreading resistance.

A new approach to the mapping of resistivity variations in semiconductors uses probe sites provided by an array of photolithographically defined spots having a density of 60,000 sites/sq cm. One- or two-probe spreading resistance or four-point-probe resistance measure-
ments were made at room temperature on wafers and on single crystals of silicon, germanium, and silicon and measurements on Si that had been ion-implanted to form abrupt boundaries in resistivity are used to show that the spatial resolution of the technique is determined primarily by the spacing of the measurement sites, not by the spreading of the current from the contacts. The technique has been implemented with reso-
lution of lateral variations in resistivity of 45 microme-
ters in extent and + or - 5% in magnitude from the background resistivity. As an example application, a study of the resistivity variations of a Si boule with pronounced growth striations is presented.

PC 0A0/MAF 02
National Inst. of Standards and Technology (EEL), Gaithersburg, MD. Semiconductor Electronics Div.

**Keywords:** "Semiconductor Measurement Technology: ISTANT-IBGT Network Simulation and Transient Analysis Tool.

PC 0A0/MAF 02
National Inst. of Standards and Technology (EEL), Gaithersburg, MD. Semiconductor Electronics Div.

**Keywords:** "InGaAsP"
These devices have the best features of both power MOSFETs and power bipolar transistors, i.e., efficient voltage gate drive requirements and high current density capability. When designing circuits and systems that utilize MOSFETs or other power semiconductor devices, circuit simulations are needed to examine how the device affects the behavior of the circuit. However, the semiconductor device models used in most circuit simulations were originally intended to describe microelectronic devices and cannot adequately describe the operation of power devices. In the publication, a compact IGBT model suitable for incorporation in circuit simulations is described, and a circuit simulation program called INSTANT is presented that simulates the dynamic behavior of IGBTs within any external drive load, and feedback circuit configuration. The INSTANT simulator solves the equations of state (state equations) that describe each component of the circuit, where the equations for the individual components are independent. The publication also describes the automated measurement methods developed to extract the IGBT device parameters from terminal electrical measurements.

200.675
P992-271603
PC A03/MF A01
National Inst. of Standards and Technology (EEL), Gaithersburg, MD, Semiconductor Electronics Div.
Semiconductor device modeling: INSTANT, Version 2.0 of the TXYZ Thermal Analysis Program:
TXYZ20.
Final rep.
J. Albers. Jun 92, 35p NIST/SP-400/89
Also available from Suppl. of Docs. as SN003-069-153169-1. See also PB90-269554 and PB98-184767.


The TXYZ computer program has been used for a number of years to model the thermal behavior of semiconductor devices and packages. The report presents version 2.0 (TXYZ20) of the revised and updated version of the original TXYZ program. The TXYZ20 program contains new features for handling large amounts of input data, assignment of positive or negative node-to-node voltages to the various heat sources or heat sinks, and a fast evaluation of limiting forms in the code.

The first part of the report consists of a discussion of the general elements in the TXYZ code and the particular changes that have been made to obtain TXYZ20. The second part of the report contains a discussion of several examples of the running of the code. Several annotated data files are included and discussed to show both the increased flexibility of the input data and the actual use of the updated code. Running the TXYZ20 code for one of the input files provides a benchmark for several machines.

200.683
P992-273378
Not available NTIS
National Inst. of Standards and Technology (EEL), Gaithersburg, MD, Semiconductor Electronics Div.
Measurement and Calculation of Metalization Interconnects: Today and Tomorrow.
Final rep.
H. A. Schafft, J. S. Suhele, and J. A. Lechner. 1992
5p. Pub. in Proceedings of International Conference (6th) on Interconnection and Packaging Technologies in Metalization Interconnects:
Today and Tomorrow.


There is a new and important use for accelerated stress tests such as are used to characterize electromigration in metallizations. It is employed to measure test parameters that affect the reliability of the product and thereby to identify the implementation of a new approach to reliability for the semiconductor industry — building in a reliability approach. The classical stress test and, to a smaller extent, the SWEAT test are discussed to promote their most effective use in implementing the reliability process. In particular, the measurement procedure and analysis, extrapolations to use conditions, measurement and interpretation pitfalls, and means to reduce test time by censoring are discussed.

200.687
P992-273551
Not available NTIS
National Inst. of Standards and Technology (EEL), Gaithersburg, MD, Semiconductor Electronics Div.
Experimental Determination of Important Techniques to Extract Si-0-Si Interface Trap Density.
Final rep.
J. Wizlczak, J. S. Suhele, and M. Gaitan. 1992

Keywords: *MOSFET, Silicon dioxide, Electron traps, Hole traps, Measurement, Comparison, Reprints, *Interface traps.

For the first time, five methods of measuring Si-O-Si interface trap densities were compared experimentally on the otherwise identical MOSFETs, which were degradation-stressed so as to induce different levels of interface trap densities. The results show that when discussing interface traps, it is important to account for these methods are capable of yielding interface trap density estimates which are in good qualitative agreement. In particular, the method used to measure interface trap densities with radiation is independent of the method used. A comprehensive review of the methods is presented.

200.682
P992-273569
Not available NTIS
National Inst. of Standards and Technology (EEL), Gaithersburg, MD, Semiconductor Electronics Div.
Structure of the Si(111) square root of 3x square root of 3-Si interface by Surface X-Ray Absorption Fine Structure and Photoemission.
Final rep.
6p. Pub. in Jnl. of Vacuum Science and Technology A 9, n3 p1956-1961 May/June

Keywords: *Interfaces, X-ray absorption, Photoelectron spectroscopy, Chemical bonds, Photoemission, Antimony, Silicon, Reprints.

The combined techniques of surface extended x-ray absorption fine structure (SEXAFS) and high resolution Photoelectron spectroscopy (PHS) have been used to investigate the local bonding structure of the Si/Si(111) interface. We find that the adsorption of 1 monolayer of S on Si(111) causes a change in the near surface components of the Si 2p core level spectrum. The Si 2p interfacial core level has been found to be shifted 0.20 ± 0.02 eV toward higher binding energy with an intensity that corresponds to the top 1 ML of surface atoms. The SEXAFS determination of the absolute surface coordination numbers and bond lengths within the first Si 5f shell is 2.1 ± 0.3 Sb atom at 2.86 + 0.2 - 0.02 A and 2.0 ± 0.02 Sr atom at 2.68 + 0.02 A. Together, these results indicate that Si trimer occupies the three fold atop sites of the Si(111) surface where each Sb atom is bonded to two Sr atoms in a modified bridge configuration.

200.683
P993-116442
PC A03/MF A01
National Inst. of Standards and Technology (EEL), Gaithersburg, MD, Precision Engineering Div.
Index.
C. F. Vezzetti, R. N. Varner, and J. E. Potzick. 1992
92, 229p NIST/SP-260/119
Available from Suppl. of Docs. as SN003-003-031747-7. Also see PB92-149798.


The precise and accurate measurement of feature dimensions on photomasks, such as those used in the production of integrated circuits, becomes increasingly difficult as the dimensions approach the wavelength of the light used to make the measurement. The undesirable effects of optical diffraction obscure the location of the feature edges. Raggledness and nonvertical walls along the edges add to the uncertainty of the measurement. Standard Reference Material SRM 473 and NISTIR-4954 are designed specifically to provide a means to calibrate the SRM and are discussed. The algorithm used for determining the line edge location incorporates a threshold criterion derived from analysis of microscope image profiles. The profiles are predicted by computer modeling based on the theory of partial coherence. The performance of this system is monitored by measuring line features on a control photomask before and after calibrating each SRM.

200.683
PB93-120715
PC A03/MF A01
J. A. Gonzalez. Oct 92, 21p NISTIR-4945
See also PB92-130302 and PB93-120723.


This is the thirty-second issue of a quarterly publication providing information on the technical work of the National Institute of Standards and Technology Electronics and Electrical Engineering Laboratory (EEL). This issue includes Technical Publications Announcements covers the first quarter of calendar year 1992. This issue contains citations and abstracts for Laboratory publications published in the quarter. Major subject headings include the following: Fundamental Electrical Measurements; Semiconductor Microelectronics; Signal Acquisition, Processing, and Transmission; Electrical Systems; Electromagnetic interference.

200.685
PB93-120723
PC A03/MF A01
National Inst. of Standards and Technology (EEL), Gaithersburg, MD, Semiconductor Electronics Div.
J. A. Gonzalez. Sep 92, 34p NISTIR-4939
See also PB92-181239 and PB93-120715.


This is the thirty-first issue of a quarterly publication providing information on the technical work of the National Institute of Standards and Technology Electronics and Electrical Engineering Laboratory (EEL) until February 1991, the Center for Electronics and Electrical Engineering (CEE). This issue includes Technical Publications Announcements covers the fourth quarter of calendar year 1991. This issue contains citations and abstracts for Laboratory publications published during the quarter. Major subject headings include the following: Fundamental Electrical Measurements; Semiconductor Microelectronics; Signal Acquisition, Processing, and Transmission; Electrical Systems; Electromagnetic interference.
Semiconductor Devices


Keywords: *Energy gap, Semiconductor doping, Charge carriers, Gallium arsenide, Silicon, Reprints. Bandgap narrowing, Density of states. Bandgap narrowing, which occurs in electronic devices as a result of heavy doping or large carrier densities, is explicitly a function of both the dopant and carrier densities. This is an important consideration in heavily doped or depleted regions, where quasi-neutrality is violated. This work shows what effects occur in such regions and demonstrates the usefulness of device models so that bandgap narrowing is treated as an explicit function of both dopant and carrier density.

200.687

Keywords: *Semiconductor devices, *Integrated circuits, Expert systems, Neural networks, Electromigration, Reliability(Electronics), Test methods, Historical aspects, Reprints, Test structures, US NIST. Some historical background introduces a description of the work in test structures being conducted by the Semiconductor Electronics Division of NIST. The three directions of the work are (1) systems for characterizing the shrinking geometries of today's integrated circuit chips, (2) to interpret the large volume of test structure data using expert system and neural network techniques, and (3) to use test structures to evaluate device reliability.

200.689

Keywords: *Electrical measurement, Verification, Calibration, Comparison, Accuracy, Waveforms, Reprints, Scattering parameters, Automatic network analyzers. A powerful new verification technique determines the measurement accuracy of scanning parameter calibrations. The technique is applied to several popular on-wafer scattering parameter calibrations, and the deviations between these calibrations and the thru-reflection line calibration are quantified.

200.689


Keywords: *Field effect transistors, *MOSFET, Temperature dependence, Radiation effects, Annihilation, Reprints, Power transistors, Threshold rebound. Nonradiation-hardened n-channel power MOSFETs were irradiated at the temperature of 77 K, which is close to the lowest temperature possible in a high power anode of a nuclear reactor. The irradiated transistors were thermally annealed at different temperatures with all terminals shorted, and under positive gate bias, with source and drain shorted. Threshold voltage rebound was observed for some transistor types under certain experimental conditions.

200.690

Keywords: *Semiconductor devices, *Electronic packaging, Chips(Electronics), Metallization, Silicon, Wafers, Reprints, *Wire bonds. The leading edge of semiconductor manufacturing is the high-yield production of semiconductor devices with high lead counts and fine pitch. The packaging of these chips has become as challenging as the silicon manufacturing itself. The object of this paper is to describe the problems associated with the solutions required to secure bond these high lead-count chips to their packages at the required high yields. The elements for achieving 6 sigma wire bond yields are summarized. Wafer-testing probe cards currently limit the minimum wire bond pad pitch on high-end devices to about 100 micrometers. However, 75 micrometer pitch wedge bonding can be performed with current (modified) auto-bonders, and 40 micrometer pitch bonding has been demonstrated. Although every aspect of fine-line bonding requires more planning and coordination and is more expensive to achieve than bonding at normal pitch.

200.691

Keywords: *High electron mobility transistors, Molecular beam epitaxy, Aluminium gallium arsenide, Aluminium arsenides, Field effect transistors, Silicon additions, Doped materials, Superlattices, Reprints, Deep level transient spectroscopy. The substitution of selectively Si-doped short period (4 by 2 and 2 by 1 monolayer(0) GaAs/AlAs superlattice alloy material (SLAM) for Si-doped AlGAs layers in conventional high electron mobility transistor (HEMT) structures has been demonstrated. Such a substitution should slightly alter field effect transistor characteristics as compared with the conventional HEMT. The threshold of voltages and amplitudes of the DX centers were found to depend on the layer thickness of the superlattices and the positions of Si-dopants within the GaAs layers.

200.692

Keywords: *Circuit interconnections, *Metallizing, *Microelectronics, Reliability(Electronics), Temperature dependence, Metal films, Thin films, Electromigration, Reprints, Temperature coefficient of resistance. The accurate measurement of the temperature coefficient of resistance (TCR) of thin-film, aluminum-based interconnects has many important applications for the reliability of microelectronics. The TCR is used to determine the metallization temperature in electromagnetic accelerated stress tests, a key element in characterizing a power metal and in assessing the effects of metal impurities and changes in structure that may have an impact on the reliability of the metal film. The resistance-versus-temperature behavior can be used to detect process variations that result in changes in cross-sectional areas of interconnect lines and residual resistivity. Also, the TCR permits metal lines to be used as temperature sensors that provide useful data for characterizing thermal environments and for thermal modeling that, again, impact reliability. To permit the effective use of TCR for these applications, this paper describes the measurement, use, and interpretation of the temperature dependence of thin-film interconnects in ways that will help avoid many pitfalls and provide guidance in the measurement and use of TCR. This paper is also intended to complement the JEDEC Standard on preparation in the temperature coefficient of resistance of metallization lines.

General

200.693

Keywords: *Electric pulses, *Electrical measurement, Pulse and flicker pulses, User manuals, Computer programs, Calibration, Waveforms, *AWAMS system, US NIST, Deconvolution, Jitter. The theory and operation of an upgraded version of the NIST Automatic Waveform Analysis and Measurement System is described. This system, the AWAMS, was commissioned by the Army Primary Standards Laboratory to facilitate measurement comparability with NIST. The AWAMS has been installed at the Redstone Arsenal, Alabama.

200.694


200.695

Keywords: *High voltage, *Lighting, Electrical measurement, Electrical discharges, Signal processing, Curve fitting, Impulses, Reprints, Parameter estimation. A brief review is presented of the techniques used for the evaluation of the parameters of high voltage impulses and the problems encountered. The determination of the best smooth curve through oscillations on a high voltage impulse is the major problem limiting the automatic processing of digital records of impulses. Noise, waveform distortion, and bad models, are all applied to the analysis of simulated and experimental data of full lightning impulses. Results of model fitting to four different groups of impulses are presented and compared with some other methods. Plans for the extension of the work are outlined.

200.696
PB92-145135 Not available NTIS National Inst. of Standards and Technology (EEL), Gaithersburg, MD. Electricity Div.
Observation of Partial Discharge in Hexane Under High Magnification.

Final rept.


See also PB91-127591. Sponsored by Department of Energy, Washington, DC.

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electrical Insulation, 26, n4 p962-698 Aug 91.

Keywords: Electric discharges, *Hexane, Dielectric breakdown, Shadowgraph photography, Photographic techniques, Direct current, Electrostatics, Reprints.

Partial discharges are observed in hexanes by means of shadowgraph photography. The photographs were obtained at a magnification of 200x. A multi-frame photograph of the cavity and a simultaneous record of the partial-discharge current provide a detailed record of the temporal and spatial development of the discharge. Examination of these data suggest that electrostatic forces are of primary importance in driving the growth of the cavity near its inception.

200.697
PB92-145218 Not available NTIS National Inst. of Standards and Technology (EIEE), Boulder, CO. Electromagnetic Fields Div.

Time-Domain Method for Characterizing the Reflection Coefficient of Absorbing Materials from 30 to 1000 MHz.

Final rept.


Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electromagnetic Compatibilnity 33, n3 p234-240 Aug 92.

Keywords: Absorbers(Materials), Microwave equipment, Very high frequency, Ultrahigh frequency, Time domain, Reflectance, Reprints, Microwave absorbers.

A wideband time-domain reflectometer is used to evaluate the reflection characteristics of RF/microwave absorbers. The reflectometer uses an array of two identical broadband antennas (both transmitting and receiving). The two antennas are used in a differential mode to remove the undesired signals and enhance the small reflections being measured. Using the technique, the authors can separate the target surface reflections from those generated outside the target area. The bandwidth of their pulses is 30 to 1000 MHz, and the reflection coefficient is measured over the range. The method has been used to characterize the reflectivity of three different types of absorber placed in an anechoic chamber. The results are reported together with a discussion of the main sources of errors.

200.698
PB92-145234 Not available NTIS National Inst. of Standards and Technology (EIEE), Gaithersburg, MD, Semiconductor Electronics Div.

Stochastic Properties of Partial-Discharge Phenomena.

Final rept.


See also PB90-128745. Sponsored by Department of Energy, Washington, DC; Office of Energy Storage and Distribution, and Nuclear Regulatory Commission, Washington, DC.

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electrical Insulation, 26, n5 p920-948 Oct 91.

Keywords: Electric discharges, Electric corona, Gas discharges, Extreme Voltage breakdown, Breakdown(Electric threshold), Stochastic processes, Statistical distributions, Electrical measurement, Dielectric breakdown, Fractals, Reprints, Partial discharges.

Prebreakdown, pulsating, partial-discharge (PD) phenomena that occur in dielectric media are inherently complex stochastic processes that exhibit significant statistical variability. This PD pulse amplitude, shape, and time of occurrence. Previously published work concerned with the theory and measurement of the stochastic behavior of PDs is reviewed. The types of PD phenomena considered in the review include ac and dc generated electron avalanches, pulsating positive and negative corona in gases, and PD that occur in liquid media and in the presence of solid dielectric surfaces. The basic physical mechanisms of discharge initiation, growth, and memory propagation that determine the PD characteristics are discussed. This paper reviews the PD pulse amplitudes of the PDs and is also given to special problems associated with measurement and interpretation of data on the various statistical properties of PD phenomena.

200.699
PB92-145242 Not available NTIS National Inst. of Standards and Technology and (EIEE), Gaithersburg, MD, Electricity Div.

Influence of a Dielectric Barrier on the Stochastic Behavior of Trichel-Pulse Corona.

Final rept.


See also PB91-134241. Sponsored by Department of Energy, Washington, DC; Office of Energy Storage and Distribution.

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electrical Insulation, 26, n3 p405-415 Jun 91.

Keywords: Corona discharges, Electric insulation, Barrier materials, Dielectrics, Electrodynamics, Air, Reprints, Polyeletrallofluoroethylene pulses.

The stochastic behavior of a negative, point-plane (Trichel-pulse) corona discharge in air has been investigated for the case where the plane electrode is partially covered with a high-resistance electrode. The influence of varying diameter and position relative to the point electrode. This behavior is revealed from measurements of the conditional and unconditional corona pulse amplitude and time-separation distributions. The results indicate that the presence of a dielectric surface around the point electrode significantly reduces the electric field at the point electrode, but does not affect the occurrence of Trichel pulses, provided that the point-to-plane gap spacing is greater than a critical value which depends on the area of the dielectric and the applied voltage.

200.700
PB92-149921 (Order as PB92-149889, PC A00) National Inst. of Standards and Technology, Boulder, CO.

Simulators of Superconductor Critical Current, Design, Characteristics, and Applications.


Included in Jnl. of Research of the National Institute of Standards and Technology, v96 n6 p703-724 Nov/Dec 91.

Keywords: Superconductors, Critical current, Simulators, Data acquisition, Standards, Temperature dependence, Circuits, Design, Uses.

The superconductor simulator is an electronic circuit that emulates the superconductor material characteristic (the basis of a critical-current measurement) of a superconductor along with its other major electrical properties. Three different types of simulators have been constructed: the passive, active, and hybrid simulator. The passive simulator has the fewest circuit components and offers the least amount of versatility, while the active and hybrid simulators offer more versatility and consequently have more components. Design, characteristics, and applications of the superconductor simulator along with a summary of features are presented. The 50 A simulator provides critical-current precision of 0.1% at a 1 micro volt signal. This is significantly higher than the precision of a superconducting standard reference material. The superconductor simulator can also be used for superconductor measurement applications that require high-precision quality assurance.

200.701
PB92-159870 Not available NTIS National Inst. of Standards and Technology (EIEE), Boulder, CO. Electromagnetic Fields Div.

Resistively-Taped-Dipole Electric Field Probes up to 40 GHz.

Final rept.


Keywords: *Probes(Electromagnetic), Electric fields, Extremely high frequency, Dipoles, Reprints, Transfer standards.

The authors have developed an electric-field probe for use as a transfer standard at frequencies up to 40 GHz. The lower frequency cutoff is below 1 MHz. The design is based on the resistively taped dipole (RTD) probes developed for frequencies up to 18 GHz. Those probes used 8-mm tapered dipoles. In the work described here, the authors used 6-mm, 4-mm, and 2-mm dipoles to extend the frequency range. Because the new probes are isotropic, they have relatively flat frequency response across their operating frequency range, they could also be used as hazard meters.

200.702
PB92-159888 Not available NTIS National Inst. of Standards and Technology (EIEE), Boulder, CO. Electromagnetic Fields Div.

Thermo-Optic Designs for Electromagnetic-Field Probes for Microwaves and Millimeter Waves.

Final rept.


Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electromagnetic Compatibility 33, n3 p205-214 Aug 92.

Keywords: *Probes(Electromagnetic), Heat measurement, Millimeter waves, Frequency response, Microwaves, Sensitivity, Design, Reprints.

The development of an electromagnetic field probe for microwave and millimeter-wave frequencies is reported. The design is based on resistively taped dipole probes designed to measure the heating of a resistive element in an electromagnetic field. The response is calculated for several different configurations of the resistive element, and two optimal designs are chosen. Measurements on experimental probes of these designs are presented. The probes produce a flat frequency response above 30 GHz and a sensitivity of 38 W/m. Improvements are identified in the design that should significantly increase the sensitivity and improve the low-frequency response.

200.703
PB92-154672 PC A03/MF A01 National Inst. of Standards and Technology (EIEE), Gaithersburg, MD, Semiconductor Electronics Div.


J. A. Gonzales; Feb 92, 39p NISTIR-4726

See also PB92-133032.


This is the thirty-sixth issue of a quarterly publication providing information on the technical work of the National Institute of Standards and Technology, Electromagnetics and Electrical Engineering Laboratory. The issue of the EEE Technical Progress Bulletin covers the third quarter of calendar year 1991. Abstracts are provided by technical staff for both published papers and papers approved by NIST for publication. Topics covered include the following: Antennas; electrical engineering; electrical power; electromagnetic interference; electronics; instrumentation; laser; magnetic; microwave; optical fibers; semiconductors; and superconductors.

200.704
PB92-165527 Not available NTIS National Inst. of Standards and Technology (EIEE), Boulder, CO. Electromagnetic Fields Div.

Proposed TEM Driven Mode-Stripped Chamber for Laser System Radiated EMC/V Testing, 10 KHz - 40 GHz.

Final rept.


Sponsored by Army Electronic Proving Ground, Fort Huachuca, AZ.


ELECTROTECHNOLOGY

General

susceptibility, Performance evaluation, Vulnerability, Design, Reprints, TEM cells.

The paper describes work in progress at the National Institute of Standards and Technology (NIST) to develop a single, integrated facility for whole system electromagnetic (EM) susceptibility testing and characterization. The facility will consist of a large shielded enclosure, 13.1 m x 24.1 m x 38.7 m in size, configured as a TEM trans-
mission line for the 200 MHz-10 GHz frequency range. The facility is designed to accommodate a wide range of test configurations, including high-power testing, and to support the development of a comprehensive testing program. The paper presents a detailed description of the facility's design and anticipated capabilities.

200.708
PB92-171602
Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Total Cross Sections for Electron Scattering and Attachment for SF6 and Its Electrical-Discharge By-products.
Final rept.

Keywords: *Electrodes, SF6, electron scattering, electron attachment, discharge by-products, implications.*

Using an electron transmission spectrometer, the absolute total cross section for electron scattering and electron attachment to SF6 over the range of 10 eV to 1.2 MeV was measured. The results are presented along with previous data available from other sources.

200.709
PB92-171693
Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
S2F10 Formations and Discharges in SF6: Comparison of Spark and Corona.
Final rept.

Keywords: *Corona discharges, Fowler-Nordheim discharge.*

Among the SF6 by-products of electrical discharges that have been investigated, S2F10 is probably the least understood. Its formation is still controversial because the presence of the chemical has been reported by only a few groups. The authors report on the yields of S2F10 in two types of discharges: spark and corona. For both types of discharges the authors have found that S2F10 formation is dependent on the presence of moisture. For corona discharges, model calculations based on the proposed mechanism for the fluorine chemistry are shown to yield results that are in good agreement with experimental data. The authors show that S2F10 is formed in electrical discharges and that its formation is a function of the humidity and the discharge conditions.

200.710
PB92-171735
Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Influence of Phase-to-Phase/Phase Memory Propagation on the Stochastic Behavior of AC-Generated Partial Discharges.
Final rept.

Keywords: *AC-generated partial discharges, phase-to-phase memory propagation, stochastic.*

From measurements of phase-restricted conditional partial-discharge amplitude and phase-of-occurrence distributions performed for the first time, it has been possible to observe the influence of phase-to-phase memory propagation on the stochastic behavior of partial discharges generated by applying an ac voltage to a point electrode in contact with a solid dielectric surface associated with charge deposited on the dielectric surface by preceding discharge events. It is shown that the larger amount of charge deposited during partial-discharge activity on one half-cycle, the smaller will be the size (area) of occurrence of the partial discharges on the next half cycle. The observed memory effect is expected from consideration of the surface charging dynamics and must be considered in any attempt to interpret results of phase-resolved partial-discharge measurements.

200.711
PB92-171743
Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Phase to Phase Memory of the Statistics of Pulsating Corona.
Final rept.

Keywords: *Corona discharges, Stochastic processes.*

In order to develop a theory that accounts for observed pulse-time separation and pulse-amplitude distribution of pulsating corona discharges in gases, it is necessary to consider the effects of residuals from prior discharge pulses, such as ion space charge and metastable particles, on the development of subsequent pulses. This problem is addressed here. The results of this study are significant in controlling a better understanding of the stochastic behavior of corona pulses.

200.712
PB92-175454
Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Measurement Program Compared Automatic Vector Analyzers.
Final rept.

Keywords: *Automatic analyzers, Measurement comparison, Accuracy.*

The Automated Radio Frequency Techniques Group (ARFTG) members occasionally hold an annual workshop to compare the performance of their Automatic Network Analyzers (ANAs) with that of their peers. The group is called the Measurement Comparison Program (MCP). Participants are provided an analysis of their measurement results in comparison to measurements made at other laboratories.

200.713
PB92-175819
Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
MAP Voltage Transfer between 10-V Josephson Instabilities.
Final rept.
Keywords: Standards, Interlaboratory comparisons, Precision, Accuracy, Reprints, Voltage standards, Josephson arrays, Measurement assurance programs, Transfer standards.

A Measurement Assurance Program (MAP) for voltage transfer at the 10-V level was performed among six U.S. laboratories currently operating 10-V Josephson array systems. A commercial voltage standard based on four Zener references was used as the transfer device. The experiment provided data on the precision and traceable accuracy of the Josephson array systems relative to the National Institute of Standards and Technology (NIST) as well as among the laboratories. Preliminary measurements from five other laboratories show that all agree with NIST to within 0.04% with a maximum random uncertainty of 0.015 ppm (1 sigma).

200.717
PB92-175094 Not available NTIS National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Fields Div.
APR 1992
Microwave Noise Power in Coaxial Transmission Line.
Final rep.
Pub. in IEEE (Institute for Electrical and Electronics Engineers) Trans. on Microwave Theory and Techniques 40, n.2 p449-454 Apr 91.
Keywords: Transmission lines, Interlaboratory comparisons, Coaxial cables, Microwave, Radiometers, Reprints, Noise standards, Intercomparison.

The Physikalisch-Technische Bundesanstalt (PTB) and the National Institute of Standards and Technology (NIST) have compared microwave noise power in coaxial transmission lines. The comparison is of particular metrological interest as both laboratories have independently developed coaxial primary thermal noise standards using different techniques: a temperature standard at PTB and cold standards at NIST. Different types of comparison radiometers are operating at each laboratory: a 1-0 meter radiometer at PTB and an RF-switched radiometer with IF-attenuator at PTB. Each laboratory measured two solid state noise sources at 2.0, 4.0, and 8.0 GHz relative to their primary thermal noise standards. The agreement between both laboratories is better than 0.05 dB.

200.715
PB92-183722 PC A03/MF A01 National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Fields Div.
Phase Characteristics and Time Responses of Unknorn Linear Systems Determined from Measured CW Amplitude and Phase Response.
Technical note.
Also available from Supt. of Docs. as SN003-003-03151-B.
Keywords: Linear systems, Hilbert transformations, Laplace transformation, Continuous waves, Transform functions, Time response, Phase, Impulse response. An alternative but simpler technique for calculating the complete time and frequency characteristics of an unknown linear system from the measured amplitude response to cw excitations is described. The associated system transfer function so determined may or may not be at minimum phase. A comparison of the time responses shows the worst case. Results also indicate that the susceptibility of the minimum-phase system to damage by cw radiation is the greatest during the initial period of excitation.

200.716
PB92-197516 Not available NTIS National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Fields Div.
Improvement of Dielectric Measurements with a Resonant Cavity.
Final rep.
A. J. Estin, and M. D. Janzic. 1991, 7p
Keywords: Permittivity, *Dielectrics, Cavity resonators, Resonant frequency, Microwave equipment, Reprints, *Dielectric measurements, Automatic network analyzers.

The paper describes using an automatic network analyzer to determine to very high accuracy the resonant frequency and intrinsic quality factor of a microwave resonant cavity. With this technique, measurements of complex permittivity of samples of dielectric material can be determined with low uncertainty.

200.717
PB92-198159 Not available NTIS National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Fields Div.
Electromagnetic Properties of Materials Program at NIST.
Final rep.
C. M. Weil, and W. A. Kissick, 1991, 5p
Keywords: Magnetic materials, Dielectrics, Electrical measurement, Microwave frequencies, Electromagnetic properties, Metrology, Standards, Reprints, EPM program, US NIST.

The Electromagnetic Properties of Materials (EPM) program of the National Institute of Standards and Technology (NIST) is described, including an outline of the current goals of the project, as well as some details of ongoing work in the area of dielectric material characterization for dielectric and magnetic materials at microwave frequencies.

200.718
PB92-205350 PC A03/MF A01 National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymeric Films Project.
Two-Fluid Measurements on Thin Films.
Technical note (Final).
J. J. Mock, May 92, 26p NIST/STM-1294
Also available from Supt. of Docs. as SN003-003-03158-5. Errata sheet inserted. Sponsored by Defense Nuclear Agency.
Keywords: Polymeric films, Film thickness, *Dielectric properties, Electrical insulation, Dimensional measurement, Error analysis, Thin films, Permittivity.

The two-fluid technique to measure the dielectric constant and thickness of a thin polymeric film is discussed. The advantages include the ability to make a noncontacting measurement both of the effective electrical thickness of the film as well as the dielectric constant. The requirements for an accurate measurement are examined and the error as a function of the cell spacing, sample thickness, and dielectric constant of the host fluid are evaluated. The specifications for both the cell and the second fluid are examined. For the cell, it must be stable to good accuracy with handling, capable of small gap and have a defined electrode area through the use of a guard ring with a narrow guard gap. A design of a holder that is suitable for films from 6 micrometers to 50 micrometers is illustrated.

200.719
PB92-236918 Not available NTIS National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Fields Div.
Final rep.
M. Kanda, and D. A. Hill. 1992, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Engineering.
Keywords: Dipole moments, Electric dipoles, Magnetic dipoles, Loop antennas, Electromagnetic radiation, Reprints.

The paper proposes a method for determining the radiation characteristics of an electrically small source. The source is measured by a three orthogonal loop antennas, each terminated with identical loads at diametrically opposite points. The electrical small source is represented by equivalent electric and magnetic dipole moments, and these dipole moments can be determined from the appropriate combinations of the loop responses.

200.720
PB92-232730 Not available NTIS National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Technology Div.
Final rep.
G. Obraski, T. Drapola, and M. Young. 1992, 12p
See also PB92-165943.
Keywords: Dimensional measurement, *Line width, *Diameters, Error analysis, Measurement, Reprints, Scanning confocal microscopy, Circular edges, Image processing.

We calculated the image of a circular edge as determined by a scanning confocal microscope with fully coherent illumination. In scalar theory, the quarter-inter- intensity point locates the geometrical-optics image of a straight edge. For a circular object, however, the quarter-intensity point is displaced from the geometrical-optics image of the edge according to the diameter of the object. For example, for an object that has a diameter of 21 resolution limits the displacement error is approx 0.01 resolution limits. We give the error that results in the quarter-intensity point limit for diameters as small as 1 resolution limits. The error will be even greater if the object is scanned off-axis. For example, for a diameter error for an object whose diameter is 21 resolution limits and which is scanned 3 resolution limits off-axis is approx 0.45 resolution limits. Finally, we calculated errors for vertical lines of width as small as 1 resolution limit.

200.721
PB93-129252 Not available NTIS National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Fields Div.
Final rep.
J. W. Adams. 1990, 9p
See also PB89-161525.
Keywords: *Electromagnetic shielding, Electrical measurement, Planar structures, Test methods, Effectiveness, Standards, Reprints.

The American Society of Testing and Materials (ASTM) Subcommittee on Standards, Test Methods for Measuring the Electromagnetic Shielding Effectiveness of Planar Materials, in November, 1989, completed a round of efforts of ASTM Committee 0.9.12.14 to accomplish this review, with emphasis on results of the measurement round robins that led to the acceptance of the standard in April of 1989. Very good agreement was obtained during these round robins conducted by five different workers at five different organizations. The samples used were plastic based, but treated three different ways. Surface roughness of the sample is an important factor in determining measurement uncertainty. The design of the sample holder and the measurement procedure given in this ASTM standard were developed at the National Institute of Standards and Technology (NIST), formerly the National Bureau of Standards (NBS). The comprehensive effort at NIST also established why this measurement method was chosen over 9. Standard Test Method for Measuring the Electromagnetic Shielding Effectiveness of Planar Materials is now in place. How and when calculations can be used to obtain near-field data from the measured far-field data are covered.

200.722
PB93-130458 PC A03/MF A01 National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Fields Div.
Power Measurement System for 1 mW at 1 GHz. Technical note.
F. R. Clague. Nov 90, 32p NIST/TN-1345
Also available from Supt. of Docs. as SN003-003-03137-1. Fleming’s tool.

Keywords: Microwave equipment, *Power measurement, Computerized control systems, Electric power meters, GHz range 01-100, Ultrahigh frequency, Computer programs, Automation.
ELECTROTECHNOLOGY

General

An automated measurement system designed to measure power accurately at the level of 1 mW and at the frequency of 1 GHz is described. The system consists of commercial IEEE Std-488 bus-controlled instruments, a computer controller, and software. The results of a series of measurements are output to the computer display and, optionally, to a printer. The results are the mean of a measurement series and an estimate of the systematic and random uncertainty. The total estimated uncertainty for the average of six consecutive measurements of a nominal 1 mW, 1 GHz source is typically less than 0.1 percent. The system can measure any power from 0.1 to 10 mW at any microwave frequency by making appropriate changes to the software and possibly the hardware.

length of the flame. By contrast, the use of a single-component fuel -- heptane in particular -- allowed the internal structure of a burning spray to be observed directly, because of a reduced temperature field, and vapor which extends over the upstream portion of the spray. The study of heptane may provide data for validation of future fuel models, because of the availability of the physical properties of heptane. The importance of observing the internal structure of a burning spray lies in the information which can be obtained about such parametric effects as swirl and nozzle type on the size and spatial distribution of droplets, the size of which can be determined by light scattering methods obtained. The advantage of studying burning sprays is to observe the spray characteristics under realistic conditions.


The interaction of the fuel spray with the surrounding combustion flow field defines the structure of the flame and affects its combustion and emission characteristics. Near the spray boundary, droplets of different sizes, temperatures, and velocities are expected to be found. In addition, combustion spray affects fuel-air mixing and modifies the entire spray pattern. Therefore spatio-temporally resolved information about the effect of swirl on droplet properties, especially near the spray boundary, is important for understanding the structure of sprays and spray flames. Experiments were carried out in a spray combustion facility which included a movable vane swirl burner. Droplet velocity distributions were obtained using a single-channel laser Doppler velocimeter (LV). The measurements were carried out off-axis light collection optics, positioned at a scattering angle of 30 degrees, with 0.5 mm resolution in the flame of about 1 mm (sup 3). The measured distributions were used to obtain statistical data on mean and rms velocities, turbulence intensities, and turbulence scales. Time resolved data were also recorded to provide information on droplet intermitteney at selected positions in the spray flame.


Influence of Laser Atomization and Spray Systems (ILASS) conference (2nd), Irvine, CA (United States), 16-17 May 1989, Sponsored by Department of Energy, Washington, DC.

Keywords: Liquid Fuels, Sprays, Atomization, Combustion, Density, Droplets, Velocity, Measurements, Drops, Time-Resolved Laser Scattering (TRL), Particles, laser diffraction, etc.


Several different techniques are utilized to atomize a liquid fuel stream into a multitudes of droplets, with a wide range of sizes and velocities, in order to increase the flameability of the fuel. One technique that has been utilized successfully in furnaces, boilers and gas turbines is the air-assist nozzle, in which a low-capacity, high velocity air jet is used to atomize a low pressure fuel stream. These nozzles provide the capability to vary the atomization characteristics of the nozzle, without affecting the fuel flow to the droplet velocity distributions of the droplets generated by the atomizer have a critical effect on transport processes, and the resulting flame stability and spray characteristics. It is, therefore, important to examine the atomization characteristics of the air-assist nozzles -- a topic which forms the basis of the paper. The results presented are from an ongoing investigation to obtain detailed information on droplet dynamics in sprays and spray flames.


The nature of the fuel spray on the structure of the swirling spray flame has been investigated. Droplet size, number density and velocity measurements have been carried out in pressure-atomized spray flames using phase/Doppler interferometry. Four fuels with different physical properties were studied, namely n-heptane, methanol, 50/50 methanol/1-dodecanol mixture, and kerosene. Droplet size, number density and velocity are influenced primarily by the fuel viscosity. No detectable trend could be attributed to changes in surface tension. Fuel volatility seems to have some effect on the spray flame structure, especially in the methanol flame. Flame luminosity is found to exceed that of gasoline by a factor of approximately 2.


Keywords: Ethanol Fuels, Methanol Fuels, Atomization, Sprays, Non-Pyritic Combustion, Fuel Sprays, Combustion, Flame Propagation, Flames, Velocity, Measurements, Drops, Time-Resolved Laser Scattering (TRL), Particles, laser diffraction, etc.


International symposium on combustion (23rd), Orleans (France), 22-27 Jul 1990, Sponsored by Department of Energy, Washington, DC.

The effect of fuel properties on the structure of swirled spray flames has been studied. Droplet size, number density and velocity measurements have been carried out in pressure-atomized spray flames using phase/Doppler interferometry. Four fuels with different physical properties were studied, namely n-heptane, methanol, 50/50 methanol/1-dodecanol mixture, and kerosene. Droplet size, number density and velocity are influenced primarily by the fuel viscosity. No detectable trend could be attributed to changes in surface tension. Fuel volatility seems to have some effect on the spray flame structure, especially in the methanol flame. Flame luminosity is found to exceed that of gasoline by a factor of approximately 2.
ENERGY

Fuels


Keywords: "Solid fuels, Reduced gravity, Radiant energy, Ignition, Mathematical model, Heat transfer, Combustion, Radiative heat transfer, Fuel combustion, Reprints.

A mathematical model of the gas motion induced by radiative heating of a solid surface in a micro-gravity environment is presented. The absence of buoyancy forces dramatically alters the induced flow pattern and greatly simplifies the analysis task. Analytical and numerical results are shown and a physical picture of the process is presented.

200,749
PB92-236694 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Fire Measurement and Research Div.


Keywords: "Droplets, Evaporative cooling, "Fire models, "Sprinklers, "Solid fuels, Finite difference method, Control volume method, Thermodynamics, Evaporation, Cooling rate, Thermal conductivity, Fire extinguishers, Fire tests, Reprints.

Insight on extinguishment of a solid fuel fire by sprinkler generated droplets is obtained by detailed modeling of a single droplet evaporative cooling on a hot low thermal conductivity solid. The assumption of constant and uniform temperature at the solid-liquid interface, which decouples the solid and the liquid modeling, cannot be applied to this case because strong local cooling of the solid requires the solutioins of both regions (liquid and solid) to be coupled. The large thermal gradients observed at the edge of the droplet preclude the application of finite difference Techniques for the integration of the transient conduction governing equation. A mixture technique that uses a control volume method for the liquid and a boundary element formulation for the solid is proposed. Both methods are briefly outlined and the computed predictions are validated with experimental measurements which encompass high resolution thermography of the solid surface subjected to evaporative cooling. Insight on the location of the solid-liquid interface is obtained, deduced from the model, and the deviation from the constant and uniform temperature at the liquid-solid interface is assessed. The radial versus axial conduction in the liquid droplet is also quantified.

200,741
PB93-130342 Not available NTIS National Inst. of Standards and Technology (CSL), Boulder, CO. Chemical Engineering Div.


Pub. also PB91-147199.

In NASP Technical Memorandum 1099 (REF WBS 2.5.02), 12p May 90.


A 4.68 cm (1.84 in) auger rotating inside a tube refrigerated with liquid helium was used to produce slush hydrogen. Hydrogen was continuously supplied to the auger which was kept cool by liquid helium. The auger assembly was submerged in liquid hydrogen and the frozen hydrogen was scraped from the tube as it froze. The particles scraped from the tube were a mixture of air and hydrogen ice. The device was very efficient at low pressures initially and they lost most of the sharp corners as they aged. The slush produced by the auger appeared to have a mean particle size of about 4 microns, slush produced earlier by the freeze-thaw production method. The aged particle sizes, as determined from video pictures taken of the particles in front of a grid, were similar to those measured for freeze-thaw produced slush. The power required to scrape the solid from the tube reached 15% of the refrigeration supply of liquid helium.

200,743


Keywords: "Velocity measurement, "Drops(Liquids), "Combustible flow, "Spraying, Atomizers, Velocity distribution, Kerosene, Atomizing, Swirling, Laser doppler velocimeters, Flames, Reprints.

Axial velocity distributions, along with droplet mean velocity, have been measured in a swirling kerosene spray flame with a pressure-jet and air-assist nozzle. The effect of combustion air swirl and atomization air flow rate on the spatial variation of the axial velocity distributions is discussed for nonburning and burning sprays. The results indicate that the presence of swirlers located inside the nozzle has a significant influence upon the velocity distribution of droplets in the region immediately downstream of the nozzle. The presence of combustion and/or atomization air can lead to bimodal and tridimensional velocity distributions at spatial positions near the spray boundary. Monodimensional velocity distributions are found near the centerline and outside the spray boundary. At downstream positions, droplet dispersion results in monomodal forms of droplet velocity distribution.

200,747


Keywords: "Burning rate, "Fuels, "Flames, "Heat transfer, Soot, Heat transmission, Combustion products, Fires, Combustion, Reprints, "Pool fires.

Measurements of burning rates and radiative heat loss fractions for pool flames burning a variety of fuels in pools of three sizes are reported. The data show significant effects of fuel type on burning rates. The radiative heat loss fractions of luminous flames are found to be relatively independent of sooting tendency. Measurements of monochromatic absorption and two line emissive properties indicate that the differences in the radiative efficiencies are due to the presence of large quantities of cold soot in heavily sooting flames.

Heating & Cooling Systems

200,744
PB92-143759 PC A04/FM A01 National Inst. of Standards and Technology (BFL), Gaithersburg, MD. Performance Evaluation of a Variable Speed, Mixed Flow Centrifugal Pump, as Reprinted. P. J. Rothfleisch, and A. D. Didion, Jun 91, 59p

NISTIR 4597

See also PB87-152286 and PB88-218227. Sponsored by Environmental Protection Agency, Research Tri-
Selected Studies in Nuclear Technology

200.751
PB93-113845
PC A12/MF A03
National Inst. of Standards and Technology, Gaithersburg, MD


J. T. Fong, B. Bornstein, and J. J. Filliben, Aug 92, 266p, NISTIR-4907
Contract DE-0191NE-20413.0001
Prepared in cooperation with Illinois Inst. of Tech., Chicago, Ill. and Battelle Energy
Self-Assessment.

Keywords: *Expert systems, Data analysis, Nuclear energy performance, Energy savings, Database management, Performance evaluation, Computer programs,* PDA expert system, DATALOG computer program, DOE/Department of Energy.

A personal computer (PC)-based expert system is developed as a front end to commercially-available MS-DOS-based software and a public-domain statistical package named DATALOG (v. 92.2). Coded in micro-

PDP-11/44, the expert system PDA is designed (1) to facilitate the analysis of the so-called performance indicator data by the technical staff of the Office of Nuclear Energy (NE), U.S. Department of Energy (DOE); (2) to enhance the analysis and database management capability of an engineer or scientist through a suite of tutorial text frames, and (3) as a provision for the modification of the Prolog code of PDA or the English-based codes of the DATALOG macro's by users interested in customizing the system for new or proprietary applications.
ENVIRONMENTAL POLLUTION & CONTROL

Air Pollution & Control

200,755

Keywords: "Fossil fuels, *Computerized simulation, Atmospheres, Fossils, Fuels, Greenhouses, Rates, Records, Slope, Temperature, Greenhouse effect, Component Reports, Global fossil fuel effect."

Mankind is returning fossil fuel generated CO2 to the Earth's atmosphere at an exponential rate, causing concern about a greenhouse warming. Jones, et al. (1986) derived the record of yearly average temperature changes plotted in Fig. 1. The least squares straight line has slope 0.38 ±/− 0.04 (deg C) (century)-1, but the average slope since 1970 has been much greater and is thought to be caused by the injection of the greenhouse.

200,756

Keywords: "Chemical properties, *Chlorofluorocarbons, Bases, Analytical Methods, (Data), *Environmental chemical substitutes, *Air pollution, *Atmospheric chemistry."

Presented here are recommended values and correlations of selected physical properties of several alternatives to the fully halogenated chlorofluorocarbons. The quality of the data used in this compilation varies widely, ranging from well-documented, high accuracy measurements from published sources to completely undocumented values listed on anonymous data sheets. That some of the properties for some fluids are available only from the latter type of source is clearly not the desired state of affairs. While some would reject all such data, the compilation given here is presented in the spirit of laying out the present state of knowledge and making available a set of data in a timely manner, even though its quality is sometimes uncertain. The conclusions presented here are certain to change quickly as additional information becomes available.

200,757

Keywords: "Air pollution detection, *Neutron activation analysis, *Particles, Air pollution sampling, Aerosols, Waste disposal, Municipal wastes, Trace elements, Chemical analysis, Atmospheric composition, Reprints."

Instrumental neutron activation analysis (INAA) is a powerful analytical technique for the elemental characterization of atmospheric particulate samples. It is a true multielement technique with adequate sensitivity to determine 30 to 40 elements in a sample of atmospheric particulate material. Its nondestructive nature allows simple analysis by the same or a different analytical technique. As an example of the applicability of INAA to the study of atmospheric particulate material, the use of the emissions from municipal incinerators is described.

200,758

Keywords: "Air pollution effects (Humans), *Toxicity, *Air pollution detection, "Chemical analysis, Combustion products, Laboratory equipment, Inhalation, Exposure, *Laboratory animals, Calibrating, Fires, *Smoke, Statistical analysis, Interlaboratory comparison, Autocorrelation, Comparisons, Materials testing, Plastics, Standards, *Smoke, Cup Furnace Smoke Toxicity Method, SRM 1048, Acrylonitrile butadiene styrene."

A standard reference material (SRM 1048) has been developed for use with the smoke toxicity test method. This SRM is to be used to calibrate the apparatus and to enable the user to have confidence that the method is being conducted in a correct manner and that the equipment is functioning properly. The toxicological results from this SRM should not be used to compare with those of other materials (i.e., to determine if a material is less toxic than another material, more or less toxic than those from this SRM). SRM 1048 is an acrylonitrile-butadiene-styrene (ABS) and is similar to SRM 1007B which was used for calibrating the smoking mode of the Smoke Density Chamber test method (ASTM E-662 and NFPA 258).

200,759

Keywords: "Chemical analysis, "Bioassay, "Environmental surveys, "Air pollution detection, Solvent extraction, Sampling, Particles, Gravimetry, Aromatic polycyclic hydrocarbons, Concentration (Composition), Exhaust emissions, Coal tar, Urban areas, Fractionation, Thermal analysis, Reprints, *Standard reference materials, National Institute of Standards and Technology, SRM 1649, SRM 1597, SRM 1650."

Standard Reference Materials (SRM's) from the National Institute of Standards and Technology (NIST) are often used in methods development and inter-laboratory comparison studies since they are homogeneous and readily available to the scientific community. NRM 1048, SRM 1597, SRM 1649 and SRM 1650 (Diamond-like Carbon, Carbon Particulate Matter), and SRM 1597 (Complex Mixture of Polycyclic Aromatic Hydrocarbons from Coal Tar) are three environmental samples which have been used by the scientific community for this purpose. The SRM's were originally developed to assist laboratories in verifying analytical procedures for the determination of polycyclic aromatic compounds in complex mixtures. In addition, the SRM's have been valuable for the comparison of methodologies for bacterial bioassays and the development of biosensor-directed fractionation and bioassay directed chemical analysis techniques. Most recently the SRM's were chosen for use as test samples in a collaborative study coordinat-
ed by the World Health Organization-International Program on Chemical Safety. The paper provides a summary of much of the work to date (published and unpublished) on the chemical and biological characterization of the three SRM's. Information regarding the availability of other NIST SRM's that might be useful for the final types of studies will be provided also. (Copyright © 1992 Elsevier Science Publishers B V)

14C Source Apportionment Technique Applied to Wintertime Urban Aerosols and Gases for the EPA Integrated Air Cancer Project.


Supported by Environmental Protection Agency, Washington, DC.


The (sup 14)C source apportionment technique for tracers to fine (<2.5 micrometer diameter) atmospheric particles collected in Albuquerque, NM and Raleigh, NC, during the winter of 1984 to 85. The work was part of the EPA's Integrated Air Cancer Project (IACP). The major objective of the study was to quantify the impact of woodburning (living room source) and motor-vehicle (sup 14C) on emissions on these urban airsheds through (sup 14C) monitoring. Additionally, (sup 14C) measurements were necessary for evaluation of the EPA's single-tracer multiple-linear regression model (MLR) for source apportionment. Good agreement was found between (sup 14C) and MLR techniques. Future work includes applying these two techniques to samples collected in Boise, ID.

200.762

PB92-156560

Not available NTIS National Inst. of Standards and Technology(Technical Services Div.), Gaithersburg, MD. Surface and Microanalysis Science Div.

Source Apportionment of Wintertime Organic Aerosols in Boise, Idaho by Chemical and Isotopic (14C) Methods.


Supported by Environmental Protection Agency, Washington, DC.


The work reported here was part of the second field and measurement program of the EPA Integrated Air Cancer Project (IACP). The objective was to determine impact of residential wood combustion (RWC) on winter-time organic aerosols collected in Boise ID (1986-87), of which some aerosols were carcinogenic. The contribution of RWC was determined from (14C) measurements performed on organic material extracted from fine-particulate filter samples. Aliquots of these extracts were also subjected to mutagenicity testing to determine their biodegradability. Lastly, (14C) results were used to evaluate the EPA's Multiple Linear Regression (MLR) Model using K and Pb concentrations to estimate wood burning and motor vehicle contributions, respectively, to the organic aerosol fraction. The report summarizes the chemical methods and quality assurance procedures used to obtain (14C) results reported here and elsewhere in support of the EPA IACP.

200.761

PB92-171016

Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Gas and Particulate Science Div. Uniformity of Particle Deposition for Indoor Air Sampling under Anisokinetic Conditions.


As part of a cooperative effort between NIST and EPA to develop quality assurance for the sampling of asbestos fibers, a systematic evaluation of the uniformity for particle deposition in sampling filter cartridges under anisokinetic conditions was carried out. The paper discusses the sampling procedure and test methods used to simulate indoor air conditions, the effect of cassette orientation, and wind velocities. Sampling was carried out in a National Bureau of Standards knock out test apparatus at wind velocities of 0.91 x 0.91 m wind tunnel with wind velocities of 0.15 - 0.5 m/sec. Test aerosols were monodisperse ammonium fluorosilicate spheres with approximate diameters of 2.0, 3.0, and 5.0 micrometers. Under calm sampling conditions, there was no indication of particle deposition on the filter. Film samples were collected and compared was made between samples collected isokinetically and anisokinetically. The deposits for the smaller particle size were not uniform across the filter, but a loss of collection efficiency was observed when the orientation was inclined relative to the flow. 200.762

PB92-171370

Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Gas and Particulate Science Div.

200.764

PB92-236843

Not available NTIS National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Chemical Kinetics Div. Sources and Source Strengths of Volatile Organic Compounds in a New Office Building.


See DE88009328, Sponsored by General Services Administration, Washington, DC.


The study was conducted at a newly constructed office building in Portland, OR. The primary objectives were to identify the major sources of volatile organic compounds (VOC) in the building and to measure both long-term (one year) and short-term (several day) variations in the extent and identity of VOC emissions. The study was conducted on four occasions over a 14-month period with the first month of occupancy. Samples were also collected on each of the four occasions, 15 days after the initial sample period. The primary source of VOC in the building was liquid process photo copiers and plotters which emitted a characteristic mixture of C10-C11 branched alkanes. Vehicles in the below ground parking garage were probably also a major source of hydrocarbons. The source strength of total organic carbon emissions was determined as a ratio of the photocopy machine emissions, remaining relatively constant over the course of the study. The short-term variations in source strengths clearly demonstrated the relationship between building occupancy and sources. 200.765

PB92-238675

PC A03/MF A01 National Inst. of Standards and Technology (BSTL), Gaithersburg, MD. Environmental Evaluation of the Federal Records Center in Overland Missouri.


Sponsored by Public Buildings Service, Washington, DC.


The National Institute of Standards and Technology (NIST) is studying the thermal and environmental performance of new federal office buildings for the Public Buildings Service of the General Services Administration (GSA). The project involves long-term performance monitoring starting before occupancy and extending into early occupancy in three new office buildings. The performance evaluation includes an assessment of the thermal integrity of the building envelope, long-term monitoring of ventilation system performance, and measurement of indoor levels of selected pollutants. This is the second report describing the study of the Federal Records Center in Overland, Missouri, and the report presents measurement results from pre-occupancy to full occupancy. Ventilation rates ranged from 0.3 to 2.6 air changes per hour (ach) with the minimum levels being both the building design value of 0.8 ach and the recommended minimum in ASHRAE Standard 62-1989. The measured radon concentrations were 2 pCi/L or less on the sub-base- ment level, and less than or equal to 0.4 pCi/L on the other floors. Formaldehyde concentration was found to be from 0.03 to 0.07 ppm. Daily peak levels of carbon dioxide in the building were typically between 500 and 800 ppm and carbon monoxide was typically on the order of 1 to 2 ppm, essentially tracking outdoor levels induced by automobile traffic. There have been some incidents of elevated carbon monoxide and carbon dioxide levels in the building associated with unexplained episodic increases in the outdoor levels. 200.766

N92-144583/5


A review is given of the chemical aspects of incineration. The aim is to demonstrate that it is possible to explain in semiquantitative terms the nature of failure mecha-

See also PB91-149237.
Pub. in Environmental Science and Technology 25, n10 p1655-1704 Oct 91.

Keywords: Water pollution detection, "Mussels, Marine biology, Bioassay, Tissues(Biology), Aromatic polycyclic hydrocarbons, Trace elements, Polychlorinated biphenyls, Gas chromatography, Mass spectrometry, Pesticides, Neutron activation analysis, Chemical analysis, Water pollution effects(Animals), Standards, Reprints, "Standard reference materials, SRM 1974.

A new mussel tissue Standard Reference Material (SRM) has been prepared and analyzed for trace organic and inorganic constituents. SRM 1974 (Organic in Mussel Tissue (Mytilus edulis)) is a frozen mussel tissue homogenate that has been certified for the concentration of organic and inorganic constituents. SRM 1974 is the first frozen tissue SRM for environmental measurements of organic and inorganic constituents.

Water Pollution Control

200,768
PB92-143717
PC A07/MF A02
Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD.

Alaska Marine Mammal Tissue Archival Project: Sample Inventory and Results of Analyses of Selected Samples for Organic Compounds and Trace Elements.

See also PB88-198732 and PB91-185705. Prepared in cooperation with National Ocean Service, Anchorage, AK. Arctic Environmental Assessment Center.

Keywords: "Aquatic animals, "Mammals, Tissues(Biology), "Water pollution effects(Animals), "Arctic regions, Sampling, Archives, Chlorine organic compounds, Pesticides, Trace elements, Offshore drilling, Concentration(Composition), Inorganic compounds, Chemical analysis, Trends, Alaska, Tables(Data), Polychlorinated biphenyls.

In 1987, the Alaska Marine Mammal Tissue Archival Project (AMMTAP) was established as part of the National Biomonitoring Specimen Bank (NBSB) program at the National Institute of Standards and Technology (NIST). The purpose of the AMMTAP was to establish a representative collection of Alaska marine mammal tissues for future contaminant analyses and documentation of long-term trends in environmental quality. Since 1987, specimens have been collected from 65 animals (seven species) from six different areas. The report contains the current sample inventory and the results of the analysis of selected samples for the measurement of inorganic and organic compounds.

200,769
PB92-145317
Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Organic Analytical Research Div.
Industrial & Mechanical Engineering

Hydraulic & Pneumatic Equipment

200.773 PB92-236744 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Brief Review of Some Recent Relevance and Sensitivity Considerations for Several Commercial Ionometer Gauges. Final rep.
Keywords: "Vacuum gauges, ionization gauges, Sensitivity, Electrical measurement, Reviews, Modulation, Measuring instruments, Electric current, Linearity, Standards, US NBS, Ultrahigh vacuum, Vacuum apparatus, Reprints, Ultrahigh vacuum range.

The vacuum standards and gauging program of the National Bureau of Standards (NBS) has now been extended to encompass the ultrahigh vacuum (UHV) range. The NBS orifice/flow primarily high vacuum standard has been used to determine the sensitivities of a group of UHV gauges, representing several commercial types, for He, N2, and H2 into the 10 to the power of -8 to the 10 to the power of -7 Pa range. Pressure response of the gauges was examined with respect to linearity and the measured sensitivities are compared with nominal values specified by the manufacturers. Residual currents were determined for a different group of Bayard-Alpert gauges, including two modulated Bayard-Alpert gauges, by comparing the gauges' pressure response against that of an extracarure gauge. For four nominally identical Bayard-Alpert gauges in this group, the residual current values were found to differ by as much as a factor of 10. The modulation technique was also used to determine residual current in the two modulated Bayard-Alpert gauges. Comparison of the results of the two methods indicated significant modulation of the residual current itself, in one of the gauges. The results of the two methods were combined to obtain an estimate of the residual current modulation factors.

Laboratory & Test Facility Design & Operation

200.776 AD-P007 934/3 PC A01/MF A01 National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Surface Science Div.
Keywords: High resolution, High sensitivity, Sensitivity, Surface roughness, Microscopy, Scanning Microscopy, Component Reports, Optical measurement.
The Scanning Scattering Microscope (SSM) one can produce two-dimensional, high resolution micrographs of very small surface features and surface microtopography, this optical technique is very sensitive to surface roughness, surface and near-surface damage, and individual surface defects. Its present lateral resolution of about 5 micrometers is augmented by an extremely high sensitivity to surface roughness of about 2 nm.

Industrial Safety Engineering

200.774 PB92-170687 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Fire Measurement and Research Div.
Conal Calorimeter: A New Tool for Fire Safety Engineering.
Final rep.
V. Babrauskas, 1990, 4p. See also PB87-134730.
Keywords: "Calorimeters, "Fire detectors, Heat measurement, Ignition, Fire tests, Reprints."
The Cone Calorimeter standard is proceeding towards adoption in ASTM. The article summaries some of the main features of the apparatus and discusses applications using the Cone Calorimeter.

200.775 PB92-144583 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Fire Measurement and Research Div.
North American Experience in the Use of Cone Calorimeter Data for Classification of Products. Final rep.
Keywords: "Calorimeters, "Fire detectors, Heat measurement, Ignition, Fire tests, Building codes, Reprints."
The North American building codes traditionally use the concept of 'noncombustible,' required of products to be used in certain applications, plus other requirements, which can be considered 'degrees of combustibility.' Noncombustibility is intended to ensure a low heat release rate. However, these traditional concepts are not entirely in harmony with current fire protection engineering, where only a single, quantitative scale for measuring the rate of release of heat is used. The objective of this project was to compare and quantify the performance of products for any required applications. Nonetheless, as an intermediate step, it is shown that replacement of combustibility and various degrees of-combustibility requirements by heat release-based measurements may be fruitful. In recent years, the acceptance and widespread use of the Cone Calorimeter (ISO DIS 5600) has prompted a number of exploratory studies. The goal of these studies has been to determine the data release-based stoichiometry for these traditional measures could be established. Such a scheme would correct existing classification anomalies, and with suitable product data, be included in the appropriate category as determined by these building codes at the present. In the paper, the progress of these exploratory studies towards the goal is reviewed, and it is found that such a replacement is feasible and appropriate.

200.779 PB92-144807 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Automated Production Technology Div.
Round Robins: Simplest is Best.
Final rep.
Keywords: "Precision, Interlaboratory comparisons, Reproducibility, Consistency, Test methods, Reprints."
A brief, general description is given of the revised ASTM Standard Practice E691 for Conducting an Interlaboratory Study to Determine the Precision of a Test Method. The short paper is designed to acquaint ASTM members with this Standard Practice, for use in their work in the interlaboratory evaluation of test methods.

200.780 PB92-149495 (Order as PB92-149889, PC A08) National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Reference Material Div.
Keywords: "Microspheres, "Particle size, "Dimensional measurement, Space manufacturing, Reduced gravity, Light scattering, Electron microscopy, Polystyrene, Diameter, Micrometry, "Standard reference materials, Micrometry.
Experimental, theoretical, and calculational details are presented for the three independent micrometry techniques used to certify the mean diameter of Standard Reference Material 1960, nominal 10 micrometer diameter polystyrene spheres (space beads). The mean diameters determined by the three techniques were measured accurately well, with all measurements within 0.1% of each other, an unprecedented achievement in the dimensional metrology of microspheres. Center distance finding (CDF), a method based on optical microscopy, gave a value of 9.89 +/- 0.04 microme.
The authors report on the experience gained with these gages and, in particular, on their long- and short-term calibration stability, on factors affecting accuracy, and on the ability of the accuracy measurement coefficient, and on factors affecting the stability of the offset correction.

200.784

PB92-162270 PC A05/MF A01 National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Measurements Div. Spectral Analysis on a PC

Final rep.
D. E. Hess Dec 91, 78p NISTIR-4733

Keywords: "Spectral analysis," "Computer applications," "Programs," "Data processing," "Sampling," "Programs," "Data processing," "Sampling," "Programs," "Data processing," "Sampling,

These notes are intended to serve as a brief instruction manual for engineers engaged in the spectral analysis of experimentally derived random data. A collection of techniques are described which are necessary for the proper software implementation of spectral analysis procedures on a personal computer; data transformation, mean value and linear trend removal, digital filtering, time history tapering and data overlap-peration, and the calculation of spectral density functions are then defined and explained along with a means for the calculation of the error associated with a particular estimation method. The notes are intended to provide a self-contained guide to the use of the software. The manual also contains a brief description of the considerations necessary when sampling the data to be analyzed.

200.785

PB92-163513 Not available NTIS National Inst. of Standards and Technology, Gaithersburg, MD. Lab. Accreditation Program. Advantages of Laboratory Accreditation.

Final rep.
R. L. Gladhill 1989, 5p See also PB96-127187

Keywords: "Accreditation," "Laboratory accreditation," "Laboratory accreditation," "Laboratory accreditation," "Laboratory accreditation," "Laboratory accreditation,

Laboratory accreditation provides advantages both to laboratories and users or potential users of laboratory services. Laboratories benefit by receiving national and international recognition of their competence and qualifications, by using the evaluation process as a quality assurance tool (for example, an independent audit), and by saving both time and money through the possible elimination of multiple audits from many funding or operating agencies. Laboratories can benefit by having an independent objective means to select a laboratory for the required services, an easy way to provide specifications for laboratory services, and after savings in both time and money by not having to perform extensive evaluations on their own. These advantages are realized only when a highly credible laboratory accreditation system is providing the service.

200.786

PB92-171754 Not available NTIS National Inst. of Standards and Technology, Gaithersburg, MD. National Voluntary Lab. Accreditation Program. Interlaboratory and Intralaboratory Proficiency Testing.

Final rep.
J. H. Yee, 1991, 1sp, 5p See also PB91-618796

Keywords: "Laboratories, Performance, Proficiency Testing, Reprints," "Proficiency Testing, Reprints," "Proficiency Testing, Reprints," "Proficiency Testing, Reprints," "Proficiency Testing, Reprints,

Proficiency testing is an integral part of the NVLAP laboratory accreditation process. Demonstration of appropriate facilities, equipment, personnel, etc. is necessary, and may not be sufficient for the evaluation of laboratory competence. Inter- and intralaboratory test data using special proficiency testing samples provide the accrediting authority with a way to determine the operational competence of the laboratory. For many test methods, results from proficiency testing are good indicators of a laboratory's testing capability. Information obtained from proficiency testing helps to identify and lead to solutions to problems in a laboratory. If problems with the test method are suspected, information can be provided to the appropriate standards-writing bodies to use as a basis for improving the method. Each field of testing and each specific test method within a field has unique proficiency testing requirements. Proficiency testing data should be analyzed by the accreditor in confidence and summary reports of the results sent to the participants.

200.787


V. J. Famiano, and G. J. Rosasco, Apr 92, 219p NISTIR-4828

See also PB98-105002

Keywords: "Pressure measurement," "Meetings, Temperature measurement," "Military requirements, Explosive effects, Pressure transducers, Shock waves, High pressure, Calibration, Transients, Standards.

The talks and the discussions at the Workshop on the Measurement of Transient Pressure and Temperature held at NIST, Gaithersburg, MD on 23-24 April 1991 are reviewed. Twelve talks were presented describing new developments and future trends in this area. In many cases these measurements are needed for establishing national standards for such measurements, and possible methods for improving these measurements.

200.788

PB92-187087 PC A03/MF A01 National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Automated Production Division. Automation of Strain-Gauge Load-Cell Force Calibration.

K. Y. Yee, Apr 92, 13p NISTIR-4823

See also PB97-116901

Keywords: "Load cells," "Strain gages," "Calibration, Loads(Forces), Automation, Dead weight machines.

The National Institute of Standards and Technology (NIST) has six dead-weight machines (DWMs), used for force calibrations up to 4.4 meganewtons (MN), which were all placed in service ca. 1965. More than 20 years later, five of these machines were automated. The authors now automatically apply programmed force values to the strain-gauge load cell and record the output using a high-performance computer controlled by a PC-XT class computer. Subsequently, environmental chambers have been added to three machines with a goal to automate the type evaluation testing of load cells used in scales in commerce.

200.789

PB92-192095 (Order as PB92-192079, PC A05) National Inst. of Standards and Technology, Gaithersburg, MD. Certification of NIST SRM 1962: 3 micrometers Diameter Polystyrene Spheres.

A. W. Hartman, T. D. Doron, and J. F. Xu, 1992, 13p Included in Jnl. of Research of the National Institute of Standards and Technology, v97 n2 p253-265 Mar/Apr 92

Keywords: "Microspheres, \"Sphere size, \"Spheres, Diameter, Polystyrene, Electron microscopy, Optical measurement, \"Standard reference materials.

The report describes the certification of SRM 1962, a NIST Standard Reference Material for particle diameter. It consists of an aqueous suspension of monosize 3 micrometer polystyrene spheres. Two calibration procedures were used: optical microscopy and electron microscopy. The reported value covering the two results is D = 2.983 micrometer with a maximum uncertainty of 0.016 micrometer with a standard deviation of the size distribution OD = 0.020 micrometer.

200.790

PB92-197367 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Temperature and Pressure Div.

The Bureau of National Standards has used molecular drag gages for six years as transfer standards for high vacuum work in the pressure range 0.0001 to 0.1 Pa.

The National Bureau of Standards has used molecular drag gages for six years as transfer standards for high vacuum work in the pressure range 0.0001 to 0.1 Pa.

Theoretical calculations of the distortion coefficients for piston gages require experimental verification in order to establish a basis for error analysis. A three-term capacitance method for measuring the radial displacement of the outer radius of the cylinder of a piston gage as a function of pressure to test such calculations is included in the paper. The measurements are repeatable at the nanometer level.

Possible Change in the U.S. Legal Unit of Mass.

At present the working standard for NBS mass calibration is based on two nickel-chromium kibograms designated N(1) and N(2). These artifacts were originally calibrated (1958) in SI units, but until recently it has not been possible to assess with statistical rigor either the long-term stability of the calibration or the long-term stability of the assigned value. The authors now find that the mass values assigned to the N kibograms are offset from the SI value by about 1.5 ppm. Indirect evidence suggests that this situation has probably existed for at least the last 15 years. The evidence they have collected will be presented as well as their plans to shift NBS calibrations on January 1, 1990 to be in accord with the SI unit of mass. Finally, they present a new quality control system which will closely tie the U.S. unit of mass with the SI unit. The quality control system depends on close cooperation with the International Bureau of Weights and Measures and the development of NBS at a kilogram comparator with sub-microgram precision.

Interactions Graphs: Graphical Aids for Planning Experiments.

Interaction graphs make it possible for engineers to plan fractional factorial experiments on their own without undertaking statistical training. A fractional factorial plan can be generated from an orthogonal array by selecting certain columns of the orthogonal array and using interaction graphs which are very-easy-to-use graphical aids for identifying the appropriate columns. They are most useful for planning two-level fractional factorial experiments that have uncontoured estimation of all main effects and some specified interaction effects under the assumption that only interactions of a specified order and degree are of interest. Interaction graphs, unlike Taguchi's linear graphs, identify the confounding relationships associated with the fractional factorial plan. And, unlike most other methods for planning experiments that allow uncontoured estimation of all main effects and some specified interaction effects, interaction graphs require no prior statistical training.

NIST Impact Test Facility.


Keywords: *Impact tests, Test facilities, Impact forces, Data acquisition, Dynamic response, Kinetic energy. *On-line, Off-line, Mechanical tests, Mechanical tests, Load(Forces), Loading(Mechanical).

The National Institute of Standards and Technology has recently constructed an Impact Test Facility (ITF), which is to be used in the investigation of the behavior of impact phenomena and systems subject to loads of short duration and high intensity. The ITF consists of a 21.9 m vertical drop tower and free-fall impactor. A possible payload of 100 kg is available. The ITF is equipped with a test table with a 21.9 m vertical drop tower, impact sled, sled hoist assembly, sled fall arresting system, specimen support frame, instrumentation, and data acquisition system. The system has been designed to be versatile and can be adapted to meet a wide variety of test requirements and is described in the report.

Not presented

DISCLOSURES

A09/MF 200,797

The National Institute of Standards and Technology has recently constructed an Impact Test Facility (ITF), which is to be used in the investigation of the behavior of impact phenomena and systems subject to loads of short duration and high intensity. The ITF consists of a 21.9 m vertical drop tower and free-fall impactor. A possible payload of 100 kg is available. The ITF is equipped with a test table with a 21.9 m vertical drop tower, impact sled, sled hoist assembly, sled fall arresting system, specimen support frame, instrumentation, and data acquisition system. The system has been designed to be versatile and can be adapted to meet a wide variety of test requirements and is described in the report.
apparatus, test data, and engineering applications of the test data. While most of the material surveyed is in English, a few foreign-language publications are also included. The annotations include a brief description of the work reported, however, the data are neither critically evaluated nor assessed.

200.800
PB93-125920 Not available NTIS National Inst. of Standards and Technology (IMSE), Gaithersburg, MD Metallurgy Div.
Automation of Microhardness Testing.
Final rep.
J. L. Muller, and D. S. Lashmore, 1987, 8p

Keywords: *Microhardness, *Automation, *Penetration, *Optical measurement, Calibration, Test facilities, Displacement, Standards, Toughness, Mechanical properties, Impact tests, Reprints.

One of the most important sources of error in microhardness testing is the optical measurement of the width of the hardness impression. Many other sources such as imperfect calibration standards and instrument problems such as load overshoot and vibration can also influence the results of the hardness measurement. Since the relationship of the depth of penetration to the measured distance is known, the hardness can be calculated by knowing the depth of penetration. This paper describes a scheme whereby the displacement of the indicator is continuously monitored and the surface sensed by the slope change of the displacement-time plot. A prototype system has been designed and built. Results are presented for automated hardness measurements of both soft and moderately hard samples.

200.801
PB93-130359 Not available NTIS National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Final rept.
D. A. Shepherd, and T. A. Siewert, 1992, 25p


In February of 1991 an interlaboratory study (ILS) was conducted according to ASTM Standard Practice E 691-87 at the National Institute of Standards and Technology (NIST). The purpose of the study was to determine the precision of Charpy V-notch (CVN) impact testing, as described in ASTM Standard E 23-88. The results of the study form the basis for a precision statement for future revisions of E 23.

Nondestructive Testing

200.802
PB92-165638 Not available NTIS National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.
Final rept.
P. H. Heyliger, J. C. Moulder, and N. Nakagawa, 1989, 6p
See also PB90-152809.

Keywords: *Nondestructive tests, *Dielectric properties, *Capacitance, Harmonic functions, Electrical properties, Finite element method, Electric fields, Surface defects, Dielectric breakdown, Inspection, Electromagnetic testing, Numerical analysis, Detectors, Mathematical models, Reprints.

Finite elements with exponential decay were used to model a three-fingered capacitive array sensor interfacing dielectric slabs. Flaw geometries modeled were a step and a square groove. The influence of boundary conditions and dielectric constant were examined for these two geometries. The response of the probe was measured using a line integral that is a function of the electostatic potential and its normal derivative along the surface in the test sample. By using infinite elements to model the infinite region around the probe, more accurate values of the change in admittance were obtained.

Using Standards to Facilitate Access and Reuse of Museum Information.
Final rept.
J. Moline, 1991, 9p


Standards for dealing with electronic records must be selected based on a careful analysis of user requirements. These requirements must be taken into account the long time frames of the larger community. For any particular museum the larger community could include archives and libraries, as well as other museums and the nation's museums. Consistent use of standards among members of the museum community would facilitate the interchange of information among systems. Further, standards allow the reuse of information. The reuse may be for the same or different purposes. The paper presents a framework for determining the needed standards for museum records management. Although options are discussed based on the Open System Environment, these are not a predetermined set of standards. The goal of the paper is to help a particular user community select appropriate standards.

200.806
PB92-238674 PC A03/MF A01 National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Advanced Systems Div.
Retrieving Records from a Gigabyte of Text on a Microcomputer Using Statistical Ranking.
Final rept.
Pub. in Jnl. of the American Society for Information Science 41, n8 p381-389 Dec 90.

Keywords: *Automatic indexing, *Information retrieval, *Ranking, Data structures, Database management systems, Search structuring, Response time, (Computers), Minicomputers, Text processing, Reprints.

Statistically-based ranked retrieval of records using keywords has not been widespread use in large operational retrieval systems. To show the feasibility of the approach, research was done to produce very fast search techniques using these ranking algorithms, and then test the results against large databases with many end users. The results show not only response times in the order of 1 and 1/2 seconds for 800 megabytes of text, but very favorable user reaction. Work was also done in using new indexing techniques to create inverted files for large databases using a minicomputer.

200.804
PB93-114478 PC A07/MF A02 National Inst. of Standards and Technology (CSL), Gaithersburg, MD Office of Information Services.
Fact sheets on databases available in the Research Information Center of the National Institute of Standards and Technology.
Special pub. (Final).
D. Cunningham, Sep 92, 14p NIST/SP-842 Also available from Sup. of Docs. as NISTIR-4873, B Supersedes PB92-109016.

Keywords: *Data bases, *Information services, Information systems, Indexes, (Documentation), Subject indexing, Directories, Vendors, Tables, (Data), US NIST.

Databases available online in the Research Information Center of the National Institute of Standards and Technology (NIST) are listed by acronym and by full title. In addition, descriptions of the databases, dates covered, producers, hard copy counterpart, principal sources and vendors are listed. A general subject index, a cross reference index, and a full text database list are also supplied.

Operations & Planning

200.805
PB92-171552 Not available NTIS National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Systems and Software Technology Div.

LIBRARY & INFORMATION SCIENCES

Information Systems

200.803
PB92-175397 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD Advanced Systems Div.
Retrieving Records From a Gigabyte of Text on a Microcomputer Using Statistical Ranking.
Final rept.
Pub. in Jnl. of the American Society for Information Science 41, n8 p381-389 Dec 90.

Keywords: *Automatic indexing, *Information retrieval, *Ranking, Data structures, Database management systems, Search structuring, Response time,(Computers), Minicomputers, Text processing, Reprints.

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200.806
PB92-238674 PC A03/MF A01 National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Advanced Systems Div.
Automatic Indexing.
D. Harman, Sep 92, 20p NISTIR-4873 See also PB-256262.

Keywords: *Automatic indexing, Information retrieval, On line systems, Documents, Full text.

Automatic indexing has been a critical technology as more full-text data becomes available online. The paper discusses issues for automatic indexing of different types of full-text and also presents a survey of much of the current research into new techniques for automatic indexing.

Reference Materials

200.807
PB92-190487 PC A12/MF A03 National Inst. of Standards and Technology (TS), Gaithersburg, MD. Office of Information Services.
Special pub. (Final).

Keywords: *Periodicals, *Catalogs(Documentation), *Collection, *Information centers, Standards, Libraries, *US National Institute of Standards and Technology, *NIST.

The publication contains bibliographic information on approximately 5,000 titles held in the NIST Research Information Center, representing current and noncurrent journals, periodicals, annuals, memoirs, proceedings and transactions.

200.808
PB92-217587 PC A03/MF A01 National Inst. of Standards and Technology (TS), Gaithersburg, MD. Office of Information Services.
Abstract and Index Collection in the Research Information Center of the National Institute of Standards and Technology.
Special pub. (Final).
D. Cunningham, Jun 92, 40p NIST/SP-836 Also available from Sup. of Docs. as NISTIR-4873, B Supersedes PB91-148448.

Keywords: *Indexes, (Documentation); *Abstracts, Technical reports, Information centers, Technical information center, Subject indexing, Document types, *National Institute of Standards and Technology, *Research Information Center.
The diffusion and absorption properties of boxboards, commonly used to store archival documents, with sulfur dioxide have been measured. For the most common boxboard used by National Archives and Record Administration (NARA) a diffusion constant of about 0.001 cm²/sec is measured for SO₂ in the concentration range 10 ppm to 150 ppm. For this 15 fold change in gas concentration the calculated diffusion constant is found to be almost independent of gas concentration. These results are discussed in terms of Passaglia's model of the microenvironment provided by these boxboards as used in archival storage. Uptake of sulfur dioxide by boxboard was found to be very dependent upon the nature of the boxboard sample. Both permanent and nonpermanent binding of SO₂ were observed and the contribution of each to the absorption of storage containers is discussed.

MANUFACTURING TECHNOLOGY

Computer Aided Design (CAD)

Validating STEP Application Models at the National PDES Testbed Report Series.

K. C. Morris, M. J. Mitchell, and D. A. Sauder. Dec 91, 27p, NISTIR-4735
See also PB91-107581, PB92-112374 and PB92-120308. Sponsored by Assistant Secretary of Defense (Production and Logistics), Washington, DC, and the National Institute of Standards and Technology.

Keywords: *Specifications, Computer aided design, Computer aided manufacturing, Automation, Software tools, Computer systems programs, Testing, STEP (Standard for the Exchange of Product Model Data), AP (Application Protocol), VTS (Validation Testing System), AIM (Application Interpreted Models).

The problem of sharing data has many facets. The need for the capability to share data across multiple enterprises, different hardware platforms, different data storage paradigms and systems, and a variety of network architectures is growing. The emerging Standard for the Exchange of Product Model Data (STEP) is an emerging standard for the Exchange of Product Model Data (STEP), a project of the International Organization for Standardization (ISO), addresses this need by providing information models which clearly and unambiguously describe the data. The models are organized into application protocols. An application protocol addresses the data sharing needs for a particular application area. STEP integrates the information requirements from all the application protocols. The validity of these information models is ensured by a highly automated environment. The document describes how application models will be validated in the National Institute of Standards and Technology, Gaithersburg, MD.

200.911
PB92-143734 PC A03/MF A01 National Inst. of Standards and Technology, Gaithersburg, MD


K. C. Morris, Dec 91, 27p NISTIR-4742
See also PB91-107576, 20mb (Vics) by Assistant Secretary of Defense (Production and Logistics), Washington, DC, Computer-aided Acquisition and Logistic Support Program.

Keywords: *Computer systems programs, *Tests, Software engineering, Protocols, Computer program verification, Computer aided design, Computer aided manufacturing, Data processing, Standards, PDES (Product Data Exchange System), STEP (Standard for the Exchange of Product Model Data), Object-oriented programming.

The problem of sharing data has many facets. The need for the capability to share data across multiple enterprises, different hardware platforms, different data storage paradigms and systems, and a variety of network architectures is growing. The emerging Standard for the Exchange of Product Model Data (STEP), a project of the International Organization for Standardization (ISO), addresses this need by providing information models, called application protocols, which clearly and unambiguously describe data. The validity of these information models is essential for success in sharing data in a highly automated business environment. The document describes an architecture for an exchange of data to verify the validation of STEP application protocols. The architecture provides a basis for software development to support the exchange of data for the exchange of Product Model Data using the STEP Testbed. (PDES is the U.S. effort in support of the international standard.) The software architecture and the use of object-oriented techniques enables code reusability and system extensibility. The software developed for the VTS can provide the foundations for STEP related systems or software projects requiring general purpose editing tools for structured information.

200.812
PB92-148238 PC A03/MF A01 National Inst. of Standards and Technology, Gaithersburg, MD

Comparison of ISO 10303 Part 47 Draft with ANSI and National Institute of Standards and Technology Conformance and Completion of Part 47. National PDES Testbed.

S. C. Feng, B. Jan 92, 41p NISTIR-4744
See also PB91-167221

Keywords: *Standards, *Comparison, Computer aided design, Computer aided manufacturing, Production development, Data, Dimensional measurement, Tolerances (Mechanical), STEP (Standard for the Exchange of Product Model Data), ISO (International Organization for Standardization), ANSI (American National Standards Institute), DMIS (Dimensional Measurement Integration System).

The report provides an evaluation of the ISO 10303 Part 47 draft with respect to ANSI and ISO tolerancing standards. It is expected that the information contained in the report will contribute toward the completion and harmonization of Part 47. The document is the result of a comparison of the Part 47 draft with existing and developing U.S. and international dimensional and tolerancing standards. Comparison results are summarized in tables in each section. The comparison of Part 47 with other standards is made in the basic tolerancing principles, size tolerance, datum and datum establishment, and geometric tolerances specified by standards. Additions and modifications of Part 47 are at the end of each section. The objective is to have Part 47 completely cover the basic tolerancing principles, and the tolerancing methods specified in ANSI and ISO standards.
MANUFACTURING TECHNOLOGY

Computer Aided Design (CAD)

The National Institute of Standards and Technology (NIST) in Gaithersburg, MD, has developed EXPRESS, a
structured, object-oriented design language. The EXPRESS
language is used for design, documentation, and
communication. EXPRESS is based on the EXPRESS
language, which is an object-oriented design language
created by the ISO/IEC JTC1/SC4/WG7 working group.

EXPRESS is used in a variety of applications, including
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MANUFACTURING TECHNOLOGY
Computer Aided Design (CAD)

The document describes the information sharing requirements and approaches used to fulfill those requirements for the development of standardized data constructs for the Standard for the Exchange of Product Model Data (STEP). It also describes the architecture used to conceptually organize the data constructs, and the information sharing architecture in which the standardized constructs are used.

Computer Aided Manufacturing (CAM)

Computer aided manufacturing, "Control theory, Automation, Scheduling, Planning, Management, Control systems, Reprints, Multilevel control, Multilayer control.

Computer aided manufacturing, "Control theory, Automation, Scheduling, Planning, Management, Control systems, Reprints, Multilevel control, Multilayer control.

The paper addresses the problem of designing an organizational structure which will be appropriate for the manufacturing enterprise of tomorrow. Those systems will have computers and robots executing most of the functions currently done by humans. It proposes a multi-level architecture to manage shop floor activities. Each module within that architecture is a multi-layer controller performing the functions.

The paper addresses the problem of designing an organizational structure to manage production activities in the factories of tomorrow. Those factories will have computers and other automated machinery performing manufacturing functions. The paper proposes a multi-layer/multi-level control architecture to manage shop floor activities. Each module in that architecture performs the following functions: adaptation, optimization, and regulation. It describes these functions and discusses integration and future research issues.

200,910
PB92-197847
Not available NTIS National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Factory Automation Systems Div.

Keywords: Computer aided manufacturing, Control theory, Hierarchies, Automation, Control systems, Management, Reprints, Multilevel control, Multilayer control.

The paper addresses the problem of designing an organizational structure which will be appropriate for the manufacturing enterprise of tomorrow. These systems will have computers and robots executing most of the functions currently done by humans. The authors use spirals and temporal composition to develop layer control architecture to manage shop floor activities. Each module within that architecture is a multilayer control resulting in the ability to perform the functions of adaptation, optimization, and regulation. They describe these functions and discuss future research needs.

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**MANUFACTURING TECHNOLOGY**


Pub in Software Engineering Jnl. 4, n5 p283-291 Sep 89.

Keywords: Automation, Computer aided manufacturing, Control systems, Industrial plants, Process control, Finite state machines, Prototypes, Reprints.

The paper describes a method of transforming structured control constructs into extended state transitions that can be used by an emulation tool for automated factory systems. The emulation tool, NBS Hierarchical Control System Emulator (HCSE), allows concurrent simulation of modules emulating both physical processes and decision processes. The concurrent modules are specified as extended finite state machines; reentrancy rules are associated with decision tables in a structured control construct. The implementation of the model on an HCSE is shown to be feasible. The HCSE is programmed by specifying, for each module, conditions, consisting of values of internal variables and variables in shared memory, and actions, consisting of code fragments to execute when the condition evaluates to true. The paper presents this model at different levels of detail for a large automated manufacturing system.

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**Job Environment**


Keywords: Automation, *Industrial plants,* Research and development, *Standards,* Information systems, Computer aided manufacturing, Research projects, Industries, Systems engineering, Concurrent engineering, National Institute of Standards and Technology.

The report describes the 1992 technical program of the Factory Automation Systems Division (FASD), one of four technical divisions in the Manufacturing Engineering Laboratory, within the National Institute of Standards and Technology (NIST). The Manufacturing Engineering Laboratory supports the U.S. mechanical manufacturing industry through research and measurement services that are oriented toward a modern automated environment. The mission of the Factory Automation Systems Division is to provide a focus for national research and standards efforts related to information systems for manufacturing. The work is divided into four programs, Design Methods, Product Data Sharing, Systems Integration, and Life Cycle Applications.

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**Joining**

PB93-113611 PC A03/MF A01 National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Robot Systems Div.


Keywords: Deburring, Chamfering, Workstations, Computer aided manufacturing, Robotics, Inventories, Real time operations, Controllers, Robots, Computer Software, Automated Manufacturing Research Facility.

The manual provides a complete inventory of the equipment used in the Advanced Deburring and Chamfering System of the Automated Manufacturing and Research Facility at the National Institute of Standards and Technology.

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Keywords: *Welding,* Nondestructive tests, Reliability, Tolerances, Research projects, Inspection, Radiography, International organizations, Technology assessment, Welding methods, Reprints, International Institute of Welding.

The report summarizes the July 20 to 27, 1990 meeting of the commission (V) that deals with the testing, measurement, and control of welds. The commission's
activities are important because it is an international forum for NIST's research on metal standardization. Many of its documents are accepted by the International Standards Organization (ISO) and become standards. Over the past 50 years, NIST investigators have written over 200 peer-reviewed papers for U.S. researchers to present, and have discussions with other researchers.

200.842
PB92-159587
Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Fracture and Deformation Div.
Welding Technology in Eastern Europe.
Final rep.

Keywords: *Welding, Technology assessment, International trade, Research, Hungary, Czechoslovakia, Technol., order, Reprints, "Foreign technology, "Eastern Europe."

During May and June 1990, Drs. Siewert and Gerken traveled (independently) throughout Eastern Europe and had a chance to visit various Universities and Institutes in Czechoslovakia and Hungary. One goal was to learn about their welding technology, as a first step in encouraging the trade of technology with firms and organizations in the West. The report describes some of these activities and lists some opportunities for interaction with them.

200.843
PB92-156018
Not available NTIS
National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.
On-Line Arc Welding Data Acquisition and Analysis System.
Final rep.
G. Adam, and T. A. Siewert, 1990, 5p, See also PB90-117981.

Keywords: *Gas metal arc welding, *Data acquisition, *Data analysis, Electrical measurement, Welding current, Welding, Electric current, Personal computers, Fourier transformation, Histograms, Reprints.

A 16 MHz microcomputer with a fast analog-to-digital conversion board was used to sample the current and the voltage during welding experiments. After the necessary software was developed, sampling rates of up to 50 KHz could be used. The length of the record being limited only by available disk space. The analysis software enables us to extract numerical data, as well as to manipulate and analyze, for example, amplitude frequency harmonics, peak searching algorithms, and smoothing procedures. To evaluate the validity of these mathematical techniques, mild steel welds were produced, and the current and voltage signals were recorded. A current-voltage matrix that sampled short, go and spray transfer modes, as well as transitions between these modes was developed. After analysis of the data, several parameters which could be used to characterize the metal transfer mode were defined. Monitoring these parameters during welding should permit real-time control of the welding process.

200.844
PB92-161171
PC A03/ MF A01
National Inst. of Standards and Technology (TS), Gaithersburg, MD. National Voluntary Lab. Accreditation Program.
National Voluntary Laboratory Accreditation Program Workshop on Fastener Test Methods, Part 1. Held in Gaithersburg, Maryland on April 22, 1991.
Final rep.
S. W. Sietel, Apr 22, 5p, NISTIR-4817
See also Part 2, PB92-161189.

Keywords: *Fasteners, *Meetings, Test methods, National Voluntary Laboratory Accreditation Program, Fastener Quality Act, NVLAP program.

The President signed the Fastener Quality Act (FQA), Public Law 101-592, on November 16, 1990. The purpose of the FQA is to increase the quality and reduce danger of fastener failure. The Act requires the Secretary of Commerce, acting through the Director of the National Institute of Standards and Technology (NIST), to establish a laboratory accreditation program for fastener testing laboratories under the procedures of the National Voluntary Laboratory Accreditation Program (NVLAP). A notice was published in the Federal Register Register March 22, 1991, announcing the Workshop on Fastener Test Methods, Part 1, Held in Gaithersburg, Maryland on April 22, 1991 at NIST to provide interested parties an opportunity to participate in the development of a list of test methods to be included in the Fastener Quality Act accreditation program. The workshop resulted in presentations and lists of fastener specifications and test methods published by least 28 fastener manufacturers and private, manufacturers, standards organizations, instrument manufacturers, distributors and importers. The presentations and the lists of test methods are presented in the report. The lists have been categorized by fastener specification, and by type of fastener. The workshop results and lists of test methods will be used in the determination of an initial list of test methods to be offered for accreditation. Part I of the workshop report (NISTIR 4917) summarizes the workshop presentations and the test method categories submitted in response to the notice published in the Federal Register (NISTIR 4818) contains the appendices.

200.845
PB92-181189
PC A06/ MF A02
National Inst. of Standards and Technology (TS), Gaithersburg, MD. National Voluntary Lab. Accreditation Program.
National Voluntary Laboratory Accreditation Program Workshop on Fastener Test Methods, Part 2. Held in Gaithersburg, Maryland on April 22, 1991.
Final rep.
S. W. Sietel, and E. R. Lindstrom, Apr 22, 115p, NISTIR-4818
See also Part 1, PB92-181171.

Keywords: *Fasteners, *Meetings, Test methods, National Voluntary Laboratory Accreditation Program, Fastener Quality Act, NVLAP program.

Public Law 101-592, "The Fastener Quality Act," requires the establishment of an accreditation program for laboratories that test fasteners. The Act provides for the use of the National Institute of Standards and Technology (NIST) procedures followed by the National Voluntary Laboratory Accreditation Program (NVLAP) to develop lists of test methods as a response to the notice published in the Federal Register inviting interested parties to provide a list of test methods to be included in the accreditation program. A public workshop was held at NIST in Gaithersburg, MD on April 22, 1991, to discuss the test methods list. Part I of the report (NISTIR 4917) summarizes the workshop presentations and the test method categories submitted in response to the notice published in the Federal Register;
(2) detailed presentations by NIST and response to audience questions;
(3) detailed presentations by public participants and response to audience questions;
(4) the text of an open discussion session which followed the presentations;
(5) a compilation of the test method lists; and
(6) a list of the workshop presenters and attendees.

200.846
PB92-236314
Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Real-Time Particle Size Analysis during Inert Gas Atomization.
Final rep.


Metal powder produced by inert gas atomization was analyzed with a nonintrusive particle sizing instrument. The technique operates on the principle of laser Fraunhofer diffraction. A line-of-sight measurement of the particle size distribution and total metal content was used to determine the metal particle size distribution. The particle size distribution was successfully tested during several metal powder runs. Results obtained with the particle sizing apparatus were compared with data obtained using a total weight sieving technique. It is expected that the laser diffraction technique will be a suitable candidate for process feedback and control.

200.847
PB92-237379
Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.


Commission V on Quality Control and Quality Assurance of Welded Products (formerly Testimony, Measurement, and Standardization of Welded Joints) requested a summary of the assembly of the International Institute of Welding (IIW) held July 1 to 5, 1991 in the Hague, Netherlands. The Commission's activities are important because it is an international forum for research and standardization activities in nondestructive evaluation. Many of its documentation is forwarded to the International Organization for Standards (ISO) and becomes standards. The meeting provides an opportunity to present and discuss research and standardization activities with experts from other countries. This report is a summary of the meeting. 

200.848
PB93-116408
PC A03/ MF A01
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Standard Contact Tube Wear in Gas Metal Arc Welding.
M. A. Morris, T. P. Quinn, T. A. Siewert, and J. P. H. Steele, 1992, 6p, See also PB93-116424.
Prepared in cooperation with Colorado School of Mines, Golden. Dept. of Mechanical Engineering. Sponsored by David Taylor Research Center, Annapolis, MD.


Welding tests confirmed that the circuit voltage can serve as a through-the-arc sensing parameter for monitoring contact tube wear in gas metal arc welding. The test rig was fabricated so that the gas metal arc welding. The test rig was fabricated so that the arc stability, which degraded as the contact tube was eroded by the electrode. W reached a peak value when the wear reached the maximum limit contact tube wear. The "W" became erratic as the electrode started to oscillate within the slot that had worn in the tube.

200.849
PB93-125433
Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Fracture and Deformation Div.
Metal Transfer Mode in Gas Metal Arc Welding.
Final rep.

Keywords: *Gas metal arc welding, *Welding current, *Transfer, Drops(Liquids), Welding current, Signal processing, Stability, Transport properties, Mathematical models, Reprints.

In gas metal arc welding, the filler metal is transferred across the arc in the form of molten metal droplets. The rate of transfer of these droplets determines the metal transfer mode and stability of the process. The arc current and voltage signals associated with gas metal arc transfer can be used to monitor the metal transfer mode and the stability of the process. In this paper, a method is described for extracting arc current and voltage variations observed during each transfer cycle, to characterize the different metal transfer modes. This method also indicates that metal transfer occurs most in mixed modes throughout the entire welding current and voltage range. In the traditionally recognized current and voltage ranges for single transfer mode, one of the transfer modes predominates. In the transition range, however, the arc alternates between...
Manufacturing, Planning, Processing & Control

200,850
PB89-181213 PC A04/FA01 Catholic Univ. of America, Washington, DC. Dept. of Mechanical Engineering.
Library of Material Removal Shape Element Volumes (MRSEVs).
Grant NABN90/23
See also PB98-164181 and PB89-160634. Sponsored by National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Robot Systems Div.

Keywords: *Machining, Metal cutting, Computer aided manufacturing, Automation, Numerical control, Prototypes, Software libraries, "Material Removal Shape Elements", PDES/Product Data Exchange Using STEP, STEP/Standard for the Exchange of Product Model Data.

In machining metal parts according to process plans, it is useful to define Material Removal Shape Element Volumes (MRSEVs). A MRSEV gives the shape of the material to be removed by carrying out one step of a plan. Each step in the plan which calls for a cutting operation will refer to a MRSEV. The volume described by a MRSEV should have no material in it when the machining operation is complete, and the operation should remove no material outside the volume. A library of generic MRSEVs for 3-axis machining is presented. Appendix B presents a prototype EXPRESS schema for a subset of the library. Appendix C discusses software for generating NC-programs which uses the schema.

200,851
PB82-226307 PC A03/FA01 National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Factory Automation Systems Div.
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.


The National Institute of Standards and Technology (NIST) is in the process of establishing a testbed which will serve the research and information needs of the process planning community. Part of this testbed is an on-line annotated bibliographic service dedicated to process planning publications. The document provides the information necessary for one to become a registered user and begin using this service. It also provides information on interfacing with the software; i.e., the specific commands and syntax for writing queries, commenting on and scoring citations, as well as using the on-line documentation. Policies and procedures regarding the submission of new citations, inclusion of citations, editing, commenting and scoring of citations are also provided in the text.

200,852
PB93-129344 Not available NIST National Inst. of Standards and Technology (MSEF), Gaithersburg, MD. Metallurgy Div.
Inverse Problems in the Sensing of Materials Processing.

Keywords: *Process control, *Eddy current tests, *Temperature distribution, Tomography, Sensors, Electrical resistivity, Eddy currents, Electrical measurement, Electrical properties, Production engineering, Reprints.

Several applications of inverse problems to the sensing of materials processing have been explored. These include ultrasonic time-of-flight tomography for reconstructing temperature distributions in hot metallic bodies, the reconstruction of the solid-liquid boundary of a solidifying body again using ultrasonic time-of-flight techniques, and eddy-current profiling of radial conductivity distributions in axi-symmetric bodies. We report on the results of laboratory implementations of both of these inversion problems. They clearly establish the feasibility of these new techniques for process control.

200,853
PB92-172774 PC A04/FA01 National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Fabrication Technology Div.
See also PB92-164644.

Keywords: *Automation, *Machine shops, *Small businesses, Productivity, Competition, Cost effectiveness, Computer aided manufacturing, Computer aided design, Numerical control, Cost estimates, Personal computers, Management, Machining, Training, Quality, Technology transfer, Programs.

The Shop of the 90's project has created a model for increasing the productivity and competitiveness of small manufacturing firms through automation technology that is appropriate for small manufacturers. The report addresses the affordability issue by advocating commercially available "off-the-shelf" PC based hardware and software technology. This type of hardware and software has a shorter training time and corresponding lower training cost. A modular approach consisting of upgrades, retrofits, and add-ons allows the small manufacturer to automate at a rate that is appropriate for a company's budget for purchasing new technology and providing employee training. The report documents, in a chronological and anecdotal format, the Shop of the 90's project's experiences. It also lists federal and state organizations that can provide information to small manufacturers.

200,854
PB92-144732 Not available NIST National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Boundary Integral Equation Methods for Two Dimensional Models of Crack-Field Interactions.
Final rept., A. H. Kahn. 1988, 12p Pub.in:

Keywords: *Eddy currents, *Crack propagation, *Integral equations, Electromagnetic fields, Nondestructive tests, Mathematical models, Cracks, Defects, Inspection, Surface properties, Impedance, Reprints.

An introduction to the application of surface integral equation methods to the calculation of eddy current/faw interactions is presented. Two-dimensional problems are solved by the boundary integral equation method. Application of collocation methods reduces the problems to systems of linear algebraic equations. The first problem is that of a closed surface crack in a flat slab with an ac magnetic field parallel to the plane of the crack. The second is that of a closed surface crack in the ac field of a pair of parallel wires placed parallel to the vertex of the crack. In both cases, maps of the current densities at the surface are displayed, as well as the impedance changes due to the cracks.

200,855
PB92-159110 Not available NIST National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.

Keywords: *Nondestructive tests, *Eddy current tests, *Electric probes, Characteristics, Calibration, Reprints, Aluminum alloy 7075.

The authors report the results of measurements establishing the flaw response of a differential, air-core, eddy current probe. The parameters chosen for the probe’s construction were picked from a set of 32 combinations of factors which were varied at 2 levels. These 5 factors include: (1) the number of layers of the inner coil, (2) the number of layers of the outer coil, (3) the number of turns on the inner coils, (4) the number of turns on the outer coil, (5) the inside diameter of the inner coils. The authors report the results of calibrating the test probe considered in the laboratory and they also discuss some of the idiosyncrasies they encountered in the calibration process. The calibration reported here was carried out on 7 notches made by electrical discharge machining in blocks of 7075-T6 aluminum alloy. The probe output is correlated to changes in flaw area.

200,856
PB92-165505 Not available NIST National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Statistical Engineering Div.
Dispersion Models and Estimation of Dispersion Effects in Replicated Factorial Experiments.
Final rept., S. Ghosh, and E. S. Lagenbren, 1990, 10p See also AD-A184695.

Keywords: *Quality control, *Combinatorial analysis, *Dispersion, Mathematical models, Experimentation, Mathematical residues, Mathematical arrays, Reprints.

The paper considers the problem of estimation of dispersion effects of replicated factorial experiments under a general dispersion model. It also characterizes the arrays so that the estimation of dispersion effects is possible in the paper. The paper concludes with some comments on some papers using similar factorial designs and the methods and algorithms are available to industrial experimenters.

200,857
PB92-172014 PC A03/FA01 National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Factory Automation Systems Div.
Form Error Models of the NIST Algorithm Testing System.
Sponsored by Naval Research Lab., Washington, DC. Navy Manufacturing Technology Program.


The National Institute of Standards and Technology (NIST) is in the process of establishing a testbed which is a software package for testing geometric fitting software. In order to create realistic test scenarios, the ATS provides the capability to generate test data that simulate part features with errors. The replacement components form the model error tests modeled in the Algorithm Testing System.

200,858
Special pub. (Final).
C. W. Hyer. Mar 92, 135p NIST/SP-831, NIST/SP-831.
Grant 43NANB013668 Also available from Suppl. of Docs. as SN003-003-31144-5; Supersedes PB91-108968. See also PB91-167379 and PB91-194415. Sponsored by National Inst. of Standards and Technology, Gaithersburg, MD. Office of Standards Code and Information.

104
Keywords: "Test facilities," "Quality assurance," "Directories, Trade associations, Organizations, Inspection, Standards, Tests, USA," "Laboratory accreditation.

The directory is a guide to laboratory accreditation and similar types of programs conducted by professional trade associations, trade organizations. The programs accredit or designate laboratories or other entities to assist private sector professional societies, trade associations, related certification bodies, their membership, as well as government agencies, carrying out their responsibilities. The directory is also based on an assessment of the capability of the laboratory to conduct the testing. However, the nature of the assessment varies significantly by organization and program. Entries in the directory are based on information provided by each organization and reflect the organization's view of the activities. Parties interested in laboratory accreditation are referred to NIST SP 808, Directory of Federal Government Laboratory Accreditation/Designation Programs, and NIST SP 815, Directory of State and Local Government Laboratory Accreditation/Designation Programs, which contain information on similar programs conducted at the federal, state and local government levels.

200:865
PB92-191204 PC A03/MF A01 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div. Use of Visual and Touch Sensors for Dimensional Inspection Tests. M. Nishman. Apr. 92, 16p NISTIR-4839 See also PB92-156279

Keywords: "Verification inspection," "Sensors," "Dimensions, Computer vision, Interactions, Image processing, Pattern recognition, Tactile probe sensors, CMM (Coordinate measuring machines)."

The purpose of dimensional inspection is to verify the geometry of a manufactured part. A machined part is either accepted or rejected based upon the sensed errors between the object and its specified geometry as defined in a CAD (Computer Aided Design) model or other model database. Various sensors can be used for inspection tasks. The use of multiple sensors is relatively new, the application and coordinate measuring machine (CMM) manufacturers have only recently begun supplying machines that provide multiple sensor capabilities. The purpose of the paper is to discuss the current use of vision and touch sensors for inspection tests and to suggest alternative strategies for the use of these sensors to increase their capabilities.

200:866


Keywords: "Quality assurance," "Experimental design, Quality control, Statistical analysis, Process control, Product development, Reliability, Reprints."

The chapter describes and discusses the statistical engineering methods promoted by Professor Genichi Taguchi. The discussions relate Taguchi’s ideas to the preceding literature. The first section describes the concepts of loss functions and expected quadratic loss due to variations in a product’s performance characteristics. Then the loss function is used to determine manufacturing tolerances that meet customer’s tolerances. The variation in a performance characteristic can be reduced by identifying the causes of variation and implementing countermeasures against them. Subsequent sections describe Taguchi’s approach to identify and implement counter-measures against the variation in the dynamic characteristic of a product. Taguchi’s approach is the use of statistically planned experiments to reduce the sensitivity of engineering designs to the variation in use of a product. The details of statistical methods proposed by Taguchi are controversial. The last section includes a discussion of the competing viewpoints.

200:867


Keywords: "X-ray radiography, X-ray inspection, X-ray imaging, Testing and inspection digital systems, Reporting Image quality indicators, Nondestructive evaluation, X-ray tomography, Radioscopy,"

A new image quality indicator (IQI) is proposed. The IQI design consists of a thin, high-density shell around a void or a low-density core, forming an object such as a thin-walled sphere. This design has advantages over previous IQI's in that it functions close to the lower detection limit and provides image-quality information even when rotated through large angles. The IQI provides a mechanism to allow more latitude in the scan plans of digital x-ray imaging systems and permit further automation of the image evaluation process. A statistically based methodology is introduced for evaluating a radiographic or radioscopy image containing an IQI. This technique is useful for quantitatively determining whether the design thickness sensitivity has been achieved. The method is operator-independent and yields the same results regardless of the specific IQI design. IQIs designed with IQIs of new design and also of the plaque design are amenable to evaluation with this method.

200:868

Keywords: "Inspection, Flatness, Sampling, Computer aided design, Computer aided manufacturing, Dimensional measurement, Comparison, Data acquisition and data analysis, CMM (Coordinate measuring machines)."

The document reports on inspection sampling plans as related to coordinate measuring machines (CMM). The goal of the investigation was to compare various inspection plans, and to make recommendations on minimal sample sizes to achieve pre-specified engineering tolerances on a CMM. The investigation is baselining in the sense that the recommendations flow from a part geometry which is, by design, fundamental (i.e., for fundamental dimensions (flatness). The report provides details on the engineering considerations that went into setting up and running Taguchi appropriate experiments. The results are both quantitative and graphical data analysis steps involved in the subsequent statistical analysis. The authors expect that the information included in the report will be of interest to CMM users, designers, and manufacturers; and that such procedural detail will serve as a guideline for other researchers involved in more complicated part geometries and part characteristics.

200:869
PB92-238566 PC A03/MF A01 National Inst. of Standards and Technology, Gaithersburg, MD. Technology Administration. Improving the Quality Control of Automated Machine Tools. T. V. Vorburger, K. W. Yee, B. R. Scace, and F. F. Puffer. Feb 92, 44p NISTIR-4772 See also UCRL-52960-5 and PB90-244476

Keywords: "In-process quality control, Automation, Machine tools, Error correction codes, Control systems, Numerical control, Measuring instruments, Computer aided design, Quality control, Diagnostic systems, QA, Reprints, (Automation), National Institute of Standards and Technology,"

The automated control of machine tool accuracy is discussed in combination with the three control loops: real-time, process-interrrupted, and post-process. This architecture is being implemented at the National Institute of Standards and Technology under the Quality in Automation (QIA) project. One objective of the QIA project is to test the philosophy of determining systematic and random errors in the accuracy of machine tools. Deterministic metrology relies on repeatability of the process and empasizes the measurement of process variables over statistical process control. A machine tool environment is being carried out for a two-axis turning center, but the architecture may be applied to a three-axis milling center as well. The strategy for automated correction is focused on five types of adjustable variables in the QIA system: machine offsets, NC code, real-time correction algorithms, parameters of the theoretical model, and weighting factors for each of the above quantities. The stages of automating the system are also proposed.

200:870

Keywords: "Weight measurement, Regulations, Handbooks, Packaging, Standardization, Revisions, Administrative, Consumer, Conformity, Compliance, Labels, Prices, Food, Sales, Metrology, Law/Enforcement, Weights and measures, Open dating and marking, Weightmaster law."

The handbook, which is revised annually, compiles the uniform laws and regulations developed by the Committee on Laws and Regulations of the National Conference on Weights and Measures. The Conference’s annual meeting in 1992. The NCWM recommends adoption and promulgation by the States of these uniform laws and regulations as updated in this handbook.

200:871


Keywords: "Electrical resistivity, Eddy currents, Electromagnetic testing, Electrical measurement, Nondestructive tests, Electrical impedance, Magnetic fields, Eddy current tests, Algorithms, Errors, Reprints."

A method for reconstructing radially-varying conductivity profiles from electrical measurements and eddy current measurements is presented. The method uses a combination of electrical field and eddy current data in the sample and an AC magnetic field applied by the driving solenoid and induces axi-symmetric eddy currents in the sample. It is shown how a radially-varying conductivity profile can be recovered from impedance measurements recorded as a function of the excitation frequency. Impedance here is defined as the ratio of the induced e.m.f. in the sensing coil to the current in the driving coil. An iterative nonlinear mean-square error algorithm is employed to reconstruct the profiles. Reconstructions are presented based on both simulated and experimentally-measured impedance data. The general inversion scheme presented here for cylinders can also be used to reconstruct depth-dependent conductivity profiles in flat plates using coils with axes oriented normal to the plate surface.

200:872

MANUFACTURING TECHNOLOGY
Quality Control & Reliability

Keywords: "Error correcting devices, "Machine tools, Real time, Accuracy, Coders, Machining, Reprints. Using a personal computer, signals corresponding to machine tool movements and sensor data can be inserted between the position feedback elements and the machine tool controller to provide an error compensation for these errors.


Keywords: "Manufacturing," Technology transfer, "Industries, Case histories, Organizational structure, Government/industry relations, Regional centers, National Institute of Standards and Technology.


Keywords: "Manipulators," "Computerized simulation, Robot arms, Robot dynamics, Control systems, Algorithm, Position/Location, Force, Parallel processing, Reprints.

A parallel link manipulator, which may be used as a robot wrist, has been designed. The dynamic equations of the system have been formulated rigorously without assuming that the displacements and rotations are small. In computer simulation, it is shown that this manipulator may be used to perform tasks such as position control, path tracing, and force control. For each task, the control algorithm is formulated and tested.


Keywords: "Robot dynamics, "Control systems, Real time systems, Software engineering, Systems engineering, Teleoperators, Computer aided manufacturing, Reprints, National Institute of Standards and Technology.

The U.S. Army Laboratory Command is developing a testbed for cooperative, real-time control of multiple land vehicles. The system requires the development and integration of many elements which allow the vehicle to perform autonomously and under supervisory control. The National Institute of Standards and Technology is supporting the program by developing a control architecture based on experience gained with hierarchical control systems in robotics and automated manufacturing. The paper starts with a high level presentation of the program and the background to the development of the hierarchical control concept. A review of the design methodology, including an example task decomposition follows.

Research Program Administration & Technology Transfer


Keywords: "Manufacturing," Technology transfer, "Industries, Case histories, Organizational structure, Government/industry relations, Regional centers, National Institute of Standards and Technology.


Keywords: "Manipulators," "Computerized simulation, Robot arms, Robot dynamics, Control systems, Algorithm, Position/Location, Force, Parallel processing, Reprints.

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The position and orientation of the manipulator end-effector for a set of joint angles is developed using the standard Denavit-Hartenberg method as well as an alternative link transform method. The Denavit-Hartenberg method is found to be more accurate than the other method, but both methods require a consistent parameter set for each link provided in the transform table. The transformation matrix for each link is then derived using these parameters and the Denavit-Hartenberg approach. The inverse kinematic model, which determines the joint value set for a given end-effector position and orientation, is developed from the kinematic model derived using the Denavit-Hartenberg method. The first three joints are solved using a geometric approach. The last three joints are solved for by algebraic trigonometric manipulation of the rotation part of the transformation matrix. There are two problems that are dealt with when solving the inverse kinematics: (1) the singularity point in the manipulator, and (2) the singularities occur when two or more joint-axis line up causing an infinite number of possible solutions for any given orientation. As the singularity is approached, excessive speed occurs in joint 4 as the wrist "rolls over." A singularity occurs when joint 5 is zero. When a singularity occurs, joint 5 is set to 0, joint 4 is set to its previous value and joint 6 is solved for.

There is also an ambiguity in the wrist. There are two solutions for the last three joints for a specific orientation.

**Keywords:** Control systems, Real time systems, Artificial intelligence, Systems engineering, Automation, Robotics, Software engineering, Hierarchies, Computer programs, National Institute of Standards and Technology.

The paper presents an approach to a Real-Time Control System (RCS) systems engineering methodology which complements the RCS Reference Model Architecture developed by Robot Systems Division researchers at the National Institute of Standards and Technology (NIST). It also offers software implementation examples within the context of this RCS methodology approach. NIST has been conducting research to develop a methodology to support the automation and robotics, for more than a decade. NIST researchers, working in the Automated Manufacturing Division (AMD) and on a number of other agency projects, have defined a theoretical reference model architecture as a first step in establishing a methodology for developing the system approach. The paper presents a second step toward that goal.

**Keywords:** Robots, Control systems, Automation, Teleoperation, Shared Control.

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**MANUFACTURING TECHNOLOGY**

**Robots/Robotics**

A geometric approach for a set of joint angles, is developed using the standardized Denavit-Hartenberg method as well as an alternative link transform method. The Denavit-Hartenberg method is found to be more accurate than the other method, but both methods require a consistent parameter set for each link provided in the transform table. The transformation matrix for each link is then derived using these parameters and the Denavit-Hartenberg approach. The inverse kinematic model, which determines the joint value set for a given end-effector position and orientation, is developed from the kinematic model derived using the Denavit-Hartenberg method. The first three joints are solved using a geometric approach. The last three joints are solved for by algebraic trigonometric manipulation of the rotation part of the transformation matrix. There are two problems that are dealt with when solving the inverse kinematics: (1) the singularity point in the manipulator, and (2) the singularities occur when two or more joint-axis line up causing an infinite number of possible solutions for any given orientation. As the singularity is approached, excessive speed occurs in joint 4 as the wrist "rolls over." A singularity occurs when joint 5 is zero. When a singularity occurs, joint 5 is set to 0, joint 4 is set to its previous value and joint 6 is solved for. There is also an ambiguity in the wrist. There are two solutions for the last three joints for a specific orientation.

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**Keywords:** Robots, Control systems, Automation, Teleoperation, Shared Control.
A new type of crane suspension mechanism is described. This mechanism can provide a significant increase in the payload to external and internal loads compared to the suspension of conventional cranes, thus making cranes more suitable for robotic applications. An optimization study was conducted to determine the best choice of the design parameters in this suspension mechanism which maximizes its stiffness. The stiffness functions of the robot crane suspension to various types of external loads common to robot crane applications were determined. Their optimization properties were studied using theoretical and numerical analysis techniques. It was found that feasible optimal designs which maximize stiffness are possible, but they are dependent on the type of the external load and height. The paper reports the optimization results for the case of a single external horizontal force.

**200,884**  
PB93-131399

(OR as PB93-131381, PA A07)  
National Inst. of Standards and Technology, Gaithersburg, MD.

Characterization of a Piston Displacement-Type Flowmeter Calibration Facility and the Calibration and Use of Pulled-Thread Type Flowmeters.  
G. E. Mattingly, 1992, 23p

Included in Jnl. of Research of the National Institute of Standards and Technology, v97 n5 p509-531 Sep/Oct 92.

Keywords: *Flow measurement, *Flowmeters, *Calibration, Test facilities, Performance, Output flowmeters, Turbine flowmeters, Volumetric calibrators.

Critical measurement performance of fluid flowmeters resulted from the introduction of new technology. These data should be generated using calibration and traceability techniques established for these verification purposes. The three steps: (1) characterizing the calibration facility itself, (2) using the characterized facility to calibrate a flowmeter, and (3) using the calibrated flowmeter to measure a flow. The measurement is described and the pertinent equations are given for an encoded-stroke, piston displacement-type calibrator and a pulsed output flowmeter. It is concluded that, given these equations and proper instrument interfacing of this type of calibrator, very high levels of performance can be attained and, in turn, these can be used to achieve high fluid flow rate measurement accuracy with pulsed output flowmeters.

**200,887**  
PB92-39138  
Not available NTIS  
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD, Ceramics Div.

Analysis of Subsurface Crack Propagation and Implications for Wear of Elastic Deforming Materials.  
F. X. Wang, 1990, 20p

Pub. in Wear 141, n1 p95-114 1990.

Keywords: *Crack propagation, *Wear, *Stress intensity factors, Elastic properties, Cracking/ Fracturing, Tribology, Fracture mechanisms, Loads/Forces, Cracks, Reprints.

The photoelastic method is used to analyze the stress intensity factors and crack trajectories for subsurface cracks that are relevant to the process of wear particle formation. The study results are given with a shallow subsurface crack oriented parallel to the boundary. A concentrated load is applied to the boundary of the half-plane in close proximity to the crack tip. Three different series of experiments were conducted and results for the stress intensity factors for both the opening and sliding directions were determined. The mixed mode stress intensity factors were combined to give the magnitude of an effective stress intensity factor which drives the subsurface crack.

**200,888**  
PB92-171149  
Not available NTIS  
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD, Ceramics Div.

Friction and Wear Characteristics of Silicon Nitride-Graphite and Alumina-Graphite Composites.  
A. Gangopadhyay, S. Jahanmir, 1991, 9p


In order to take advantage of the beneficial properties of advanced ceramics it is necessary that their friction coefficient be reduced to an acceptable value. One method for achieving this goal is incorporation of a lubricating counterface. The specific friction properties of the study ceramic-matrix composites were fabricated by drilling a series of small holes in alumina and silicon nitride and intercalating graphite under a high pressure. It was found that addition of graphite to silicon nitride considerably reduces the friction coefficient, but aluminum-graphite composites exhibit only a marginal reduction in friction coefficient compared to alumina. The worn surfaces of the counterfaces were examined under scanning electron microscope and analyzed using energy dispersive spectroscopy and micro-Raman spectroscopy to gain a better understanding of the friction and wear behavior. The reduction in friction for silicon nitride-graphite composite can be explained by the formation of transfer films consisting of a mixture of materials from both contacting surfaces. However, in the case of alumina-graphite composites the graphite regions were completely covered with steel transfer particles, exhibiting the formation of graphite containing transfer films.

**200,889**  
PB92-197730  
Not available NTIS  
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD, Ceramics Div.

Tribology and Mechanical Systems.

Final rept.  


Mechanical systems are designed to achieve optimum productivity, efficient operation, and low wear that will result in long machine life, and freedom from premature failure. Tribology is the science that embraces technologies in areas of lubrication, friction and wear, tribocorrosion, and tribological systems. During the past seventy seven years the ASME - Research Committee on Tribology (RCT) has been instrumental in promoting tribology research and development activities in this country and abroad through research programs, publications and technical meetings. In the article, the authors will review the role of tribology in the development of today's technology, explore challenges of the future, examine the Committee's accomplishments in the past and discuss its present activities.

**200,891**  
PB92-197748  
Not available NTIS  
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD, Ceramics Div.

Development of a Tribology Research-Information Program Database.  
S. Jahanmir, M. B. Peterson, 1990, 6p

See also PB92-226274.
Lubrication
Production
United regenerators
the metal-cutting
tribology
the Strategic
extremely new
Not control,
evaluated
Condensation.
The survey
ing surface-tension-drained
radius,
PB92-144781
search-in-progress
Preliminary
delivery

I. A.

Kedzierski,
Aerodynamics,
A.

Aspiration.

Webb.

Atomizer.

is inert

Inert

Reprints.
The report
in recent
tolerances
in a number of U.S. discrete-parts manufactur-
ing industries and the measurement challenges
to the National Institute of Standards and Technology
(NIST) there are. The changes in tolerances have
been shown to be part of a long-term trend by which
tolerances have been decreasing at the rate of ap-
proximately 0.5% of the three every five years.
The report has also shown that whether by the twice-ap-
plicated Gage-Makers factor-of-ten or Military-Standard
tolerances the tollerance analysis for the various
manufacturing tolerances, NIST needs to be more ac-
curately than these moving-target tolerances by factors
of some few hundred. Since NIST does not have the
current capability to adequately address such needs,
it needs to develop new laboratory-based ca-
pability for each of the three tolerance ranges:
the normal-tolerance regime of metal-cutting machine
tools and coordinate measuring machines, the preci-
sion calibration regime of diamond scribing and ad-
vanced interferometers, and the ultraprecision-toler-
ance regime of scanning tunneling lithography and mi-
croscopy.

200,899
PB92-144781
Not available NTIS National Inst. of Standards and Technology (BFRIL), Gaithersburg, MD, Building Materials Div.

Practical Fin Shapes for Surface-Tension-Drained Condensation
Final rept.

The paper introduces a new family of high-performance
fin profiles for surface-tension-drained condensation. Previously described profiles for this situation
have been defined in terms of the fin curvature and arc length. The existing profiles are generally not suitable
for commercial manufacture. The fin profiles presented
in the paper are conveniently defined by the fin tip
diameter, the fin height and the fin base thickness. Conse-
quentially, the designer may easily specify a fin shape with
parameters that are compatible with those used by
the manufacturing industry. The heat transfer
performance of the new profiles provides an improvement
over existing, commaval fin shapes. An analysis is presented to show the R-11 condensation performance
of the new profiles as a function of the geometric variables. A geometrical design procedure is presented
for surface-tension-drained condensation is given also.

200,899
PB92-159490
Not available NTIS National Inst. of Standards and Technology (IMSE), Gaithersburg, MD, Metrology Div.

Aerodynamic Analysis of the Aspiration Phenomena in a Close-Coupled Inert Gas Atomizer
Final rept.
J. P. Espina, S. D. Ridder, F. S. Biancianello, and G.
E. Mattingly. 1989, 13p
Pub. In Proceedings of Symposium TMS Annual Meet-

Keywords: *Atomizers, Compressible flow, Supercon-
flow, Rare gases, Mach number, Aerodynamics, Prandtl-Meyer expansion, Efficiency, Design, Velocity, Reprints, Aspiration.

Geometric design of a close-coupled inert gas atomizer
is examined via compressible gas flow analysis. Ex-
perimental results are obtained for the atomizer using a model
that explains the measured aspiration behavior (the aerodynamic pulling force acting on the molten metal
delivery nozzle) and the method of evaluating the
measured pressure and temperature fields in the super-
sonic gas flow as well as the calculated velocities and
Mach numbers derived from these measurements.
The values combined with schlieren photograph-
graphs of the supersonic gas jet density waves are
compared to the results of a mathematical analysis
using Prandtl-Meyer theory by the method of the char-
acteristics method. The discussion incorporates the implication of these results on various geometric design parameters, especially their relationship to atomization efficiency.

200,899
PB92-159847
Not available NTIS National Inst. of Standards and Technology (CSTL), Boulder, CO, Chemical Engineering Div.

Development of a Thermacoously Driven Orifice Pulse Tube Refrigerator
Final rept.
R. Radebaugh, K. M. McDermott, G. W. Swift, and R. A. Marchant, 1990, 10p
See also PB88-188557.
Pub. in Proceedings of Interagency Meeting on Cryo-

Keywords: *Refrigerators, *Cryogenics, Orifices, Oscilla-
tions, Pressure measurement, Mathematical models, Helium, Nitrogen, Two-stage, Flow, Reprints, Pulse tube refrigerators.
The project to develop a thermacoagnostically driven or-
ifice pulse tube refrigerator (TADOPTR) was started
in February 1989 to meet the infrared sensor cooling
requirements of Strategic Defense Initiative (SDI) satellite programs. It is a collaborative effort in-
volving development of a thermacoagnostic driver (TADOPTR) by Los Alamos National Laboratory (LANL) and development of an orifice pulse tube refrigerator (OPTR) by the National Institute of Standards and Technology (NIST). The heat-driven TAD provides a 28 Hz oscillating, thermacoagnostically-produced pressure source for the OPTR, eliminating the need for a mechanical com-
pressor. The TADOPTR is the first cryocooler with no moving parts; thus, it has potential for exce-
ptional reliability and low cost. The first laboratory model built to test the concept has a low temperature of 90 K with no load and produced 5 W of cooling power at 120 K. The TAD was powered by an electrical heater at
materials

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Manufacturing Technology

General

A significant number of advances have been made during the last few years in a variety of cryo-coollers. The paper discusses some of these advances in Machinability, Cryogenics, Reliability, Cryopumps, Cryogenic Fluids, Refrigeration, Brayton cycle, Reprints.

The 3D Piping IGES Application Protocol (AP) specifies the mechanisms for defining and exchanging 3D piping system models in IGES format. The AP defines three-dimen-sional arrangement data of piping systems which includes definition data types of geometry (shape and location), connectivity, and material characteristics. The scope of the AP includes only piping system data and not drawings or internal details of equipment. The specified piping model is sufficiently detailed to support the fabrication and final assembly of a piping system. IGES is designed to support a broad range of applications and information, and is recognized that few implementations will support all of the specification. An application protocol defines a logical sub-schema of the IGES specification, the usage of the sub-schema, and the necessary benchmarks for testing implementations. The 3D Piping IGES Application Protocol is the first IGES AP to be delivered to industry and is an important example for the development of STEP (Standard for the Exchange of Product Model Data) application protocols.

Materials Sciences

Carbon & Graphite

MATERIALS SCIENCE

200.902
PB92-236710 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD.

RAMAN SPECTROSCOPY OF SYNTHETIZED DIAMOND GROWN BY HOT FILM METHOD CHEMICAL VAPOR DEPOSITION

Final rept.
E. S. Ezet, E. N. Farahaba, A. Feldman, and L. H. Robins, 1988, 9p


Keywords: "Diamonds, Raman spectroscopy, Chemical vapor deposition, Microstructure, Luminescence, Impurities, Crystal defects, Substrates, Reprints, Diamond films.

Raman microprobe studies of individual microcrystals of diamond and thin diamond films deposited by the hot-film method chemical vapor deposition (CVD) method are focused on the determination of the purity of the diamond phase and on the extent of the structure of the diamond. The findings are related to the deposition parameters, growth mechanisms, and diamond morphology. The specimen consists of single microparticle in the signal of the Raman features. Luminescence emissions arising from either structural imperfections or substitutional inclusions in the diamond lattice are observed. A luminescence band centered around 738 nm (1.68 eV), attributed to either the native lattice vacancy in diamond, or the oxygen substitutional in the diamond lattice, widely varied in intensity among the samples analyzed. The observation of these luminescence bands is correlated with results from subsequent cathodoluminescence measurements.

200.903
PB93-135416 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD.

TRIBOCALITICAL CHARACTERISTICS OF SYNTHETIZED DIAMOND FILMS ON SILICON CARBIDE

Final rept.


Keywords: "Wear resistance, Tribology, Chemical vapor deposition, Silicon carbides, Wear tests, Thin films, Friction, Reprints, Diamond films.

The purpose of this research is to explore the possible use of synthesized diamond films as wear resistant, high friction materials for tribological applications. Silicon carbide specimens, in the form of small disks, were coated with diamond films using the hot film method CVD process. A ball-on-three-flat contact geometry was used in the wear experiments. The experimental results confirmed that wear rate of the disk specimens can be reduced by a factor of 200, when they are coated with a diamond film. The friction coefficient was reduced by almost one order of magnitude. Although it was not explicitly shown, the wear resistance may be related to the hardness of the diamond film. EDAX analysis of the worn surface of the diamond indicated that the SiC counterpart undergoes tribochemical reactions with the air atmosphere producing hydroxyl silicate. Formation of this tribochemical reaction product cannot be responsible for low friction coefficient, since the same material is formed in SiC/SiC tests. It is therefore, hypothesized that the low friction coefficient of diamond may be related to forma-tion of a thin film of graphite at the sliding contact surface. Removal of these graphic regions by wear would thus produce a smooth wear surface.
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MATERIALS SCIENCES
Ceramics, Refractories, & Glass
Characterization of the Denslfication of Alumina
by Multiple Small-Angle Neutron Scattering.

ARO-26123.2-MS
Contract MIPR-ARO-1 02-90, Grant DE-FG0584ER45063

nished by NTIS.

Keywords: Density, Microstructure, Neutron scattering,
Sintering, Reprints, 'Aluminum oxide, Small angle
scattering.

Multiple small-angle neutron scattering was used to
follow the evolution of the pore-size distribution in

alpha-AI203 through the intermediate and final stages
of sintering. This new technique enables the study of
microstructure in the 0,08-10 micrometers size regime,
which is the size range of importance for many matehals systems, without needing to increase the resolution
currently available small-angle scattering instruments. The microstructure evolution results indicate a
nearly constant effective pore radius for the alumina
throughout the intermediate sintering stage, ranging
from 0,19 micrometers at 54% of theoretical density to
0,17 micrometers at 79% dense. As the alumina densities further, there is a transition region after which the
effective pore radius grows rapidly to > or = 0,6 micrometers at 97,5% dense.
of

200,907

AD-A249 510/9
National
burg,

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Standards and Technology, Gaithers-

MD.

Small-Angle Neutron Scattering Characterization
of Processing/Microstructure Relationships in the
Sintering of Crystalline and Glassy Ceramics.
G. G. Long, S. Krueger, R. A. Gerhardt, and R, A.
Page. Dec 91, lip ARO-26123.5-MS
Contract MIPR-ARO-1 02-90, Grant DE-FG05-

84ER45063
Pub. in Jnl. Mater. Res., v6 n12 p27062715, Dec 91 Available to DTIC users only. No copies
furnished by NTIS.
Availability:

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Keywords: 'Neutron scattering, 'Sintering, 'Ceramic
materials,

Microstructure, Polycrystalline,
'Crystalline
ceramics.
SANS(Small Angle Neutron Scattering).

'Glassy

silica,

Reprints,
Porosity,

Small-angle neutron scattering measurements were
used to examine the pore microstructure evolution of
glassy silica and polycrystalline alpha-alumina as a
function of sintering. It was shown that the two major
sintering mechanisms, viscous flow and surface and
volume diffusion, lead to very different microstructure
evolution signatures in terms of the average pore size
as a function of density. However, with respect to topology, the evolution of the porosity per unit surface
area as a function of density is remarkably similar in
the two systems.

200,908

PC A04 / M F A0

AD-A255 729/6

National Inst, of Standards and Technology (IMSE),
Gaithersburg, MD. Ceramics Div.
Fundamental Understanding of the Effects of Ce-

ramic Processing on Product Microstructure.
Final rept.

G. G. Long,

J. P. Cline,

and

J, J, Ritter.

15 Feb 92,

57p ARO-26126.3-MS
Contracts MIPR-1 20-89, MIPR-1 02-90
Sponsored in part by Army Research Office, Research
Triangle Park, NC, under MIPR-1 18-91
Keywords: 'Ceramic bodies, 'Microstructure, 'Processing, 'Sintering, 'Ceramic materials. Chemistry, Diffraction, Functions, Internal, Measurement, Models,
Neutron scattering. Neutrons, Scattering, X ray diffraction, X rays, Surfaces, Diffusion, Density, Aluminum
compounds, Porosity, Particle size. Product, Intelligent
processing. Small angles. Size distribution. Green
state, MSANS(Multiple Small Angle Neutron Scattering), Pores, Alumina.
This

the final report arising from our research proinvolving the investigation of processing/microstructure relationships in selected ceramic systems.
The first year of this program was dedicated to the development and detailed assessment of the novel neutron scattering and x-ray diffraction techniques required for the measurement of ceramic microstructure
evolution as a function of sintering and chemistry. The
next two years of the program were used to study several systems in detail, and has led to some remarkable

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conclusions which have changed the way in which the
sintering stages in different systems are understood.
The sintering behavior of a ceramic body and the properties of the ceramic product depend directly on the
internal microstructure. The goal of our research pro-

Transition from Mild to Severe

gram

with the Army Research Office (ARO) has been
investigate well-characterized systems and to
measure microstructure evolution during ceramic processing in order to obtain an improved understanding of
the relationships between processing and microstructure. This approach has led to progress in improving
process models and to improved predictability of product microstructure. Ceramic Processing, Microstructure Characterization, Processing Models, Intelligent

Sponsored by Gas Research

to

Pub.

Processing.

Wear

in

Alumina

during Sliding.
Final rept,
S, J,

Cho, H, Moon,

B, J,

Hockey, and

S,

M, Hsu.

1992, 8p
in

Inst., Chicago, IL.

Keywords: 'Aluminium oxides, 'Wear

tests, 'Sliding

Fracture tests, Fatigue(Materials), Stresses,
Cracking, Reprints.
friction.

The occurrence of a wear transition in alumina during
sliding has been investigated experimentally. The results show that a transition from initially mild wear to
severe wear occurs abruptly, but only after a defined

200,909
PB92-144294

Not available NTIS
National Inst, of Standards and Technology (IMSE),
Gaithersburg, MD. Polymers Div.
Pressure Induced Sintering of ZnS.
Final rept.
S. Block, G. J. Piermarini,

M. Balmer, and V. Bean,
1989, 6p
Pub. in Proceedings of SPIE (Society of Photo-Optical
Instrumentation Engineers) Window and Dome Technologies and Materials, Orlando, FL., March 27-29,

Keywords: 'Zinc sulfides, 'Sintering, Nickel sulfides,
High pressure, Denslfication, Toughness, Hardness,
Ceramics, Reprints.
Pressure-induced sintering of ZnS compacts requires
much lower temperatures than those used in conventional sintering processes. The hardness of the ZnS
compacts is found to be directly proportional to the initial denslfication pressure. Toughness, as well as hardness, can be superior to those obtained by conventional sintering of ZnS. Initial studies were carried out in a
miniature diamond anvil high pressure cell. More
recent work involves the preparation of much larger
samples using large volume hydraulic presses. Hard-

ness and toughness were measured ijy the microindentation technique The addition of NiS markedly Improves the toughness of ZnS, Pore pressure is a critical factor in pressure induced sintering, Microstructure
photographs of ZnS compacts show that trapped air
causes pores and produces spring-back effects. If not
eliminated, trapped air can lead to cracking.

200,910
PB92-153972

Not available NTIS
National Inst, of Standards and Technology (MSEL),
Gaithersburg, MD. Ceramics Div.
Microstructure,

cal Properties of

Toughness Curves and MechaniAlumina Ceramics.

Final rept.
S. J.

and
Pub.
rials,

Bennison, J. Rodel, S. Lathabai,
Lawn. 1991, 25p

P. Chantikul,

B. R.

Toughening Mechanisms

in

in

Quasi-Brittle Mate-

Keywords: 'Aluminium oxides, 'Ceramics, MicrostrucMechanical properties. Fracture properties. Performance evaluation. Wear, Crack propagation. Structural engineehng. Reprints.
ture,

period of initial wear. The time required for this transition increases with decreasing grain size and decreasing applied load. Examination of wear samples revealed that, during the initial stage, surface material is
removed by a plastic grooving process and is accompanied by the accumulation of subsurface dislocations
arrays and twins. With continued sliding, internal
stresses associated with the accumulating damage
eventually results in grain boundary cracking and grain
pull-out, which leads to the onset of fracture dominated, severe wear.

200,912
Not available NTIS
National Inst, of Standards and Technology (IMSE),
Gaithersburg, MD. Ceramics Div.
Steady-State Creep Behavior of Si-SiC C-Rings.

PB92-154145

Final rept.

Chuang, W. J. Liu, and S. M. Wiederhorn. 1991,
7p
Grant GRI-TPSU-NBS-1 302-37922
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in Jnl. of the American Ceramic Society 74, nIO
p2531-2537 0ct91.

T. J.

Keywords: 'Silicon carbide, 'Creep tests, 'Rings, Mechanical properties, High temperature tests, Fracture
properties. Stress relaxation tests. Reprints.

Because of the ease of experimental setup as well as
economics in sample preparation, C-ring specimens
are sometimes chosen for the evaluation of mechanical behavior. In the paper, the long-term creep of siliconized silicon carbide (Si-SiC) C-rings is investigated.
Creep tests on a number of Si-SiC C-rings were carried
out under constant compressive loads at 1300 C in air.

Load-point displacements were continually monitored
as a function of time, thereby establishing the steadystate regime as a function of load and ring geometry.
Optical micrography on the postcrept specimens was
performed to obtain damage zone sizes. A simple
curved beam theory was employed to analyze the
stress state developed throughout the body during
steady-state creep. Load-point displacement rates
were numerically calculated using both geometric and
energy methods. Observed damage zone sizes and
shapes within the specimen agreed with those predicted theoretically. Results obtained on the stress solutions are useful as local loading parameters in the
study of high-temperature fracture behavior of a
cracked C-ring,

The

microstructural variables that determine the
toughness (T-curve) characteristics of alumina and
other structural ceramics are considered. Alumina ceramics gain their toughness from sheilding by graininterlock bridging at the interface behind the crack tip.
A general fracture mechanics formalism for describing
the bridging is outlined in terms of desirable microstructural elements, such as weak internal boundaries,
high internal stress, coarse microstructure. The T-

curve imparts the quality of flaw tolerance to the
strength properties. The authors examine the quality,
under both inert and interactive environmental conditions, monotonic and cyclic loading, using indentation
flaws. In situ observations of bridging sites during loading in the scanning electron microscope provide insight into the bridge degradation micromechanisms.
shorl-crack properties, spontaneous microcracking and wear degradation, are examined in light
of the bridging model. It is concluded that design with
ceramics may require certain tradeoffs, long vs short
cracks, high strength vs flaw tolerance, etc. The key to
optimal performance in ceramics rests with microstrucFinally,

tural

processing for specific properties.

200,911

PB92-154111

Not available NTIS
National Inst, of Standards and Technology (MSEL),
Gaithersburg, MD. Ceramics Div.

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200.913
PB92-1 54384

Not available NTIS
National Inst, of Standards and Technology (MSEL),
Gaithersburg, MD. Ceramics Div.

Small-Angle Neutron Scattering Characterization
of Processing/Microstructure Relationships in the
Sintering of Crystalline and Glassy Ceramics.
Final rept.

G. G. Long, S. Krueger, R. A. Gerhardt, and R. A.
Page. 1991, 10p
Contracts MIPR-ARO-1 02-90, DE-FG05-84ER45063
Sponsored by Army Researcti Office, Research Triangle Park, NC, and Department of Energy, Washington,

DC.
Pub.

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in Jnl. of

Materials Research 6, n12 p2706-2715

91,

'Silica glass, 'Aluminum oxide, 'Ceramics,
'Microstructure, 'Sintering, Diffusion, Viscous flow,
Polycrystals, Neutron scattering. Reprints,

Keywords:

Small-angle neutron scattering measurements were
used to examine the pore microstructure evolution of
glassy silica and polycrystalline alpha-alumina as a
function of sintering. It was shown that the two major
sintering mechanisms, viscous flow and surface and
volume diffusion, lead to very different microstructure

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evolution signatures in terms of the average pore size as a function of density. However, with respect to topology, the evolution of the porosity per unit surface area as a function of density is remarkably similar in the two systems.

200.914
PB92-154426 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Silicon Nitride Powder Milling Kinetics in a High-Energy Agitation Ball Mill.
Sponsored by Department of Energy, Washington, DC.

Keywords: *Silicon nitrides, *Powders, Milling, Surface properties, Surface chemistry, Particle size distribution, Kinetics, Reprints.* 

The application of high-energy agitation ball milling is described for silicon nitride powder size reduction in a specially designed system. All components of the milling system that come into contact with the powder are made of silicon nitride, and milling is carried out with hot-pressed silicon nitride media. The milling kinetics are measured by the measurement of particle size distribution and specific surface area of the milled powders as a function of milling parameters and milling liquid. Surface area and porosity analysis of the powders were also carried out to determine compositional changes in the milled powder. The data of the tests demonstrate that the rotor speed has a strong effect on the material rate and that feed rate of the slurry has an effect on the surface oxide content of the milled powders.

200.915
PB92-154574 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Strength and Proof Testing.

Keywords: *Ceramics, *Glasses, *Strength(Mechanics), State of the art, Mechanical properties, Materials testing, Composite materials, Structural engineering, Fracture(Mechanics), High temperature tests, Compressive properties, Reprints.

The strength of ceramics and glasses is reviewed in both their fundamental and their technological applications. The state-of-the-art of fundamental understanding and test methodologies are covered. The uniaxial tensile strength of monolithic ceramics is fairly well understood and is controlled by the fracture toughness and the defects present in the material. The Weibull model of strength scatter is derived in an introductory fashion. Common mechanical test procedures are presented. Multiaxial and compression strength are also discussed. Elevated temperature strength and environmental effects upon strength, and strength with time are reviewed. Ceramic composite materials offer new possibilities with respect to strength and design but will require different test procedures. Proof testing is a valuable means to ensure component reliability, but there are severe restrictions on its applicability.

200.916
PB92-154582 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Pub. in Jnl. of the American Ceramic Society 74, n9 p2037-2066 1991.

Keywords: *Ceramics, *Structural engineering, *Flexure strength, Design criteria, Reviews, Materials testing, Statistical analysis, Life(Durability), Mechanical properties, Reprints.

The uniaxial strength of engineering ceramics is often measured using well known flexure test method. There is a risk that flexure data are not representative of the properties of fabricated components. Reliability estimates for components based on statistical extrapolation techniques from flexure data may not be valid. The paper reviews the problem and judges the usefulness of flexure data for design purposes. It is shown that some of the limitations of flexure data apply to other modes of testing, including direct tension testing.

200.917
PB92-154576 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Studies of Ceramics by Use of Backscatter Diffraction Patterns in the Scanning Electron Microscope.


Electron back scatter diffraction patterns (EBSP) have been recorded in the SEM from crystals as small as 0.2 microns. The patterns are recorded in real time using a phosphor and a video camera; computer-aided analyses of these patterns are used to determine crystal orientations and stress. Dislocation density information can be obtained in the paper. The application of the technique to ceramic systems that are complicated by the presence of subgrains or microcracks is discussed. The patterns are also compared with those recorded by a backscattered light microscope.

200.918
PB92-154136 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Technique for Tensile Creep Testing of Ceramics.
See also PB91-159277, Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of the American Ceramic Society 72, n9 p1610-1614 1989.

Keywords: *Ceramics, *Creep properties, Plastic deformation, Mechanical tests, Tensile properties, Displacement, High temperature, Mechanical properties, Deformation, Heat engines, Creep, Reprints.

An experimental technique for measuring tensile creep deformation in ceramic materials to temperatures of 1500 C is described. The technique uses simple flat dogbone-shaped specimens and a high-hip for the loading fixture, which provides good alignment at a minimum cost. Creep deformation is measured using laser extensometry to monitor the relative displacement of flags that are attached to the gauge section of the specimen.

200.919
PB92-154909 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Investigation of C-Creep Cables by Synchrotron Microradiography.

Keywords: *Ceramics, *Cables, *Crystal defects, *Metals, *Creep tests, Microradiography, High temperature tests, G rain boundaries, Synchrotron radiation, Thermal fracture, Nucleation, Stress analysis, Reprints.

The long term, high temperature failure mechanism for metallic wires is the result of one or more of the following: dislocation pile-up at a grain boundary, grain boundary embrittlement, and intergranular fracture. Small voids or cavities have been observed to nucleate and grow on stressed grain boundaries. Overheating of the materials covered by ceramics that cavities form at the grain boundary. Many theories have been proposed to predict the details of cavity nucleation and growth and it is still an area of current theoretical interest. Experiments designed to evaluate these theories have mainly compared predicted lifetimes to fracture with those observed for polycrystalline cable specimens. One interesting approach compared the density change in specimens from interrupted tests with that predicted from theory. There have often been large discrepancies among the various theories and the above observations.

200.920
PB92-165182 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Diffusional Crack Growth in Alumina.
MATERIALS SCIENCES
Ceramics, Refractories, & Glass

200.926 PB92-171446 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Characterization of Ceramic Powders.
Final rep.
S. G. Malghan, and A. L. Dragoo. 1991. 10p

Imaging techniques, X-ray diffraction, Single crystals, Polycrystalline, Rollins, Reprints.

The growing range of devices that process information with high velocity has stimulated interest in crystal regularly. The paper reviews the high resolution imaging of residual irregularities in high quality microcrystalline X-ray diffraction. The prepared monochromatized X-ray beam. As a result of recent progress, guidance is available for the formation and proper design not only of single crystals but polycrystals of polycrystalline ceramics as well.

200.822
PBQ2-197722 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Phase Equilibria in the Systems SrO-CoO and SrO-2Bi2O3.
Final rep.
N. M. Hwang, R. S. Roth, and C. J. Rawn. 1990, 3p
Pub. in Jnl. of the American Ceramic Society 73, 582-593 1990.

Keywords: *Strontium oxides, *Copper oxides, *Bismuth oxides, Phase transformations, X-ray diffraction, Superconductors, Reprints, Phase equilibria, Strontium bismuthates, Strontium cuprates.

The phase equilibria relations in the systems SrO-CoO and SrO-2Bi2O3 were studied by X-ray diffraction analysis of powder prepared by the quenching method. Sr2CoO4 and Sr2Co3O7 melt incongruently at 1963 and 1225°C, respectively. The newly found phase Sr6Bi2O9 decomposes at 965°C into SrO and Sr3Bi2O6; Sr3Bi2O6 melts incongruently into SrO and Sr3Bi2O6. This system undergoes a phase transition around 825°C and although both are nonstoichiometric, the low temperature phase is positioned in SrO with 93.5% SrO than that of the high temperature phase.

200.933
PBQ2-213511 PC A06/MF A02 National Inst. of Standards and Technology (MSEL), Gaithersburg, Md. Ceramics Div.
Special pub. (Final).
Also available from Suppl. of Docs. as NIST003-0315-9. 1992.


Advanced structural ceramics, such as silicon nitride, are attractive for many advanced applications due to their high strength at elevated temperatures, resistance to chemical degradation, wear resistance, and low density. Despite these advantages, there are considerable impediments to the introduction of advanced ceramics. With the current technology, fabrication costs are high, compared to other materials, and component reliability is uncertain. A study was conducted to assess the current state-of-the-art in the machining of advanced ceramics and to identify research areas which could lead to significant improvements. In conducting this assessment, an extensive literature survey was carried out, visits and discussions were held with industrial companies interested in ceramic machining. A telephone survey was conducted on ceramic machining shops, a research-in-progress database was consulted, individuals were invited to visit NIST and discuss the above issues with researchers. The ultimate goal of the program is to further the utilization of advanced structural ceramics in industrial applications.

200.934
PBQ2-229520 PC A03/MF A01 National Inst. of Standards and Technology (MSEL), Gaithersburg, Md. Ceramics Div.
High-Temperature Flexure Fixture for Advanced Ceramic Applications.
G. D. Quinn. Jun 92, 26p NISTIR-4864

Keywords: *Ceramics, *Test facilities, *Fixtures, *High temperature tests, Mechanical properties, Loads(Forges), Fracturing, Test methods, Flexural strength.

A test fixture for elevated temperature flexure strength testing is presented. The fixture is suitable for fast fracture or stress rupture experiments up to 1500°C in air or inert environments.

200.935
PBQ2-236397 Not available NTIS National Inst. of Standards and Technology (NREL), Gaithersburg, MD. Ceramics Div.
Transient Thermal Response of Plasma-Sprayed Zirconia Measured with Thin Film Thermocouples.
Final rep.
D. R. Burgess, M. Yust, and K. G. Kreider. 1990, 7p

Keywords: *Zirconium oxides, *Thermocouples, Transient response, Aluminum oxide, Pulsed lasers, Heat sources, Thermal conductivity, Thermal diffusivity, Thin films, Reprints, Plasma sprayed coatings.

A pulsed laser heat source method for measuring the thermal response of the film thermocouple (TFC) was used to determine the thermal response of the FCT's. Some deviation from this model was obtained for the thickest films on a substrate with a high thermal conductivity (Al2O3). The technique was determined to be sensitive to the thermal properties of the substrate on dimensions of the thermal diffusion lengths. This explanation is corroborated by experiments of planar thermal response on CflTC's, which may vary from batch-to-batch.

200.936
PBQ2-237007 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, Md. Metallurgy Div.
Discontinuous Coarsening of Tetragonal Precipitates in Partially Stabilized Zirconia Induced by Diffusional Coherency Strain under Applied Stress.
Final rep.
Pub. in Jnl. of the American Ceramic Society 73, n2 p3659-3660. 1990.

Keywords: *Zirconium oxides, *Precipitates, *Boundary layer, Flow, Aging tests(Materials), Coarseness, Stress-strain relationships, Stress distribution, Chemical composition, Temperature effects, Stability, Reactions.

When partially stabilized zirconia with 6 mol% MgO and 4mol% CaO aged at 1450°C, intergranular precipitation occurs and concurrently the boundaries between the grains migrate, forming a precipitate-free cubic phase and large tetragonal precipitates behind them. At these compositions and the temperature boundary migration is rapid and shows the characteristics of a discontinuous coarsening. A uniaxial compressive stress applied to this specimen during the aging treatment increases or decreases the migration rate; the boundaries parallel or perpendicular to the stress axis, respectively, in agreement with the prediction that a compressive coherency strain due to the diffusion of Ca atoms is produced at the surface of the retreating grains and drives the migration. The diffusional coherency strain energy is thus shown to be the dominant driving force for the discontinuous coarsening in this solid.

200.937
PBQ2-251722 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Factors Affecting Reactions in Noncyclic Loading of Ceramics with Crack-Resistance Curves.
Final rep.
Pub. in Jnl. of Materials Science 24, n12 p4298-4306 Dec 89.

Keywords: *Ceramics, *Fatigue limit, *Loads(Forges), Crack propagation, Stress analysis, Fatigue(Materials), Mechanical properties, Case studies, Algorithms, Toughness, Reprints.

Fatigue properties in the noncyclic loading of ceramics with R-curves are studied. Particular attention is directed toward the potential rate of crack closure in the environment and determination of fatigue limits. A numerical algorithm for solving the appropriate differential equations of rate-dependent crack closure is derived. The criterion for a crack of constant size is formulated. This criterion incorporates a crack-size dependent toughness function, based on grain-localized interfacial bridging, and represents a family of solutions to a fundamental activation process. In a case study, dynamic fatigue (constant stressing rate) and static fatigue (constant applied stress) are studied for a coarse-grained alumina with a pronounced R-curve are analyzed. With a foreknowledge of the toughness parameters, the intrinsic crack-tip velocity function is described. The intrinsic function is distinguished from the usual 'apparent,' or shielded', (and demonstrably non-unique) function determined directly from the external load.

200.938
PBQ2-237130 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Final rep.

Keywords: *Glass, *Crack initiation, *Fatigue(Materials), Defects, Models, Residual stress, Crack propagation, Crackling(Fracturing), Mechanical properties, Reprints.

In Part II of this two-part study we extend the shear-fault/microcrack model to nonequilibrium fracture, to allow for rate effects in the critical instability configurations of a dislocation environment. The "calibrated" K-fields of Part I are combined with independently evaluated crack velocity functions to determine kinetic parameters. The approach is based on determining the time and location at which the system enables evaluation of: (i) a time delay in crack pop-in from a subthreshold flaw; (ii) a time dependence in the strength characteristics, in both the subthreshold and postthreshold domains. Comparisons with literature data on delayed pop-in and strength vs. stress-rage for silicate glasses in most environments indicate that the analysis is capable of quantifying the predictive properties of kinetic characteristics. In the strength data, the model accounts for the relatively high levels of scatter, and strain rate sensitivities in the subthreshold region.

200.939
PBQ2-237171 Not available NTIS National Inst. of Standards and Technology (MSEL), Boulder, CO. Fracture and Deformation Div.
Elastic Properties of Porous Ceramics.
Final rep.
H. M. Ledbetter, M. Lei, and S. K. Datta. 1985, 8p

Keywords: *Elastic properties, *Ceramics, *Porous materials, Bulk modulus, Poisson ratio, Shear modulus, Porosity, Models, Mechanical properties, Modulus of elasticity, Reprints.

Using theoretical models, we consider the elastic constants of ceramics containing pores. As an example, we consider alumina. However, the approach applies to all ceramics. As a point of departure, we consider spherical pores. For all the usual elastic constants of Young modulus, shear modulus, bulk modulus, Poisson ratio — we give relationships for both the forward and the inverse problems for various source properties and estimating the pore-free ceramic properties. Following a suggestion by Hasselman and Fulton: for ceramics with cylindrical pores and or porosity producing cylindrical pores, we derive a relationship for the elastic constants of a distribution of randomly oriented long cylinders. This model predicts elastic constants lower than those for spherical pores, but well above observation. We obtain agreement with observation by assuming the pores are oblate spheroids. For alumina, the necessary aspect ratio equals one-ninth. Using this oblate-spheroid pore-shape model, we give predictions for all
of alumina's elastic constants versus pore volume fraction. Besides porosity (P), the model requires only the pore-free alumina elastic constants. It contains no adjustable parameters.

200.940 PB92-237189 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD, Ceramics Div.

Physical Aging Response of an Epoxy Glass Subjected to Large Stresses.

Final rept.
A. Lee, and G. B. McKenna, 1990, 8p
Pub. in Polymer 31, n3 p423-430 1990.

Keywords: "Aging tests(Materials), "Epoxy resins, "Glass, Quench aging, Nonlinear systems, Stress analysis, Equilibrium, Quenching(Cooling), Creep properties, Loads(Forces), Mechanical properties, Prints, Physical aging studies were made using model epoxy network glasses. Nonlinear viscoelastic properties were measured after quenching the glasses to the temperatures, except for Lt.Ce, Pr, Nd and the physical aging responses at different magnitudes of applied load, different duration times of the load application and at different temperatures. The creep compliance/curves at different aging times were able to be superimposed to form a single master curve, demonstrating the validity of the superimposition principle for this epoxy network. Similar to many other physical aging studies, we observed that the double logarithmic shift rules do not apply to the superimposed master curve, and that the aging was ' erased' by large mechanical stimuli. Furthermore, we compared the creep response after reaching equilibrium for the different glasses that are subject to the repeated stress responses as it aged into equilibrium with that of the same glass which was aged thermally into equilibrium without any stress application. There was no significant difference between the responses in these two conditions.

200.944 PB93-125466 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD, Ceramics Div.

Small Angle Neutron Scattering and Small Angle X-ray Scattering from Bulk Microporous Silica.

Final rept.
See also PB91-203489 and PB93-125458.

Keywords: "Silicon dioxide, "Small angle scattering, "Microstructure, "Porous materials, "Ceramics, "Collod, Particle size distribution, Physical properties, Sintering, Particle size, Solids, Gelation, Neutron scattering, X-ray scattering, Reprints.

The microstructure of low-density porous silica precursors is studied through the observation of starting chemistry. The ratio of colloidal silica sol to polysilicic acid is known to have a marked effect on the size distribution of colloidal silica particles. One such system has a major impact on the resultant physical properties of the sintered product. In the present research, the sizes and the size distribution of particles undergoing the pore microstructure was investigated, and it was found that the lower the amount of colloidal silica, the greater the size distribution of particle aggregates.

200.945 PB93-125581 Not available NTIS

National Inst. of Standards and Technology (MSEL), Gaithersburg, MD, Ceramics Div.


Final rept.
S. G. Maughan, and V. K. Pujari, 1990, 7p

Keywords: "Silicon nitrides, "Powder metallurgy, "Injection molding, Ceramics, Structural engineering, Physical properties, Chemical properties, Thermodynamic properties, Surface chemistry, Manufacturing, Reprints, Advanced materials.

Silicon nitride powders of a range of physical and chemical properties have been used in a variety of ceramic components for structural applications. Detailed characterization of all the powder constituents is a prerequisite for the reproducible manufacture of ceramic components that will perform reliably in intended applications. In this paper, selected powder properties and chemical techniques for characterization of silicon nitride powder will be evaluated. The characterization data will be discussed in the context of how these data, through their influence on powder processing unit operations, can affect the final microstructure. In the formation of ceramics, some of the major variables include: pressing conditions and powder control; and the measurement and control of these variables is emphasized for manufacture of ceramics with a high degree of reliability.

200.946 PB93-125813 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD, Ceramics Div.

Effect of Photodeposited Iron Oxide and Tin Oxide on the Consolidation of Porous Yoruc Glass.

Final rept.

Keywords: "Cellular glass, "Silica glass, "Iron oxides, "Tin oxides, "Deposition, Consolidation, Porous materials, Scanning electron microscopy, Surface properties, Small angle scattering, Particles, Porosity, Rutherford scattering, Reprints, Photodeposition.

Iron oxide and tin oxide have been photodeposited in porous Yoruc glass and examined before and after consolidation. Scanning electron microscopy (SEM) coproves the isothina oxide particles are larger than the tin oxide particles. However, small angle x-ray scattering studies indicate that the glass cements about the iron oxide but not about the tin oxide. Photodeposition of tin oxide, which are chemically modify the glass surface and to prevent their consolidation, offers a means of producing highly resolved regions of porosity in the otherwise consolidated glass.

200.947 PB93-125946 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD, Ceramics Div.

Materials Property Database Requirements for Gas-Fueled Ceramic Heat Exchangers.

Final rept.
R. G. Munro, and E. F. Begley, 1991, 9p
Pub. in Department of Energy, Gas Research Institute, IL

Keywords: "Heat exchangers, "Ceramics, "Information systems, Structural engineering, Data base management, Materials, Chemical properties, Physical properties, Information transfer, Requirements, Reprints.

The Structural Ceramics Databases (SCD) system is being developed at the National Institute of Standards and Technology to provide a critical link between the development of new materials in research laboratories and the application of those materials in industry. To achieve this goal, considerable effort is being devoted to establishing the SCD material's property database in a highly user-friendly computer format for use on personal computers. The system is designed to provide a consistent and attractive mechanism for com-
MATERIALS SCIENCES

Ceramics, Refractories, & Glass

municating critical data to design engineers involved in product development. The development of the SCO is being aided by focusing attention on specific applications. Such focusing provides a more cost effective approach to database construction because the materials and their applications in the database are determined and constrained by the needs of the application.

The utility of the resulting data, however, extends well beyond the building application. The first phase of the development of the SCO is focused on the materials, property, and information requirements that derive from the specific application of a materials property database to ceramic heat exchangers.

200.948
PB93-126066
Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Fracture and Contact Adhesion Energies of Mica-Mica, Silica-Silica, and Mica-Silica Interfaces in Dry and Moist Atmospheres.

Keywords: Mica, Silicon dioxide, Fractures(Materials), Adhesion, Charge transport, Surface chemistry, Interfaces, Dry methods, Wet methods, Crack propagation, Moisture, Mechanical properties, Brittle fracture, Repetition.

A study is made of the factors that contribute to the energy of mica-mica, silica-silica, and mica-silica interfaces in the presence of moist atmospheres. Energies are measured using brittle fracture and contact adhesion techniques. Both "virgin" and "heated" interfaces are investigated, with special attention on the latter. The fracture and adhesion data overlap, reflecting a common underlying separation process by "sharp-crack propagation." The study identifies several contributions to the interface adhesion energies. At virgin mica-mica and silica-silica interfaces the energy is determined by primary ionic-covalent attraction, and by the effectiveness of this attraction by condensed moisture from the atmosphere.

200.949
PB93-131423
(Ord. as PB93-131381, PC A07) National Inst. of Standards and Technology, Gaithersburg, MD.
Fracture Toughness of Advanced Ceramics at Room Temperature.

Keywords: Fracture strength, Silicon nitrides, Zirconium oxides, Aluminum oxides, Ceramic compositions, Interlaboratory comparisons, Room temperature,indentation hardness tests, Advanced materials, Round robin.

The report presents the results obtained by the five U.S. participating laboratories in the Versailles Advanced Materials and Standards (VAMS) round-robins for fracture toughness of advanced ceramics. Three test methods were used: indentation fracture, indentation strength, and single-edge pretrained beam. Two materials were tested: a gas-pressure sintered silicon nitride and a zirconia toughened alumina. Consistent results were obtained with the latter two test methods. Interlaboratory agreements in the zirconia alumina composite was complicated by R-curve and environmentally-assisted crack growth phenomena.

200.950
PB93-135259
Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD.
Phase Diagrams for Ceramics. Volume 8.

Keywords: Ceramics, Phase diagrams, High pressure tests, Salts, Water, Oxides, Reprints.

The volume supplements the seven previous collections entitled Phase Diagrams for Ceramics. This eighth compilation contains 295 commentaries and 915 diagrams on oxide and salt systems with water at pressures above atmospheric, mainly for literature published since 1975.

200.953
PB93-155564
Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Interfacial Strength between Fractural Geometry and Fractogram.

Pub. in Jnl. of the American Ceramic Society 74, n2 p1336-3136 Dec 91.

Keywords: Fractography, Fracture, Ceramics, Glass, Fracture strength, Crack propagation, Scaling laws, Mirrors, Reprints, Fractal dimensions.

Fractal geometry has been used to describe irregular fracture surfaces in a quantitative way. The fractal dimensional increment has been related to the fracture toughness of the material through the elastic modulus and a characteristic structure parameter, a(0). The study of fractography has shown the relationship between the fracture toughness and the elastic modulus to another structure parameter, b(0). Combining all of these relationships leads to the conclusion that the fractal dimensional increment, D, is directly related to the flaw-to-mirror size ratio. This note shows that experimental measurements of the fractal dimension and the flaw-to-mirror size ratio on glasses, a glass ceramic, polycrystalline ceramics, and a single crystal all agree with the prediction. The implication of this finding is that there is a linear scaling law in operation at fracture between the energy of crack initiation and the fracture toughness.

200.955
PB92-144997
Not available NTIS National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Building Materials Div.
Novel Spectroscopic Technique for In-situ Studies of Water at the Interface Between a Metal and an Opaque Polymeric Film.

Keywords: Fourier transform spectrometers, Infrared spectroscopy, Water analysis, Interfaces, Coatings, Metals, Polymeric films, Exposure, Plastic coatings, In-situ processing, Corrosion, Interfacial properties, Reprints, Multiple internal reflection spectroscopy.

A technique was developed based on Fourier transform infrared spectroscopy - multiple internal reflection (MIF-FTIR) for measuring water in situ at the coating/metal interface. The method requires direct application of a transparent or opaque polymeric coating on any thickness to a metal-free or metal-coated internal reflection element (IRE). A water chamber was attached to the organic coating side of the coated IRE and water was introduced through the chamber inlet. MIF-FTIR spectra were taken automatically at specified exposure time intervals without readjustment of the ATR accessory and without disturbing the specimen or the conditions of the experiment. The method was found useful for determining the thickness of the water layer at the coating/metal interface and its change as a function of exposure time.

200.956
PB92-145002
Not available NTIS National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Building Materials Div.
Mathematical Model for the Cathodic Blistering of Organic Coatings on Steel Immersed in Electrolytes.

Keywords: Mathematical models, Corrosion, Shielding coatings, Blistering, Electrolytes, Cations, Interfacial, Diffusion, Defects, Construction materials, Ion drift, Reprints.

A physical/mathematical model which describes blistering of coatings from the immersion of coated metal specimens containing defects exposed to electrolytes has been developed. The model is based on the two-dimensional diffusion of cations through a nonhomogeneous, nonisotropic medium. Calculations show that the coating/metal interface from the defect to the cathodic sites are assumed to be responsible for the formation of highly water soluble blistering. Solutions of the model were expressed in terms of dimensionless parameters. Concentration profiles between the blister and defect and caHon flux into the blister as
functions of time, blister size, distance between the blister and coating interface, and material potential gradient were calculated. The predictions were related to available experimental data in the literature on blister uptake rates and blistering rates for coated steel panels exposed to metal chlorides solutions.

200.957
PB92-153980

A technique for detecting and quantifying coating surface defects is presented. The technique is based on heating the coating system slightly above ambient temperature and viewing it with an infrared thermography camera attached to a computer image processor. Surface finish defects are visible in the resultant thermographic image due to coating thickness variations. Techniques for measuring coating thickness variations influence the thermal radiation emission/reflectance/transmission properties of the coating system detected by the thermographic camera. The theory for a model coating system is presented and several applications areas explored. Theoretical limitations on the use of this technique are discussed.

200.959
PB92-213370
PC A03/MF A01 National Inst. of Standards and Technology (BIFRL), Gaithersburg, MD. Lead Concentration in Consumer Products: A Pilot Study. M. E. McKnight, and W. E. Roberts. Jun 92, 15p NISTIR-4851

Keywords: *Lead(Metal), Consumer products, Paints, *Chemical analysis, Concentration/Composition, X ray spectroscopy, Environmental exposure, Consumer product safety, Consumer Product Safety Commission.

A pilot study was conducted for the U.S. Department of Housing and Urban Development (HUD) to measure the lead concentrations in a small sampling of new consumer products. Although a Consumer Product Safety Commission Regulation requires that the lead concentration be no greater than 0.06 percent (600 parts per million, ppm or 600 micrograms/g) by mass of paint solids, the actual lead concentration is not controlled by the manufacturer and the lead concentrations in new paint are needed in HUD's lead paint abatement program. Thus, the objective of the pilot study was to determine concentrations of lead in collected samples. A14 double-barreled microelectrode (C1-) ion concentration estimates were less than 100 ppm. The lead concentration of most samples was below the detection limit of the procedure used of 30 ppm.

200.959
PB92-217595


Conceptual and mathematical models are developed for processes which describe blistering of defect-containing coating on steel containing defects exposed to electrolytic solutions. The assumption is made that cations migrating along the coating/metal interface from an anode at the defect to cathodic sites are responsible for blistering. The cations are driven by both concentration and electrical potential gradients. The mathematical models are solved to predict ion fluxes as a function of concentration gradients along the coating interface and within the blister. Solutions of the models are expressed in terms of dimensionless parameters. Model results indicate that the distance between the blister and defect, ion diffusivity and potential gradients to substantiate the models, an experiment was designed and conducted to measure the transport of cations along the coating/metal interface from the defect to the blister. Sodium ion concentration-time data within a blister were analyzed to determine temperature parameters. Model results indicate that large blisters subject to a potential gradient are more likely to grow than small blisters which can build up within them. Implications of the conclusions for maintaining the integrity of organic coatings are discussed.

200.960
PB92-236769
Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Division.


Keywords: *Nondestructive tests, *Thin films, *Thermodynamic properties, Conduction, Thermal diffusivity, Porosity, Voids, Wave propagation, Thermal conductivity, Oxide coatings, Heat transmission, Reprints, Thermion etc. small sampling of new panels tended to be near the regulatory limit. The lead concentration in each of 31 consumer paints was measured using laboratory methods. A14 double-barreled microelectrode (Cl-) ion concentration estimates were less than 100 ppm. The lead concentration of most samples was below the detection limit of the procedure used of 30 ppm.

200.961
PB92-237254
Not available NTIS National Inst. of Standards and Technology (NIEL), Gaithersburg, MD. Building Materials Div.


Keywords: *Aging tests(Materials), *Protective coatings, *Water immersion, *Corrosion environments, Weathering, Artificial weathering tests, Degradation, Weathering, Artificial aging(Metalurgy), Alkali resists, Exposure, Submerging, Cycles, Corrosion tests, Reprints.

Most accelerated aging tests subject coated panels to either a continuous wet or a cyclic wet-dry exposure. The advantages of continuous exposure over cyclic exposure are that continuous exposures provide more realistic results, since they better simulate outdoor weathering conditions and give rise to failure modes closely resembling those observed outdoors. To test this hypothesis, two sets of identical oil-alkyd coated panels containing a prominent defect were exposed to either continuous immersion or cyclic wet-dry immersion in a 5% NaCl solution. It was concluded that continuous immersion was a more severe exposure than cyclic wet-dry immersion and that the failure mechanisms underlying degradation in both exposures appear to be identical.

200.962
PB93-120749
PC A04/MF A01 National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.


Quality assurance tests on incoming intaglio inks used in the printing of currency are limited to measurements such as rheology and volatile organic content. The most revealing tests, crumple and laundry resistance tests, were carried out on oil-alkyd samples. These tests determine whether a whole batch of currency is acceptable or not. A screening test is desirable to find faulty inks before the printing has begun. Such batches might be set aside and reformulated into acceptable inks. The report discusses the screening processes.

200.963
PB93-125359
Not available NTIS National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Materials Div.

In situ Measurements of Chloride Ion at the Coating/Metal Interface.


Present knowledge on the movement of Cl- ion in a coated metal is derived mostly from its permeability through a coated film, which may not be the same as those of an attached film. This paper describes a method to measure in situ (C1-)) at the coating metal interface that is based on exposing the coated material and measuring the ionic current flowing from the double-barreled microelectrode (Cl-) ion and reference electrodes in one body) and the insertion of it into the specimen to measure (Cl-) directly as a function of exposure time. Chloride ions were observed at the metal surface under a 90 micrometers thick coating after 3 hours exposure and continued to rise, surpassing the (Cl-) of the bulk solution after 80 hours of exposure. The method provides very useful transport properties of coatings on metal and will also greatly in understanding the mechanisms of corrosion and adhesion failure of coated metals.
Coatings, Colorants, & Finishes

200,96t

The influence of exposure to water at ambient pressure and at an elevated pressure on the mechanical properties of a glass fiber epoxy matrix composite was investigated. The mechanical properties of three orientations of the composite were determined in the dry condition, after exposure to water at ambient pressure and after exposure to water at 5.9 MPa. Then, to determine the mechanism of the observed degradation, the mechanical properties of samples exposed at the two pressures were determined after the absorbed water was removed. The rate and extent of water absorption and desorption was evaluated by measuring the weight change at periodic intervals. Substantial reductions in the yield stress and the ultimate strength were observed for samples at both pressures. On desorption, the yield stress returned to the originally determined dry value, but the ultimate strength was not recovered. This was attributed to a permanent degradation process caused by the absorbed water. No significant difference was observed for samples exposed at the two pressures.

200,96s

An assessment is made of the potential of optic fiber sensors to monitor the consolidation of reinforcement plies in the manufacture of polymer matrix laminates. Sensor designs based on refractive index effects and on photoconductivity have been developed and tested for consolidation. A design in which the transmitted light intensity is modulated by changes in the refractive index and in a spectroscopic technique which uses fluorescent probes was found to have advantages in terms of simplicity and good sensitivity throughout the range of consolidation.

200,96v

Two of the most common techniques used to measure fiber-matrix interfacial shear strength, the single-fiber fragmentation test and the microbond, have been analyzed and compared. Photoelastic and interferometric analyses were performed to obtain the stress distribution at the fiber-matrix interface and its dependence on the loading and geometrical parameters. The effect of a penny-shaped crack in the fiber, in the fiberfragmentation test is shown to be one of the parameters governing the interfacial failure mode. It is also shown that loading conditions, meniscus formation, and fiber free length have a large effect on the distribution of interfacial stresses in the case of the microbond, which may explain the large observed scatter of experimental results. Furthermore, it is shown that the effect of the stress distribution is highly non-uniform, thus making the calculation of shear stress very inaccurate when single-fiber tests are used. It appears that the single-fiber fragmentation test is more reliable than the microbond test because of its simplicity and the smaller number of parameters involved in its analysis.

200,96t

Keywords: 'Penetration, 'Surface properties, 'Metal coatings, 'Wear tests, Loads(Forces), Steels, Sliding friction, Impact loads, Nickel coatings, Loading rate, Wear, Microhardness, Mechanical properties, Hardness, Microhardness, Micropenetration, Nickel-phosphorous alloy coatings.

Micropenetration studies (microhardness) have been carried out on four nickel-phosphorous alloy coatings on steel. Sliding wear measurements had been previously done on the same coatings. Two different compositions were used, 5 wt pct F and 12 wt pct P. The microincrementer system consisted of an electromagnetically driven diamond pyramidal penetrometer. The loading waveform was a cos sq function that was held at a constant maximum value for 15s., and then released. The output was quantified by a load response curve, and these were interpreted in terms of mechanical response of the material. Loads ranged from 0.5N to 4N. A pressure profile was system controlled and the data were all digitally processed. The results of micropenetration testing and sliding wear testing on these coatings are compared.
Fabrication and interface Debonding of AI203-Cr203-Cr Composites.

Fabrication and interface Debonding of Al2O3-Cr2O3-Cr Composites.

Fabrication and interface Debonding of AI2O3-Cr2O3-Cr Composites.

Fabrication and interface Debonding of AI2O3-Cr2O3-Cr Composites.

Fabrication and interface Debonding of Al2O3-Cr2O3-Cr Composites.

Fabrication and interface Debonding of AI2O3-Cr2O3-Cr Composites.

Fabrication and interface Debonding of AI2O3-Cr2O3-Cr Composites.

Fabrication and interface Debonding of Al2O3-Cr2O3-Cr Composites.

Fabrication and interface Debonding of AI2O3-Cr2O3-Cr Composites.

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Fabrication and interface Debonding of AI2O3-Cr2O3-Cr Composites.

Fabrication and interface Debonding of AI2O3-Cr2O3-Cr Composites.

Fabrication and interface Debonding of AI2O3-Cr2O3-Cr Composites.

Fabrication and interface Debonding of AI2O3-Cr2O3-Cr Composites.

Fabrication and interface Debonding of AI2O3-Cr2O3-Cr Composites.

Fabrication and interface Debonding of AI2O3-Cr2O3-Cr Composites.

Fabrication and interface Debonding of AI2O3-Cr2O3-Cr Composites.

Fabrication and interface Debonding of AI2O3-Cr2O3-Cr Composites.

Fabrication and interface Debonding of AI2O3-Cr2O3-Cr Composites.

Fabrication and interface Debonding of AI2O3-Cr2O3-Cr Composites.

Fabrication and interface Debonding of AI2O3-Cr2O3-Cr Composites.

Fabrication and interface Debonding of AI2O3-Cr2O3-Cr Composites.

Fabrication and interface Debonding of AI2O3-Cr2O3-Cr Composites.
resistance of the composite compared to the unreinforced glass matrix.

200.982
PB93-129583  Not available NTIS
National Inst. of Standards and Technology (MSE),
First rep. H. Ledbetter, and C. Fortunke, 1991, 3p

Keywords: "Metal matrix composites, "Aluminum alloys, "Modulation of elasticity, "Ultrasonic tests, "Ceramic materials, Matrix materials, Composite materials, Reinforcing composites, Nondestructive tests, Elastic properties, Mechanical properties, Reprints.

We focused on the dynamic Young modulus, E, of a particle-reinforced aluminum alloy. The particles consisted of Al2O3 spheres with average sizes of 30, 45, and 100 micrometers. The measurement methods consisted of megahertz-frequency pulse-echo subposition and kilohertz-frequency standing-wave resonance. The modeling method consisted of taking the longitudinal velocity of the ensemble average of the sound velocity of plane waves scattered by a well-stirred distribution of spheres. Input to the model consisted only of the particle and matrix elastic constants. With one exception, all the measurements agree with theory within 0.7 percent. Our results confirm the model, showing that the failure to affect E, and demonstrate a seventeen-percent negative departure at (c = 0.30) from a linear rule-of-mixture.

200.982
PB93-135457  Not available NTIS
National Inst. of Standards and Technology (MSE),
Gaithersburg, MD. Ceramics Div.
Stress Relaxation in Sintering of Fiber Reinforced Composites Through Fiber Coating.
First rep. C. P. Osterlak, and S. Mgalhmin, 1989, 8p

Keywords: "Fiber composites, "Relaxation(Mechanics), "Coatings, "Stresses, "Aluminioxide, Silicon carbides, Creep properties, Densihty, Viscosity, Temperature dependence, Sintering, Reprints.

Coatings of different thickness of coarse and fine sized alumina particles on silicon carbide fibers were used to influence the stress generation during the early stage of sintering of fiber-reinforced composites. The fine particle-size coating stresses the stress development and the stress initiates at lower temperature than that for uncoated fibers. For coatings of coarse particles the stress initiation is delayed and occurs at higher temperatures and the overall stress level is reduced.

Corrosion & Corrosion Inhibition

200.982
PB92-144278  Not available NTIS
National Inst. of Standards and Technology (MSE),
Gaithersburg, MD. Polymers Div.
Modeling of Crack Chemistry in Cu-Au Alloys.
First rep. U. Bertocci, 1989, 6p
See also PB86-132954

Keywords: "Stress corrosion, "Copper alloys, "Gold alloys, "Cracking(Fracturing), "Corrosion mechanisms, Ethrode potentials, Electrochemistry, Oxidation reduction reactions, Solutions, Reprints.

The possibility of hydrogen discharge at the crack tip during transgranular stress corrosion cracking of Au-Alloys in chloride solutions was examined by modeling electronic transport and transport loss in alloys in cracks under steady state conditions. To take into account the discontinuous nature of the cracking, which causes periodic minima in the electrode potential at the crack tip, the minimum potential which can be reached was calculated considering the interplay of the various electrode reactions and their spreading along the crack. Kinetic parameters for the redox reactions Fe(II)/Fe+3 and Fe(III)/Fe+2 were measured, in order to provide values for the modeling, which are unavailable in the published literature. The result showed that there is no possibility of hydrogen discharge, which rules out hydrogen embrittlement as the cause of the cracking.

Corrosion & Corrosion Inhibition

200.985
PB92-170745  Not available NTIS
National Inst. of Standards and Technology (MSE),
Gaithersburg, MD. Metallurgy Div.
Electrochemical Noise Analysis and its Applications to Corrosion.
See also PB87-128195

Keywords: "Corrosion, "Electrochemistry, Noise("Electrical and electromagnetic", Thermal noise, Heat exchange between metal and environment, Noise measurement, Noise analyzers, Electrochemical corrosion, Reprints, "Electrochemical noise.

Random fluctuations of the electrical quantities (electrode potential and current) in electrochemical systems, are often referred to as electrochemical noise. The paper describes the experimental methods and uses of the analysis of electrochemical noise, with particular emphasis to corrosion applications.

200.987
PB92-197441  Not available NTIS
National Inst. of Standards and Technology (MSE),
Gaithersburg, MD. Ceramics Div.
Extended Charles-Hillig Theory for Stress Corrosion Cracking of Glass.
First rep. T. J. Chuang, and E. R. Fuller, 1992, 6p
Pub. in Jnl. of the American Ceramic Society 75, n3 p540-545 Mar 92.

Keywords: "Glass, "Stress corrosion, "Crack propagation, Reaction kinetics, Electrochemical corrosion, Fatigue(Mechanics), Physical properties, Cavitation corrosion, Reprints, "Charles-Hillig theory.

The work originally performed by Charles and Hillig (C&H) on the chemical stress corrosion cracking of glass is based on the chemical reaction rate theory and restricts the analysis to only the kinetic change at the exact location of the crack tip. As a result, crack sharpening/blunting is predicted when the applied stress lies above/below the static fatigue limit. The present paper extends the investigation within the same framework to the geometric change due to the entire cavity surface, particularly in the vicinity of the cavity apex region. It has been found that a physical-property-dependent parameter (m) exists which exerts a strong influence on the crack-tip morphology.
MATERIALS SCIENCES
Corrosion & Corrosion Inhibition

200.983
PB93-135218
Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Hard Segment Unit Cell for MDI-BDO-Based Polyurethane Elastomers.
Keywords: *Polyurethane*; *resins,* *Elastomers,* [Hardsegments](Materials), *X-ray* diffraction, *Electron* diffraction, *Crystal* structure, *Density*ometers, Optical measurement, Reprints, Methane disocyanate/di-isocyanate, Butanediol.

X-ray and electron diffraction data have been combined in order to determine the unit cell for the hard domains of 4,4'-diphenylmethane disocyanate/butanediol-based polyurethane elastomers. The analysis has been aided by manipulating digital intensity data obtained from two-dimensional densitometer scans of the diffraction patterns. A total of 22 reflections are resolved in the electron diffraction patterns, of which 11 are detected by x-rays. The reflections in the X-ray fiber diagrams of stretched annealed film are placed above and below the apparent layer lines, which points to inclination of the chain axis (c) away from the direction of the draw. Refined of coordinates of the predicted reflections shows that the c axis is tilted by 2.5 degrees away from the direction of draw, approximately in the 111 plane.

Fibers & Textiles

200.994
PB92-144393
Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Polymers Div.
Problem of Visibility in Noisy Images.
Keywords: *Scanning electron microscopy,* *Fibers,* *Imaging analysis,* *Visibility,* *Asbestos,* Reprints, *Rose* criterion.

The visibility of objects in noisy images is a problem of widespread interest in microscopy. Existing visibility criteria are based upon the Rose criterion, Delta > 0.8, for the minimum signal excursions above the background noise. The Rose criterion is appropriate to small objects (1% of image width). To determine a visibility criterion for long objects such as fibers, a series of experiments has been performed involving calculated digital images of fiber arrays at various contrasts. Background noise and the performance of random image fields of fibers by 18 observers reveals considerable relaxation of the Rose criterion for long fibers (length > 10 fiber diameters). Additive linear analyses will be necessary to define a robust measure of the visibility criterion.

Iron & Iron Alloys

200.985
PB92-145192
Not available NTIS National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Charyb Impact Tests Near Absolute Zero.
Pub. in Jnl. of Testing and Evaluation 19, n1 p34-40 Jan 91.
Keywords: *Charyb impact tests,* *Austenitic steels,* *Cryogenic temperature,* *Fracture strength,* Impact tests, Strain rate, Liquid helium, Standards, Reviews, Reprints.
The authors review Charpy impact testing at extreme cryogenic temperatures especially at liquid helium temperature (4K), considering methods of testing and calculating toughness. They also discuss the various stages of testing, and correlations between Charpy absorbed energy and quantitative toughness parameters. Because of the costs of testing, the authors advocate using melt analyses to assure zero, any surface condensation of gases, convective or conductive heat transfer, or plastic deformation. The test will cause the specimen to begin tempering and measurement to be used. Consequently, valid impact tests of alloys at 4K cannot be performed according to the procedure outlined in the NIST Methods 23-88. During Charpy tests, the temperature of austenitic steel specimen, initially at or near 4 K, may remain outside the cryogenic regime. Fracture does not occur at the intended temperature, but at an uncontrolled temperature, since materials with different work hardening rates heat different. In view of the temperature rise variability and scatter in measurements and property correlations, the authors conclude that it is not possible to accurately estimate the 4 K fracture toughness of austenitic steels, or rank them properly, using Charpy tests.

200.98
PB92-145200  Not available NTIS National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.

Water-Precracking at 295 K and Its Effects on the 4-K Toughness of Austenitic Steels.

Final rept.
Sponsored by Department of Energy, Washington, DC.
Office of Fusion Energy.

Keywords: *Austenitic stainless steels, *Cracking(Defracturing), *Toughness, *Cryogenics, Failure, Crack propagation, Fracturing, Nickel chromium molybdenum steels, Ductility, Brittleness, Test methods, Reprints.

Experiments show that some austenitic steels at extreme cryogenic temperatures are toughened by warm precracking. The authors demonstrate this for Fe-14Cr-3Ni-13Mn-0.33Ni steel specimens that were warm precracked at 295 K and then fractured in liquid helium at 4 K, with failure occurring by slip-plane cracking. On the other hand, Fe-13Cr-5Ni-22Mn-0.21Ni steel with higher toughness and a ductile fracture mechanism at 4 K was affected by similar warm precracking. Austenitic and ferritic steel behaviors are compared, and precracking procedures for 4 K fracture tests are discussed.

200.99
PB92-145434  Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Corrosion Div.

Characterization of 9Cr-1MoVnB steel by Anomalous Small-Angle X-Ray Scattering.

Final rept.
Contract DE-FG02-86ER45229
Sponsored by Department of Energy, Washington, DC.

Keywords: *Chromium carbides, *Ferritic stainless steels, *Precipitation(Chemistry), Temperature dependence, Particle size, Size determination, X-ray analysis, PhD Thesis, Reprints.

The size distribution and volume fraction of Cr23C6 precipitates in 9Cr-1MoVnB steel have been isolated from the distributions of all other precipitates by the technique of anomalous small-angle X-ray scattering. Three X-ray wavelengths near the CrK absorption edge were used to vary the scattering contrast of Cr23C6 while that of the other precipitates was left unchanged. Scattering calculated from each scattering curve using a maximum entropy method were combined by a scattering contrast gradient analysis to isolate the volume-fraction size distribution of the chromium carbides. Behavior of the carbides was studied as a function of isothermal aging temperature. Mean diameter is 30 nm or 0.6 number density at the highest aging at 811 K. Above 811 K, the mean diameter of the chromium carbides increases with increasing aging temperature.
Ferrite Number Prediction for Stainless Steel Welds.

Final rept.

A. L. Charles, W. C. McCowan, and D. L. Olson, 1992, 198
Sponsored by Welding Research Council, New York.

Keywords: "Ferritic stainless steels, "Weld metal, "Review, Weldments, Predictions, Ferrite, Iron alloys, Welded joints, Concentration (Composition), Reprints, Welding, III.

The review article summarizes progress in the prediction of the ferrite content (as Ferrite Number) in stainless steel welds.

Keywords: "Austenitic stainless steels, "Welded joints, "Cryogenics, "Fracture properties, Gas metal arc welding, Fracture strength, Fracture (Materials), Mechanical properties, Microstructure, Toughness, Reprints.

The welds that are used to fabricate a structure from wrought stainless steel subcomponents usually have poorer mechanical properties than the wrought material at cryogenic temperatures. This is because the critical fracture path in these structures could be through the welds. For many applications the welds may never bear load at these critical levels, but for very aggressive and severe structural designs it can be a real concern. For these aggressive designs, the structural designer could place the welds in less critical regions, however such a design philosophy might be difficult to implement. It would be better to learn how to make welds with improved mechanical properties, and have developed quantitative data for many of the factors that influence the strength and toughness of welds, to allow more intelligent choices of welding processes and compositions for demanding applications. This paper reviews these facts, and discusses the interactions between them. For example, the cryogenic strength of welds is influenced most by the composition, with the strength being increased strongly by Ni addition. The toughness is decreased by increasing delta ferrite (FN) and inclusion, but can be increased by addition of Ni. Recently, a gas metal arc weld with 25 wt. % Ni has produced the best combination of strength and toughness over measured at 4 K in our laboratory. Changes in the inclusion fraction are the primary cause of differences in mechanical properties, and on a geometry and welding process. A secondary cause of differences is a non-uniform distribution of elements in the microstructure.

Lubricants & Hydraulic Fluids

201,012

PB92-144690 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.

Boundary Lubrication and Frictional Force Measurements.

Final rept.

S. M. Hsu, 1991, 1p

Keywords: "Lubricants, "Boundary lubrication, "Ceramic materials, "Ceramic monolithic, "Chemical reaction, "Friction tests, Wear tests, Reprints, Chemical reaction mechanisms.

The ability to control friction and wear is oftentimes critical to the introduction of new products. A critical issue is friction and wear under the combination of high stress and slow speed, under which the surface interfaces. Boundary lubricating films formed by chemical reactions between the lubricant and the surface are thus of great interest. The work presented here examines the effect of friction and wear on the formation of such films and the mechanisms by which they form. The study involves a series of experiments designed to determine the effect of various factors on the formation of boundary lubricating films. The results of these experiments are presented and discussed in detail.
and the surface are crucial to the successful control of friction and wear. Recent advances aided by the increased power of the analytical techniques have revealed much about the chemical mechanisms. The total knowledge base in this area, however, is still rather limited. The paper reviews the current understanding of the nature of lubrication and identifies knowledge gaps for advanced materials.

Materials Degradation & Fouling


Keywords: *Aluminum oxides, *Wear, Tribology, Lubrication, Friction, Ceramics, Reprints.

The effect of load, sliding speed and lubricant temperature on the tribological performance of polycrystalline alpha-alumina was investigated. A four-ball test geometry was used with a purified paraffin oil lubricant. The test results showed that the wear behavior of the material was strongly dependent on the contact load. Mild to severe wear transitions occurred at particular loads, depending on lubricant temperature and sliding speed. The transition load was found to decrease as either the lubricant temperature or the sliding speed was increased. The onset of transition is explained by the failure of the lubricating film due to an increase in flash temperature. Examination of the worn surfaces by scanning electron microscopy revealed that intergranular fracture was the primary mechanism for severe wear.


Keywords: *Adhesive bonding, *Fractures(Materials), *Delaminating, *Composite materials, Thin films, Interfaces, Energy dissipation, Reprints.

A simplified mixed-mode fracture analysis combining nonlinear thin-plate stress solutions with crack-tip elasticity results was developed to account for local variations of G(sub I), G(sub II) and G(sub III) in thin-film debond problems associated with large film deformation. More general stress fields from the plate analysis were matched with the singularity solution over a small boundary region at the crack tip where the effect of geometric nonlinearity was small. Local variations in each of the individual components of the energy release rate was directly related to the jumps in these stresses across the crack border. Specific results were presented for 1-D and elliptic planeform cracks. Deformations were induced either by a transverse pressure or a biaxial-compression stress field in which the bending axes and debond axes coincided. The model predictions compared well with more rigorous solutions provided the film thickness was sufficiently small. In all cases analyzed, G(sub III) was negligible. The ratio G(sub I)/G(sub II) was found to decrease with increasing load or film deformation, the rate that was moderate for pressure loading while generally sharp for compression loading. Film-substrate overlap may occur for certain geometry and loading conditions. Prevention of this by the substrate may critically increase the energy available for crack propagation.

201.015 PB92-165281 Not available NTIS National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.


Keywords: *Wear tests, *Interlaboratory comparisons, *Friction tests, Ceramics, Coatings, Materials tests, International cooperation, Reprints, Foreign technology.

Very early in the VAMAS history, a technical working party was formed on wear test methods in order to conduct appropriate planning studies. The main objective was to identify, in the first meeting of the working party held in April 1985 in Vancouver, Canada, which involves 16 participants. These objectives were to establish and carry out an international comparison of wear and friction test data, using a well defined methodology with suitable advanced materials as specimens. As the first effort, measurements of the wear behavior of ceramics and inorganic coatings would be carried out in comparison with conventional wear. The work of the first comparison was begun in 1985 and focussed on the reproducibility of a sliding pin-on-disc friction and wear test. The West German Federal Institute for Materials Research and Testing (BAM) was asked by the VAMAS Steering Committee to organize, coordinate, and evaluate the comparison. This report summarizes the results of that comparison.


The materials properties of advanced structural ceramics are providing new technological opportunities for improved wear-resistant components in heat engines. Use of ceramics could result in higher efficiency, increased power output, and longer lifetimes. However, the successful application of these new materials may be inhibited by the need for evaluated materials property availability of appropriate design criteria. The paper describes a new methodology for the wear testing of ceramics that is intended to enable material design to be based on laboratory test results. The methodology prescribes a systematic effort to measure and represent the wear characteristics of materials in a uniform and unified manner. The result is a set of wear maps which collectively provide a comprehensive representation of the wear properties of the materials. Presentation of the wear results in these dimensional representations allows simultaneous parametric dependencies to be visualized more readily than the traditional two dimensional graphs. The resulting visual structures of different regions of wear space may indicate the effective limits of competing wear mechanisms and, hence, may provide a basis for wear model development.


The need for accurate and timely service life estimates for coating systems has become increasingly important in recent years as a result of hazardous chemical, clean air, and low volatile organic content legislation, demands of consumers for higher performing finishes, and competition from other materials. This need has been accompanied by perceived deficiencies in the current accelerated aging tests. An in-depth investigation of the coating’s literature was made to identify potential shortcomings in the current practice and, where possible, to indicate remedies. It was concluded from this investigation that the failing of the current practice can be attributed to asking the wrong experimental question, to using an inadequate experimental design, and basing the experimental design on the incorrect premise; i.e., the presumption that outdoor exposure results in the same degradation as the de facto standard of performance. A reliability-based service life prediction program is proposed for alleviating these deficiencies and for providing a service life prediction for a coating system exposed to the environment oxidized aging. Examples of the successful application of reliability techniques to the coatings’ service life prediction problem are presented.


Keywords: *Coatings, *Aged accelerated tests, *Evaluating tests(Materials), *Service life, Probability theory, Exposure, Weathering, Life(Durability), Reprints.

Due to deficiencies in the present accelerated aging process, little reliance is placed on these results in predicting the service life of a coating system. A probability-based procedure is proposed to aid in overcoming these deficiencies. The proposed procedure appears to be capable of satisfying many of the deficiencies in the current practice including the ability to make quantitative service life predictions for a coating system exposed to well-characterized environments, to handle high variations in the degradation response of nominally identical coated panels, and to account for cumulative damage effects occurring in coated panels exposed outdoors. The mechanics of this procedure, along with several examples, are presented.

Miscellaneous Materials


Numerous fluids have been identified as promising alternative refrigerants, but much of the information needed to predict their behavior as pure fluids and as components in mixtures does not exist. In particular, reliable thermophysical properties data and models are needed to predict the performance of the new refrigerants in heating and cooling equipment, and to design optimized equipment to be reliable and energy efficient. The objective of this project is to provide highly accurate, selected thermophysical properties data and design information for refrigerants R134a, R113, R125, and R1270. This project consists of developing new test methods and using these test methods to fit simple and complex equations of state and detailed transport property models. The new data will fill the gaps in existing data sets and resolve the problems and uncertainties that exist in and between the data sets. This report describes the progress made during the first quarter of this fifteen-
1.02
PB92-144872 Not available NTIS National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Thermophysics Div.

Keywords: *Dipole moments, *Refrigerants, *Fluorinated aliphatic hydrocarbons, *Gases, Dielectric properties, Temperature, Molecular rotation, Refractivity, Polarizability, Reprints, Freons.

Dipole constants have been measured for seven refrigerants in the gaseous state over the range 305-415 K in order to determine their dipole moments. Four of the refrigerants have temperature-independent moments: R123 (CH2Cl2CHF3), R141b (CH2Cl2CHF3), R22 (CHF2), and R32 (CHF2). Two refrigerants have conformer-dependent moments, making their time-averaged moments temperature-dependent: R114 (CH2Cl2CF4) and E134 (R114). The formation of a dipole moment requires an independent determination of its electronic polarizability; this determination has been made by means of refractive measurements. Where possible, the present results are compared with earlier determinations of dipole moments.

1.021
PB92-149814 PC A05/MF A01 National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.


The phase-out of the currently used refrigerants during the next decade requires fast and accurate methods to evaluate possible alternatives for the existing refrigerants. This report investigates possible replacement refrigerants for R22, where the replacements are binary zeotropic mixtures of the following hydrofluorocarbons (HFCs): R134a and R125a. The method, that was chosen, is based on three steps: (1) determining possible mixture components, (2) evaluating all feasible possible mixtures using a simulation program developed by NIST and determining the best performing mixtures, (3) evaluating the best performing mixtures in a NIST build test facility. Following the path, two refrigerant mixtures, R32/R134a and R32/R152a were found to perform better than R22 with respect to COP and volumetric capacity for certain composition ranges. The used simulation model proved to be a very precise tool in finding possible replacement fluids and their possible performance advantages. The results give confidence that this time saving combination of simulation and testing is a very powerful engineering tool.

1.022
PB92-156623 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.

Keywords: *Wear resistance, *Copper, *Stearic acid, *Thermodynamic properties, Tribology, Thermochromy, Reprints, Copper steate, Fourier transform infrared spectroscopy.

The trichobiochemistry of copper with stearic acid was studied using a pin-on-disc wear tester under boundary lubrication conditions. The wear rate, assessed by surface profilometry, indicated that stearic acid was able to reduce the wear fourfold. Surface analysis by Fourier Transform Infrared Microspectroscopy revealed that cupric stearate was formed during the rubbing process by trichobiochemical reactions. The reaction products were confirmed by model compounds and was also found to be comparable with those from the static thermal experiments of stearic acid on copper surface at 40 C. The affinity between the chemical or the complex copper stearate complex implies that there might be a possibility that the formation of a protective film on the copper surfaces to reduce the wear from further propagation.

1.023
PB92-165577 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Building Environment Div.

Keywords: *Azeotropes, *Refrigerants, *Viscosity, Mixtures, Refrigerating machinery, Reprints.

An investigation of proper mixing rules for liquid viscosities of refrigerant mixtures is reported. Measured liquid viscosities of 7 azeotropes and their corresponding pure components are compared with some mixing rules and Hildebrand's correlation. The results indicate that viscosities of pure refrigerants behave thermodynamically supporting Hildebrand's theory. The mixing rules popular in the refrigerant industry are not valid universally for all mixtures considered.

1.024
PB92-170836 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Building Environment Div.

Keywords: *Refrigerants, *Azeotropes, Working fluids, Refrigeration, Mixtures, Solutions, Cooling systems, Performance, Refrigerating machinery, Reprints.

A review of the state-of-the-art of refrigerant mixtures is presented. The categories of azeotropes, near-azeotropes, and non-azeotropes which could be candidates for alternatives for existing systems as well as systems with little or no change in system configuration. Zeotropes are not applicable for existing systems but offer the potential for significant performance improvements if the new systems are redesigned so as to incorporate the zeotropic attributes of two phase flow temperature glide and variable composition. Whereas the azeotropes and near-azeotropes performance development are likely to have a small impact on the immediate ozone depletion crisis, the development will take longer but will be necessary for the greenhouse warming crisis.

1.025
PB92-175878 Not available NTIS National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.

Keywords: *Temperature measurement, *Working fluid, *Oceanic environments, *Cryogenics, Regenerative cooling, Thermometers, Cryogenic fluids, Refrigerating machinery, Thermocouples, Reprints.

Characterization of an orifice pulse tube refrigerator required measurements of the instantaneous temperature at various locations in the refrigerator. This presents several challenges. The temperature probe must be fast enough to record a pulse in the stream. Void volumes, introduced by placement of a temperature probe into the system, have been kept at a minimum. The temperature sensing device has to be robust to survive pressure waves and mass flows oscillating at frequencies of up to 30 Hz. The refrigerant has a fast response time to monitor the rapidly changing temperatures in the system. The temperature resolution has to be on the order of mk. The paper discusses rapid temperature measurements with both thin-film thermocouples and fine-wire resistance thermometers. A 4 micrometer diameter copper wire was found to satisfy these diverse requirements.

1.026
PB93-120756 PC A04/MF A01 National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.


The paper presents a comparison of calorimetric and visual measurement of horizontal nucleate flow boiling of four fluids: (1) trichlorofluoromethane (R11), (2) its proposed replacement, the alternative refrigerant 1,1-dichloro-2,2,2-trifluoroethane (R123), (3) a R123/ 0.5% weight alkylbenzene lubricant mixture, and (4) a R123/2% weight alkylbenzene lubricant mixture; the nominal kinematic viscosity of the lubricant was 53 sq micrometer/s (280 SUS) at 313.15 K.

1.027
PB93-130383 Not available NTIS National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Building Environment Div.


A simulation program, CYCLE11, which is useful for the preliminary evaluation of the performance of refrigerants mixtures in the vapor compression cycle is described. The program simulates a theoretical vapor compression cycle and departures from the theoretical cycle as occur in a heat pump and in a refrigerator. The cycle simulations provide models of the control of the external heat transfer fluids with the heat exchangers generalized by their average effective temperature difference. The isentropic evaporation process is assumed. The program includes a rudimentary model of a compressor and a representation of a suction line and discharge line. The heat exchanger thermodynamic properties are calculated using the Carnahan-Starling-DeSantes equation-of-state. Refrigerant transport properties are not included in the simulations. The program can generate merit ratings of refrigerants for which limited measurement data are available.
Nonferrous Metals & Alloys

201.028
PB92-144112 Not available NTIS National Inst. of Standards and Technology (MISEL), Gaithersburg, MD, Polymers Div.

Keywords: "Rapid solidification, Liquid-solid interfaces, Quenching, Metallurgy, Solidification, Convection, Heat transfer, Kinetics, Fluid flow, Reprints, "Ostwald ripening, Lead in alloys.

The effects of convection on Ostwald ripening in solid-liquid mixtures have been studied using an Sn-Pb alloy over a wide range of volume fractions. The convection was induced by a slow rotation of a disk shaped sample with the axis of rotation perpendicular to the gravity vector. At low volume fractions of solid the experimental results show that convection can alter the exponent of the temporal power law for the average intercept length from its classical value of 1/3 to 0.7. For intermediate volume fractions of solid the temporal exponent is 1/3, but the amplitude of the temporal power law for the average particle radius depends on the rate of rotation. At high volume fractions of solid, where a stable skeletal structure was present, rotation had no effect on the kinetics of the ripening process. A theoretical analysis of Ostwald ripening in the low Poeclet number limit was undertaken in an effort to understand the experimental results. The analysis showed that temporal power law solutions to the equations describing ripening do exist when the particles move in the fluid with a constant velocity or according to Stokes law. However, if the magnitude of the fluid flow scales with time in the proper way, temporal power law solutions can be found which are qualitatively consistent with the experiments.

201.029
PB92-144195 Not available NTIS National Inst. of Standards and Technology (IMSE), Gaithersburg, MD, Polymers Div.

Keywords: "Titanium intermetallics, "Nobium intermetallics, "Crystal phase transformations, Phase diagrams, Reprints, "Aluminum intermetallics, in alloys of composition Ti4Al3Nb that are cooled from B2 phase field at 1400 or 1100C, a mixed omega (P3m1) omega phase, designated omega double prime, was observed. The phase exhibits collapse of 111 planes of omega phase to its B2 parent. An apparently equilibrium temperature phase the with B2(2) structure was found after 30 days of annealing at 780 C. Both the omega double prime and B2(2) structures were verified by means of transmission electron microscopy and by single crystal X-ray diffraction. The latter permitted detailed analysis of the collapse parameters and site occupancies. The observed transformation pattern, B2 -> omega double prime -> B2(2), includes strongly coupled chemical and displacemetal order. This is analyzed in terms of group/subgroup symmetry relations and crystal structure relations.

201.030
PB92-144203 Not available NTIS National Inst. of Standards and Technology (IMSE), Gaithersburg, MD, Polymers Div.

Keywords: "Aluminum manganese alloys, Iron alloys, Silicon alloys, Grain boundaries, Twinning, Reprints, "Quasicrystals, Icosahedral phase, Grain boundary.

Polycrystalline aggregates with overall icosahedral symmetry were found in rapidly solidified AlMnFeSi alloys. The orientation relationship between crystals in the aggregate and the crystallographic planes is not parallel. Although the cubic axes undergo fivefold rotation about irrational <1/2,1/2,0> axes, only five orientations occur among hundreds of crystals. This is a special orientation relationship, but there is neither a coincidence or lattice twin relationship (S = Sigma = infinity). The consequences of the twining and spurious grain boundaries are re-examined, and a new definition of special orientations (Face) based on the reduction of the number of kinetically independent lattice vectors is proposed. It includes both old and new special orientations and can be easily interpreted in terms of quasicrystals.

201.031
PB92-144260 Not available NTIS National Inst. of Standards and Technology (IMSE), Gaithersburg, MD, Polymers Div.

Keywords: "Hydrogen, Yttrium hydrides, Scandium hydrides, Scandium intermetallics, Neutron scattering, Rare earths, HCP lattices, Dynamics, Reprints.

Neutron scattering studies of the dynamics of the hydrogen isotopes in h.c.p. rare earth metals have demonstrated that hydrogen diffusion at temperatures far below the equilibrium transition is not limited by the understanding of hydrogen in metals. In the paper the authors review their recent measurements of hydrogen diffusion in rare earth metals and neutron scattering studies of their recent investigations of hydrogen diffusion in scandium and yttrium using quasicrystalline neutron scattering. Using simple models the authors attempt to provide a straightforward but fairly comprehensive picture of the way that hydrogen short range order, ordered directly in diffuse neutron scattering experiments, influences these measurements. The authors show, for example, how the vibrational peak splitting measured in alpha-H was found to correlate with the crystal structure of the sample, and in consequence-dependent effects of the chain-like pair ordering. The authors also describe in detail their recent demonstration of very fast local T-T hopping in alpha-ScH(x) and in alpha-YH(x).

201.032
PB92-144286 Not available NTIS National Inst. of Standards and Technology (IMSE), Gaithersburg, MD, Polymers Div.

Keywords: "Metal powder, "Atomizing, "Flow visualization, Shadowgraph photography, Schlieren photography, Flash photography, Supersonic characteristics, Flow fields, Rare gases, Gas jets, Reprints.

Fine metal powders have been shown to have unique properties due to their homogeneity, novel microstructures, metastable metastable and post-diffusion properties. The primary factor that determines these features is solidification rate, which, for powder processing, depends on the degree to which the molten metal is quenched. The powder processing is analyzed in terms of group/subgroup symmetry relations and crystal structure relations.

201.033
PB92-144338 Not available NTIS National Inst. of Standards and Technology (IMSE), Gaithersburg, MD, Polymers Div.

Keywords: "Intermetallic compounds, Order parameters, Interfaces, Reprints, "Rapid solidification, Solute trapping, Disorder trapping.

A theory is developed to predict the long range order parameter, composition and interfacial temperature of a chemically ordered phase as a function of interface velocity and composition gap. The theory extends the solute trapping theory of Aziz to a solid phase consisting of two sublattices. The engulfment of atoms by the interface is described by the rapidly moving interface velocity, the theory predicts a transition from the solidification of a phase with equilibrium long range order parameter and with equilibrium solute partitioning to the solidification of a disordered crystalline phase with the same composition as the liquid. Predictions for various free energy functions for the solid phase suggest that the percolation of order parameter with increasing interface velocity may be continuous or discontinuous and that transitions to solute trapping and disorder trapping can occur at different growth rates.

201.034
PB92-144476 Not available NTIS National Inst. of Standards and Technology (IMSE), Gaithersburg, MD, Metallurgy Div.

Keywords: "Binary alloys, Gravitational effects, Crystal growth, Intermetallics, Interfaces, Convection, Instability, Reprints, "Directional solidification.

During the directional solidification of a binary alloy, vertically upwards interfacial and convective instabilities can occur, leading to solute inhomogeneities in the solid metal. The authors review various aspects of flow-interface interactions during directional solidification. Specific calculations have been carried out for lead-tin alloys for various gravitational accelerations.

201.035
PB92-151964 Not available NTIS National Inst. of Standards and Technology (IMSE), Gaithersburg, MD, Metallurgy Div.

Keywords: "Polycrystals, "Aluminum containing alloys, "Crystal structure, "Orientation, Aggregates, Grain boundaries, Crystal symmetry, Reprints, Quasicrystals.

Polycrystalline aggregates with overall icosahedral symmetry were found in rapidly solidified AlMnFeSi alloys. The orientation relationship between crystals is such that icosahedral motifs in all the crystals are parallel. Although the cubic axes undergo fivefold rotation about irrational (1, 1, 0), axes, only five orientations occur among hundreds of crystals. This is a special orientation relationship, but there is neither a coincidence...
The study of copper with stea... was studied using a...a metal...forcement. Wear, as measured by surface profilometry, indicated that...a) showed transformations...transitions, studied...intercellular..."amorphous"...Hungary,...metallics, Niobium intermetallics, ternary compounds, BCC compositions, Aluminides, Reprints, Phase equilibrium, Omega phase.

Alloy compositions near Ti2AlNb were studied to establish... to a broad 2B phase field, transformation of bcc Ti4Al3Nb to a single phase with...Tribology...Thermochimica Acta on Coatings...Copper Alloys...Alloy...Gaithersburg, MD, Metalurgy Div.

Omega-Related Phases in a Ti-Al-Nb Alloy. Final rept.
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.


Keywords: Transmission electron microscopy, Alumina containing alloys, Nbobium diffusion are carried out, 

"Titanium alloy 37.5Al 12.5Nb, Omega phase.
Study of phase equilibria in the Ti-AlNb system is often complicated by the possibility of radical ordering occurring during the high-temperature thermal treatment. At 600°C "Omega-Al" 12.5at%Nb into 'omega-type' phases in the present study during both cooling or low temperature annealing.

01.040 PB92-165570 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD, Metalurgy Div.
Measurement and Analysis of Grain Boundary Grooving by Volume Diffusion. Final rept.
Published in Jnl. of Crystal Growth, p467-480 1991.

Keywords: Grain boundaries, "Thin, Tin alloys, Lead alloys, Boundary integral method, Grooving, Bicrystals. Diffusion coefficient, Reprints.

Experimental measurements of isothermal grain boundary grooving occurring by volume diffusion are carried out for Sn bicrystals in the Sn-Pb system near the eutectic temperature. The dimensions of the groove increase with...the associated rate constant allows the determination of the product of the liquid diffusion coefficient D and the capillarity length Gamma...interfacial free energy of the crystal-melt interface. We...generalize the small-slope theory of Mullins to the entire range of...diffusion grooves. By using the diffusion mass...grooving in a temperature gradient.

01.041 PB92-165592 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD, Polymers Div.
Microstructural Mechanisms for Reduction of Metal Compounds to Pure Metals. Final rept.
Published in Biotechnology in Minerals and Metal Processing, Chapter 6.

Keywords: "Metals, "Materials recovery, "Biological treatment, "Bioconversion, Separation processes, Ore processing, Biotechnology, Gold, Platinum, Palladium, Microorganisms, "Purification, "Dissolution, "Precipitation(Chemistry), Metal compounds, Catalysts, Reprints.

Interest and research in bioconversion of metals...on...are...non-enzymatic metallo...products by microorganisms related to...bioprocessing also deserves attention. For example, it is well known that...inorganic (e.g., H2SO4) and...play a role in metal...are other...microorganisms which can...useful metals transformations. These include...reduction of metals...by...metal...precipitation by...melting...pure...metal...the...microorganisms...me...to...suitable...metal...metal...precipitation...by...metabolites. Examples include...high...metal...gold...and...platinum...by...volatile...metal...products.

A series of shielded metal...was...mechanical properties...of...resultant...A strong aging effect...Procedures:...results...The...of...aged...by...700°C...and...say...the...strong...temperature...aging...behavior...of...Cu-Al-Li Ag-Mg Alloy Weldaite 049. Final rept.
See also N91-24405.
Published in Aluminum - Lithium Alloys, p701-710 Mar 89.

Keywords: "Aging(Metalurgy), "Aluminum alloys, "Copper alloys, "Lithium alloys, "Precipitation hardening, intermetallic compounds, Mechanical properties, Room temperature, Tempering, Reprints.

The Cu-Al-Li-Ag-Mg alloy known as Weldaite 049 exhibits a strong aging response at room temperature, both with (T3) and without (T4) prior cooling...the...the...T4...aging...behavior...has...characterized...by...through...mechanical...property...measurements...and...analysis...of...microstructures. The high...and...aged...temperatures...to...a...combination...of...Quenched-Proctor zones...and...AID(aka),...each...of...which...may...describe...several...different...morphologies...in...a...single...microstructure.
Materials Sciences
Nonferrous Metals & Alloys

An Al-Cu-Li-Mg-Al alloy Weldplate (TM049) was re-
crystallized and artificial aging of high strength alloy (700 MPa yield strength in artificially aged tempers) with good weldability. In addition the alloy exhibits an ex-
ceptional level of ductility. This alloy was produced at 400 MPa yield strength (YS) in the unstrained (T4) condition, and a high ductility reversion condition which may be useful as a cold-forming temp. In contrast to other Al-Li alloys, these materials can be processed with or without a stretch or other coldworking operation prior to aging. The present study has identified strengthening phases responsible for the alloy's me-
chanical properties. The natural aging response is due to precipitation of GP zones and A3L, or delta. Revers-
ible cold working/annealing processes involving dissolution of delta. Ex-
tended re-aging at room temperature, however, re-pre-
cipitates both phases on a fine scale and restores the original T4 condition.

201.045
PB92-171511
National Inst. of Standards and Technology (CSTL),
Gaithersburg, MD. Thermodynamics Div.
Measurement of the Heat of Fusion of Titanium and a Titan-AI-Ti Alloy by a Microse-
cond-Resolution Transient Technique.
See also PB90-271537. Sponsored by National Aeronautics and Space Administration, Washington, DC. Pub. in Jnl. of International Jnl. of Thermophysics 13, n1 p75-
81 Jan 92.

Keywords: *Heat of fusion, *Titanium, High tempera-
ture, Pulse heating, Melting, Transients, Reprints, *Ti-

tanium alloy 6Al-4V.*

A microsecond-resolution pulse heating technique was employed to measure the heat of fusion of titanium and a titanium alloy (90Ti-6Al-4V). The method is based on rapid (50- to 100-microsec) resis-
tive self-burnout heating. The specimen is heated by a high-current pulse from a capacitor discharge system and measur-
ing, as functions of time, current through the speci-

men, voltage across the specimen, and radiance of the specimen. Melting of the specimen is manifested by a plateau in the measured radiance. The time integral of the net power absorbed by the specimen during melt-
ing yields the heat of fusion. The values obtained for heat of fusion were 2.72 J/g (13.0 kJ/mol) for titanium and 286 J/g for the alloy 90Ti-6Al-4V, with an esti-

mated maximum uncertainty of + or - 6% in each value.

201.046
PB92-172477
PC A04/AF A01
National Inst. of Standards and Technology (MSEL),
Aluminum-Lithium Alloys: Surface-Tension-
Fracture Tests, Physical, and Thermal Properties at Cryogenic
Temperature.
R. C. Guntcher, M. Ausin, S. Kim, and D. Rule. Mar
92, 72p NISTIR-3986
See also AD-A229 231. Sponsored by Astronautics Lab.
(ASCII), Edwards AF, CA.

Keywords: *Aluminum alloys, *Lithium Alloys, *Frac-
ture properties, *Very low temperature, Elastic prop-
perties, *High strength alloys, Thermal conductivity, *Ther-
mal expansion, Mechanical properties, *Toughness, *Thermodynamic properties.

Surface-tension-fracture tests were conduct-
ed in the S.T-orientation at 255, 76, and 4 K on two plate alloys (X2095-T851, plate thickness of 12.7 mm and 2090-T851, plate thicknesses of 12.7 and 19.1 mm). The cryogenic toughness to room temperature toughness ratio for alloy 2090 is generally higher than that found for alloy X2095. Both alloys have signifi-
cantly lower tensile properties near the surface of the rolled plate than in the center of the plate. The physical properties of plate specimens were measured from liquid helium to liquid nitrogen temperature. Three vari-
ations in chemical composition of alloy X2095, three different samples of alloy 2090, and a single sample of alloy 2190 were evaluated.

For both materials, the heat treatments between 4 and 320 K was measured on the same seven plate specimens included in the physical properties study. The fracture toughness of alloy X2095 (4Cr-Li, 1%Al) was determined over the temperature range 4.2 to 300 K using a steady-state apparatus.

201.047
PB92-172766
PC A99/AF E08
National Inst. of Standards and Technology (MSEL),
Gaithersburg, MD. Metallurgy Div.
microscopy, Microstructure, Crystallography, Phase
equilibrium, Electron diffraction, Differential thermal analysis, Reprints. *Aluminum iron silicides.

Thermal decomposition of rapidly solidified microstruc-
tures (Al-Cu-Li, Al-Mg-Mn, and Al-Si) has been studied by DTA and TEM. The results are the follow-
ing: amorphous phase formed by solidification first transforms to metastable alpha phase. Second transforma-
tion to high temperature phase is observed by DTA and TEM. The above two phases transform by partial melting (two modifica-
tions, alpha and alpha prime, were observed). The formation of alpha prime phase is due to the fact that double prime phases is formed by sputtering and electron beam diffraction technique. At higher temper-
atures the equilibrium alpha h and Al13Fe4-type phase form.

201.050
PB92-236421
Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Surface Science Div.
Epitaxy of Metals on Metal Substrates: The Contri-
butions of Field Electron Emission Microscopy.
Pub. in Progress in Surface Science 32, n2 p173-210
1989.

Keywords: *Surface chemistry, *Metals, *Epitaxy,
*Cryostat growth, Electron microscopy, Electron emis-
sion, Crystallography, Nucleation, Substrates, Re-
prints.

The contributions to the literature on the epitaxial growth of metals on metal substrates made by re-
search using the field emission (electron and positive ion) microscopies are reviewed. In addition to a large amount of information about specific metal/metal pairs, some generalities have emerged. It is especially striking that in many cases metal/metal epitaxy the dominant factor determining the epitaxial relationship is the alignment of close-packed atomic rows in low-index crystallographic planes of each metal.

201.051
PB92-236538
Not available NTIS
National Inst. of Standards and Technology (MSEL),
Gaithersburg, MD. Metallurgy Div.
Buoyancy Effects on Morphological Instability
during Directional Solidification.
See also PB91-158550. Pub. in Jnl. of Crystal Growth

Keywords: *Buoyancy, *Stability, *Binary alloys, *Di-
rectional solidification(Crystals), Liquid metals, *Liquid-
oid interfaces, Convection, Linear systems, Morphol-
ogy, Thermal conductivity, Reprints.

The onset of morphological instability during the direc-
tional solidification of a single-phase binary alloy at constant velocity vertically upwards is treated by a linear stability analysis. We consider the case in which a solute heavier than alloy at rest. We analyze the effect of convection on the critical cond-
tions for instability. For tin containing systems we find a small destabilization of the system at low growth velocities, and a large increase in the wavelength of the instability at the onset. Calculations show that the destabilization is enhanced for high growth velocities and that the critical solute concentration is increased for an increasing value of the growth velocity. For the case of a solute heavier than alloy at rest there is a long wavelength instability for which the critical solute con-
centration is several orders of magnitude lower than that for the case of a solute lighter than alloy at rest. For the case of a solute heavier than alloy at rest there is a long wavelength instability for which the critical solute concentration is several orders of magnitude lower than that for the case of a solute lighter than alloy at rest.


Keywords: *Binary alloys, *Interfaces, *Electronic fields, Electromigration, Electrocresstivity, Thermoelectricity, Solidification, Morphology, Gallium alloys, Tin alloys, Bismuth alloys, Reprints.

We performed a full time-dependent linear stability analysis of the morphological stability of a planar interface during directional solidification of a binary alloy at constant velocity in the presence of an electric field.

We take into account electromigration of solute, Joule heating, and thermoelectric effects. This represents an extension of the simple model of Wheeler et al. in which the effects were neglected. We find that for tin-bismuth and germanium-gallium alloys the influence of electromigration and differing electrical conductivities in each phase are the most important in determining the linear stability of the system, with the Feiler heat and Thomson effect the most significant of the thermoelectric effects, particularly at low velocities where an additional long wavelength instability may arise. Joule heating and Seebeck effects appear to be of lesser importance.

201,053

Keywords: *Binary alloy systems, *Phase diagrams, Aluminum alloys, Reprints, Aluminum niobium.

The binary Nb-Al system has been evaluated.

201,054

Keywords: *Binary alloy systems, *Phase diagrams, Aluminum alloys, Reprints, Aluminum tantalum. The binary Ta-Al system has been evaluated.

201,055

Keywords: *Binary alloy systems, *Phase diagrams, Gallium tellurium, Gallium alloys, Reprints.

The binary Ga-Te system has been evaluated.

201,056

Keywords: *Electrodeposited coatings, *Electrodeposition, *Superlattices, Copper alloys, Nickel alloys, Metals films, Thin films, Magnetic properties, Reprints.

Electrochemical deposition of artificial compositionally modulated superlattices is described. It is shown how the quality of these alloys is comparable or superior to materials produced by vapor deposition or sputtering. The ambient temperature process described by Yafur and M. N. Trakl (1987) may be modified to include a feedback and control system in order to compensate for natural convective disturbances in the electrolyte. Magnetic data is presented for copper-nickel samples of varying wavelengths down to 2 mm and suggests that magnetic properties of thin nickel films are more uniform than those of other thin metals whose properties can be tailored on a narrow atomic scale would also be discussed along with potential applications.

201,057


Microbiology metal recovery is an emerging technology likely to play an increasing role in commercial ore leaching, metal removal from process and waste streams, and perhaps ultimately in processing to yield metals as the feedstock for alloys. The authors are studying the potential for using microorganisms for the recovery of elements important to emerging materials technologies and for which domestic supplies are limited and/or low. Examples to be discussed include the bioaccumulation of yttrium and gallium. These elements are important in the production of new superconductor and semiconductor materials. However, limited domestic reserves and technologies for their recovery may cause supply problems. Microbiological processes may offer new techniques for recovery of these and other strategic elements.

201,058

Keywords: *Crack propagation, *Rhodium, *Nickel, *Transgranular stress corrosion, Fracturing, Cracking(Fracturing), Cleavage, Dissolution, Crystallography, Stress corrosion, Repairs, *Transgranular stress corrosion.

Transgranular stress corrosion cracking (T-SCC) is a form of environmentally induced sub-critical crack growth which produces fracture surfaces that are very cleavage-like in appearance. These fracture surfaces resemble those for intergranular propagation: propagation occurs on flat crystallographic facets, steps or ledges exist between the flat facets forming river patterns, these facets extend for quite some distance on opposite sides of the fracture, and undercutting occurs at the ledges in the fracture surface. A variety of different mechanisms have been proposed to explain this form of crack growth, but no one is universally accepted. In general, the mechanisms that have been proposed can be classified into five groups, based on whether they assume that dissolution or mechanical fracture is responsible for crack growth.

201,059

Keywords: *Aluminum alloys, *Corrosion testing, *Passivity, *Lithium, Corrosion resistance, Stress corrosion cracking, Fracturing and polishing, Test methods, Stress corrosion cracking, Corrosion mechanisms. Reprints.

The influence of lithium on the rate of repassivation of aluminum alloys was studied by conducting scratch test experiments. Solutions were prepared with different lithium and copper contents and with differing heat treatments in a buffer solution containing either 0.5M HCI, or a solution of 0.5M NaOH. These experiments were conducted under either open circuit conditions, with the resulting potential transient recorded, or under potentiostatic conditions, with the resulting current transient recorded. Due to the rapid repassivation rate of aluminum alloys, unique experimental and analytical procedures had to be developed. In particular, the experiments were designed to minimize the time between initiation and completion of the scratch and to determine the bare surface at a constant rate. A constant bare surface generation rate was used to determine the rate of repassivation over the range of lithium concentrations studied. The precipitation of lithium phases altered the repassivation behavior but the nature of the observed changes depended on the type of precipitate.

201,060

Keywords: *Metal industry, *Labor force, Computer aided manufacturing, Industrial plants, Automation, Training, Personnel development, United States, Reprints.

Based on previous works which examined, first, the evolution of the technology of manufacturing toward the flexibly-automated factory of the future and, second, the technical proliferation of U.S. manufaturering sectors, the paper looks briefly at the workforce of the U.S. metals industry.

201,061

Keywords: *Binary alloys, *Solidification, *Mathematiical models, Liquid-solid interfaces, Surface tension, Kinetic methods, Copper nickel alloys, *Solute trapping, Directional solidification, Aze model.

A phase-field model for isothermal solidification of a binary alloy is developed that includes gradient energy contributions for the phase field and for the composition field. When the gradient energy coefficient for the phase field is smaller than that for the solute field, planar front models to study the segregation predicted in the liquid phase ahead of an advancing front (solute trapping), and in the limit of high solidification speeds predicts an alloy solidification with no redistribution of composition. Such solutions are commonly observed experimentally.
MATERIALS SCIENCES
Nonferrous Metals & Alloys

201,062
PB93-125284 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ultrasound Relaxation of Interstitial Aluminium in Irradiated Silicon.

201,068

Keywords: "Polymers, "Crystalization, Fibers, Polyethylene fibers, Crystals, Solidification, Polyethylene, Crystal growth, Strains, Crystallography, Reprints, "Fibres."

Solutions of crystallizable polymers subjected to orientation crystalize in a fibrillar morphology if the polymer is solidified rapidly. The central core of the polymer fibrils is noncrystalline, and the fibrils are dispersed with disordered regions. The extended chain crystals are small fibrils having diameters generally less than 100 nm; while the fibrillar cores are usually not more than 5000 A. These dimensions are limited by an unknown mechanism, because even in a saturated solution the fibril crystal size is limited. The fibril morphology of flow induced crystallization predicts that cumulative strain limits the growth of the central core fibril such that the diameter and length of the fibril are an inverse function of undercooling. This study was undertaken to obtain data to test the theory. The dependence of the fibril dimensions on undercooling at the time of orientation has been studied. Polyethylene fibrils were made by shearing a dilute solution between two sides under isothermal conditions at an elevated temperature, and the dimensions of the resulting fibrils were measured with transmission electron microscopy. The fibril diameter appeared to be a function of undercooling while the fibril length was constant and not a function of undercooling.

201,062

Keywords: "Rheology, "Gels, "Aging tests(Materials), "Polystyrene, Experimental designs, Carbon disulfide, Molecular weight, Agglomeration, Degradation, Isothermal treatment, Reprints."

Isothermal aging experiments were performed on intermediate solutions of atactic polystyrene in carbon disulfide at reduced temperatures. Dynamic rheological properties were monitored as a function of time. Below a critical temperature, the solutions were transformed into a two phase network over several hours. Slow aggregation appears to be responsible for the eventual network formation. High molecular flow and that is low molecular weight or high concentration solutions aged more slowly than did low molecular weight or low concentration solutions. Steady shearing improved the formation of the fibrils. After the completion of steady shear, the network gradually reformed. Reformation process was much faster than the original formation process, leading to the conclusion that the network is not fibrillar. Shear processing, while aggregate structures, responsible for the physical crosslinking, were not.

201,062
PB92-236561 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.

201,067

Keywords: "Sensors, "Velocity measurement, "Plasticizers, "Fibers, Polymer optics, Polymers, SAW, Laminar flow, Size determination, Slip velocity, Reprints, "Fluorescence photobleaching."

A sensor has been designed for the purpose of measuring the slip velocity, velocity gradient, and wall slip of polymer melts near the wall of polymer processing machine. The sensor operation is based on fluorescence recovery after photobleaching (FRAP). Its design consists of an optical fiber which is threaded through the wall of a processing machine and is flushed with the polymer melt. A mathematical description of its behavior has been formulated by considering the time dependence of FRAP and its relationship to the flow characteristics of the polymer melt. For the mathematical description, the tested sample volume is assumed to be a cone at the end of the fiber, its axis determined by the optical aperture of the fiber or by a focusing lens at the end of the fiber. It is assumed that the polymer melt contains a uniformly distributed fluorescent chromo-

201,062

Keywords: "Polyethylene resins, "Melt viscosity, Flow rate, Standards, Flow measurement, Low density materials, Calibrating, Melting points, Error analysis, Plastics, "Standard reference materials, "SRM 1473."

The melt flow rate of SRM 1473, a low density polyethylene resin, was determined to be 1.29 g/10 min at 190 C under a load of 2.16 kg using the ASTM Method D 1238-89. The average results from 42 determinations in triplicate are presented. Samples are gases that are not measured, since they are measured at the rate of 177 C.

201,063

Keywords: "Magnesium alloys, "Thin films, Magnesium oxides, Magnesium hydroxides, MgO-H2O2-like structure, one of the coexisting phases, depending on the alloy.

201,064

Keywords: "Aluminium alloys, "Low temperature tests, "Mechanical properties, Tensile properties, Fracture properties, Fatigue notch factor, Cryogenic, Liquid nitrogen, Notch tests, Metal sheets, Superconducting, Polymer processing."
Effect of Processing on Uniaxial Creep Behavior and Environmental Stress Crack Resistance of a Linear Low Density Polyethylene.

The paper describes characterizations performed on two types of polyethylene T. One was as the starting resin from which they were manufactured. It was found that the melt flow rate of material taken from the two types of joints differed from that of the starting resin and differed from each other by as much as a factor of two. Investigation of the environmental stress-crack resistance (ESCR) and uniaxial creep behavior of material from the two joints revealed further significant differences in material behavior between the two lots. These observations lead to the conclusion that subtle differences in the processing conditions can result in rather significant differences in the long term mechanical behavior.

201,071
PB92-236579 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Approximate Relations for the Analysis of Single Step Stress-Relaxation Data in Uniaxial Extension from Experiments Involving a Finite Step Time.

In the determination of single step stress-relaxation behavior, a finite time is required to reach the desired strain. As a result, an uncertainty is introduced into the observations when the strain at the finite time is compared to the strain at an infinite time. In this case, the region of linear behavior, an approximation has previously been derived which can be applied to shear stress-relaxation experiments. In the present work, approximate relations are derived which can be applied to uniaxial extension experiments in the region of nonlinear behavior. The derivations are based on the assumption that, under the set of strain histories considered, one can use the Bernstein, Kearsly, and Zapas theory (BKZ) as a one dimensional description. To demonstrate the validity of the approximate relations, we have obtained data on a linear low density polyethylene copolymer, and for a variety of step times, and strains well into the region of nonlinear behavior.

201,072
PB92-236702 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Structure/Processing/Property Relationships for High Molecular Weight High Density Polyethylene Blown Films.

The paper investigates the relationships among properties, fabrication conditions, and morphology for blown films from high-molecular weight polyethylene with broad or bimodal molecular weight distributions. A high stack bubble configuration is used to fabricate the films. Small-angle x-ray scattering, x-ray pole figure techniques, and transmission electron microscopy are used to characterize film morphology. Tear resistance is the principal property of interest.

201,073
PB93-135386 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.


201,074
PB92-135382 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Measurements of the Recoverable Compliance of Ring-Like Polyolefins.

In past work we have reported on the zero shear viscosity of narrow fractions of polyolefin ring melts. We concluded that they exhibit behavior similar to that of linear chains of the same molecular weight, but with the viscosity being approximately two times lower at low MW and the difference decreasing as the molecular weight increased to over ten times the critical molecular weight for entanglement of the linear chains. In addition we showed that the presence of small amounts of linear chains as contaminants in the cyclic fractions causes a very large enhancement in the viscosity of the rings and in their steady state recoverable compliance. In this work we present results of measurements of the recoverable compliance of fractions of polypropylene which show that the chains behave much as do their linear counterparts except that both the plateau compliance and the compliance per chain are much lower. The ratio of these properties is two times larger for the rings and three times larger for the linear chains. This appears to be true over the entire range of molecular weights for which we have made measurements.
**Mathematical Sciences**

### Algebra, Analysis, Geometry, & Mathematical Logic

**PB92-150407**

Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Mathematical Analysis Div.

Subordinated Holomorphic Semigroups.

Final rept.


Contract N00014-88-F-0005

Sponsored by Office of Naval Research, Arlington, VA.

In Transitions of the American Mathematical Society 327, n 2 p867-878 Oct 91.

Keywords: *Semigroup theory, Analytic functions, Laplace transformation, Markov processes, Reprints, Subordinated semigroups.*

### Operations Research

**PB93-125755**

Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Scientific Computing Dev.

Elimination of Spurious Eigenvalues in the Chebyshev Tau Spectral Method.

Final rept.

G. B. McFadden, B. T. Murray, and R. F. Boisvert. 1990, 8p

See also PB89-209282.

Pub. in Jnl. of Computational Physics 91, n1 p228-235 1990.

Keywords: *Spectral methods, "Or-Sommerfeld equation, Computational fluid dynamics, Modification, Hydrodynamics, Eigenvalues, Stability, Reprints, "Chebyshev tau method."

### Statistics Analysis

**PB93-129468**

Not available NTIS National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Applied and Computational Mathematical Div.

Survey of Existing Multidimensional Quadrature Routines.

Final rept.

D. K. Kahaner. 1991, 14p

See also PB83-124976.


Keywords: *Numerical quadratures, "Integrals, Numerical integration, Software tools, Surveys, Reprints.*

We provide a detailed description of available software to compute multidimensional integrals. More than three dozen routines are surveyed and their essential characteristics are described. This paper was presented at the American Mathematical Society Workshop on Statistical Multiple Integration.

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**Operations Research**

**PB92-226299**

PC A03/MF A01 National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Applied and Computational Mathematical Div.

Truncated SOP Algorithm for Large Scale Nonlinear Programming Problems.

P. T. Borsuk, W. L. Tolle, and A. J. Kearsley. Aug 92, 14p

NISTIR-4900

Prepared in cooperation with North Carolina Univ. at Chapel Hill, Dept. of Mathematics, and Rice Univ., Houston, TX. Dept. of Mathematical Sciences.

Keywords: *Nonlinear programming, Algorithms, Optimization, Iteration, "Sequential quadratic programming, Newton methods.*

The authors consider the inequality constrained nonlinear programming problem and a sequential quadratic programming algorithm for its solution. They are primarily concerned with two aspects of the general procedure, namely, the approximate solution of the quadratic program, and the need for an appropriate merit function. They first describe an iterative interior-point method for the quadratic programming subproblem that, no matter which algorithm is adopted, yields a descent direction for a suggested new merit function. An algorithm based on ideas from trust-region and truncated Newton methods is suggested and some of their preliminary numerical results are discussed.

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**Statistical Analysis**

**PB93-12086**

AD-P007 156/3 PC A01/MF A01 National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Statistical Engineering Div.

Bootstrapping with Constraints: Analysis of Scattering Efficiency of Polarized Beam Stays.

K. J. Coakley. 1992, 4p


In polarized beam studies, an asymmetry statistic of physical interest is an estimate of the ratio of the difference and the sum of the Poisson rate parameters for two scattering processes. Typically, an additive background signal contributes to measurements of each scattering process. Background is measured in a third
experiment. Data is corrected by subtracting measured background. When the measured background is larger than one of the other measurements, the asymmetry computed from the background corrected data is nonsensical. For such cases, true asymmetry and an associated confidence interval are estimated using a bootstrap procedure. Bootstrap replications of the observed data satisfy a constraint that insures physically meaningful results.

201.087
PB92-143742
PC A05/ MF A01
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Applied and Computational Mathematics Div.

Confidence Intervals for Discrete Approximations to III-Points Problem.
B. W. Rust, and D. P. O'Leary. Jan 92, 41p NISTIR-4720.
See also AD 720-387, PB87-218335 and ORNL-3743.

keywords: Confidence limits, Linear regression, Integral equations, Chebyshev inequality, Gamma ray spectra, Spectra unfolding, Approximation, Estimating, Ill posed problems, Buresn conjecture, Discretization(Mathematics).

The authors consider the linear regression model obtained by discretizing a system of first-kind integral equations with random measurement errors in the right hand side. These errors are assumed to have zero means and known variances. The authors consider the problem of estimating confidence intervals for linear functional of the solution vector. For such problems, the least squares solution is a highly unstable function of the measurements, and the classical confidence intervals and tolerance bands are useless. This solution can often be stabilized by imposing physically motivated, a priori nonnegativity constraints on the solution. The paper will show how to extend the classical confidence interval estimation procedure to accommodate these nonnegativity constraints in order to obtain improved confidence intervals. The technique defines valid confidence intervals even for problems with fewer measurements than unknowns.

201.088
PB92-144716
Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Statistical Engineering Div.

Taguchi's Fixed-Element Arrays Are Fractional Factorials.
See also PB92-126671 and PB92-126614.
Pub. in Jnl. of Quality Technology 23, n2 p107-116 Apr 91.

keywords: Experimental design, Factorial design, Reprints, "Quality Engineering",

Taguchi developed his catalog of orthogonal arrays from mathematical procedures published in well-known English language journals. These arrays evolved as extensions of factorial plans and latin squares. The paper illustrates the fractional factorial nature of Taguchi's two-, three-, four-, and five-element orthogonal arrays. Similarly Taguchi's mixed-element orthogonal arrays define fractionalized multi-level factorial plans. Thus Taguchi's orthogonal arrays are an element in the continuum of the development and use of statistically planned experiments.

201.089
PB92-154356
Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Statistical Engineering Div.

Estimation for Type-II Censored (Log) Normal Samples.
Final rept.
J. A. Lee, 1991, 5p
See also PB91-203414.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Reliability 40, n6 p547-552 Dec 91.


The paper presents an analysis, by simulation, of the properties of several estimators of the parameters of the normal distribution, for sample sizes from 5 to 150 and for right-censoring of 0 to 90% of the sample. Correction factors to reduce bias and recom mendations are included. The estimators are also applicable to right-censored samples from the (two-parameter) log-normal distribution, which was the motive for the study.

201.090
PB92-213420
PC A05/MF A02
National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Applied and Computational Mathematics Div.


ODRPACK is a software package for weighted orthogonal distance regression, i.e., for finding the parameters that minimize the sum of the squared weighted orthogonal distances from a set of observations to the curve or surface determined by the parameters. It can be applied to solve to the nonlinear ordinary least squares problem. The procedure has application to curve and surface fitting, and to measurement error functional models. ODRPACK can handle explicit and implicit models, and will easily accommodate complex and other types of multiresponse data. The paper will show how to extend the classical confidence interval estimation procedure to accommodate these nonnegativity constraints in order to obtain improved confidence intervals. The technique defines valid confidence intervals even for problems with fewer measurements than unknowns.

201.091
PB92-144161
Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Inorganic Analytical Research Div.

Homogeneity and Evaluation of the New NIST Leaf Certified.
Final rept.
D. A. Becker, 1990, 7p
Pub. in Biological Trace Element Research 26-27, p571-577 Jul 90.


The NIST has produced and is in the process of certifying two new leaf CRMs, SRM 1515 Apple Leaves and SRM 1547 Peach Leaves, as replacements for the no longer available NBS Orchard Leaves and the almost depleted Citrus Leaves. These two materials have been processed and are being thoroughly evaluated, and should provide the most advanced natural matrix botanical trace element reference materials available. Caution should be used in determining a basis weight (drying) for the CRMs, because of their very fine particle size. Homogeneity has been established by instrumental neutron activation analysis of both leaf materials for five elements to date to better than 1.5 percent (1) for 100mg sample sizes.

201.092
PB92-154624
Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Biotechnology Div.

Interpretation of the Effect of an Oscillating Electric Field on Membrane Enzymes.
Final rept.
B. D. Thompson, and R. D. Astrumian, 1992, 4p
Pub. in Biochemistry 31, n1 p138-141, 14 Jan 92.


Theoretical expressions for the frequency and amplitude dependence of the UPLA reaction. These data are fitted to the data of Graziama et al. (1990) (Graziama, A., Ranjeva, R., and Teissie, J. 1990 Biochem. Biophys. Res. Commun. 161, 2531-2536) for Ca{2+} uptake by carror protoplasts in an oscillating electric field. The uptake is a direct (linear) measure of the rate of increase of ATP caused by a plasma membrane enzyme in the oscillating field. The field gives 20 ms and 33 ms for the relaxation times of the enzyme and roughly 3 for the effective number of elementary changes displaced across the membrane by a conformational change of the enzyme in its catalytic cycle. Additional experiments are suggested to define further the mechanism of the enzymatic reaction.

201.093
PB92-154665
Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.

Calcium-Diacylglycerol-Cholesterol Membrane Compositions on Liposomes-Mediated Formation of Calcium Phosphates.
Final rept.
D. Skrlic, and E. D. Eanes. 1992, 8p
Sponsored by National Inst. of Dental Research, Bethesda, MD.


The present report compares the effects of different membrane phospholipid (PL) cholesterol compositions on the kinetics of liposome-mediated formation of calcium phosphate precipitates from metastable solutions (2.25 mM CaCl2.1.5 mM KH2PO4) at 22 C, pH 7.4 and 240 mOsm. In most experiments, the liposomes were composed of 7.2:1 mixtures of phosphatidylcholine (PC), neutral or acidic phospholipids, and cholesterol (Cho, X = 0, 10, 35, or 50 mol%). The neutral phospholipid (NPL) examined, in addition to PC, were phosphatidylethanolamine (PE) and sphingomyelin (Sph), and the acidic phospholipid (APL) examined were phosphatidylinositol (PI), phosphatidylserine (PS), phosphatidylethanolamine (PE), phosphatidylcholine (PC), phosphatidylcholine (PC), phosphatidylinositol (PI),...
both within and outside the liposomes. At 35 and 50 mole% cholesterol, no observable intraliposomal precipitation occurred, and extraliposomal precipitation started only after an induction period of 24 hours.

201,096 PB92-159631 Not available NTIS National Inst. of Standards and Technology (PL), Gaithersburg, MD, Radiometric Physics Div. Effect of Oxygen, Antioxidants, and Superoxide Radical on Tyrosine Phenoxy Radical Dimerization Final rept. E. P. Hunter, M. F. Desrosiers, and M. G. Simic. 1986, 5p. Pub. in Free Radical Biology and Medicine 6, p581-585 1989. Keywords: *Free radicals, *Reaction kinetics, *Chemical selectivity, Tyrosine, Antioxidants, Oxygen, Fluorescence, Radiolysis, pH, Reprints, *Tyrosine phenoxy radicals, *Biotyperoxidase. Dimerization of tyrosine phenoxy radical yields biotyrosine (BT) which can easily be monitored by its characteristic fluorescence at 400 nm. The reactivity of tyrosine phenoxy radical with O2 was examined by a variety of techniques. BT fluorescence was measured as a function of O2 concentration, over a range of pH values (4-12) there was no effect of oxygen on BT production (concentrations up to 0.2 mM). In addition, oxygen uptake by phenoxy radical was measured directly with an oxygen electrode. It was determined by the technique of constant flow with a rate constant greater than 1000 per mole per sec. Tyrosine phenoxy radical 'repair' by superoxide and physiological antioxidants results in compensation for damage occurring as a result of photodynamic reactions. Implications of these results as to the fate of tyrosine phenoxy radicals produced in biological systems is discussed.


The purity and relative distribution of beta-carotene isomers in several commercially available preparations of beta-carotene was evaluated using spectrophotometric methods and reversed-phase liquid chromatography. The purity of five lots of beta-carotene evaluated by comparison of spectrophotometric to gravimetric determinations was found to be range from 70 to 90%. Reviews of the two different reversed-phase C18 columns used were compared to the authentic isomers with the peak of the authentic isomers showing the expected retention time. The purity and relative distribution of beta-carotene isomers in the different commercial samples were determined using a different reversed-phase C18 column. The results of this study show that the use of these two different reversed-phase C18 columns can be used to determine the purity and relative distribution of beta-carotene isomers in commercial samples of beta-carotene.


We report here the activation of the Na+/K+-pump with an oscillating electric field of the same strength as previously reported for reactivation of the Na+/K+-pump by beta-carotene and beta-carotene with the frequency of 1 (H) oscillating electric field of the same strength as previously reported for reactivation of the Na+/K+-pump by beta-carotene and beta-carotene with the frequency of 1 (H) 1 Hz. At 3.5 C using the optimal amplitude and frequency, the net field induced, ouabain sensitive (0.2 mM ouabain incubated for 30 min) Rb(+) uptake differed between 10 and 20 amol/RbHr, and Na(+)-K(+) efflux between 15 and 30 amol/RbHr, depending on erythrocyte samples from different individuals. Very importantly, electric fields at this intensity, i.e. 20 V/cm, induced only the active transport but did not escalate either the background Rb(+) efflux, or the background Na(+) uptake in the frequency range 1 Hz to 10 Hz, nor did the stimulated activity depend on the cellular ATP concentration in the range 10 M to 500 M. These results have several implications. First, both the Na(+) pump-and the K(+) pump of the (Na,K)-ATPase can be activated by an a.c. electric field. Second, the adenosine triphosphate (ATP) can absorb free energy from the oscillating electric fields for transporting Na(+) and K(+) against their respective gradient with no apparent ATP consumption. Third, since the frequencies for the stimulation are very different, we conclude that the two pumps of the enzyme can function independent of each other.


An analytical method for the determination of serum retinol, alpha-tocopherol and beta-carotene is described. Separation on a wide-pore reversed-phase column using gradient-elution provides baseline separation of the three main serum vitamin A compounds. The method was applied to 15 serum samples from cancer patients and healthy volunteers, and the results indicate that the method is sensitive and reproducible.

Clinical Chemistry

**MEDICINE & BIOLOGY**

**Clinical Chemistry**

135

**Clinical Medicine**

201,105

**Keywords:** Cerebral edema, Body water, Magnetic resonance imaging, Field strength, Animal disease models, Magnetic relaxation, Reprints.

The study reported is concerned with the accurate quantification of brain water content under routine clinical conditions. Gelatin solutions of varying water content are first employed as a model of an eutonic brain and endogenous relaxation measurements in an experimental animal model of brain edema at 41 MHz. The results underscore the dominant role of total water content, $W$, in the relaxation process and verify the expected linearity between $1/T_1$ (sub 1) and $1/W$. A scheme is presented and experimentally verified at 1 T for deducing the endogenous relaxation measurements in vivo and with any MRI at $W$ at any frequency. Knowledge of this relationship along with precise measurements of $1/T_1$ (sub 1) at a given field strength allows the determination of brain water contents to be obtained with an uncertainty of less than 1%. It is concluded that, with the results reported here, the endogenous relaxation measurements are possible by MRI in a clinical environment.

201,106
PB92-236322 Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.

**Cytology, Genetics, & Molecular Biology**

201,109

**Keywords:** Peptides, Ion exchange chromatography, Pressure liquid chromatography, Biotechnology, Reprints.

Since its introduction by Moore and Stein, ion-exchange liquid chromatography has played an important role in separation and purification of peptides. This technique has been applied to the separation of peptide fragments of chemically or enzymatically cleaved proteins prior to sequence analyses. Later, automated ion-exchange chromatography provided highly reproducible separations of peptides. Various anion- and cation-exchange resin supports have been used as stationary phases. Most of these ion-exchangers were prepared from divinylbenzene cross-
linked polystyrene and functional groups have been attached to the polymeric matrix. The introduction of volatile buffers was an important improvement in ion-exchange chromatography since it permitted the isolation of salt-free peptides to be used directly in sequence analysis. The development of high-performance liquid chromatography (HPLC) during the past decade or so contributed greatly to the improved yield of peptide separations by liquid chromatography. The purpose of this paper is to review the recent applications of ion-exchange HPLC on silica-based supports to peptide separations and purifications.

201,112
PB92-166214 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Chemical Process Metrology Div. Electroconformational Coupling (EC), An Electric Field Induced Enzyme Oscillation for Cellular Energy and Signal Transductions.


Recent work has shown that membrane ATPases can extract free energy from applied oscillating electric fields (or for a given potential, from ATP) or from ADP and Pi or to transport Rb and Na ions against their respective electrochemical gradients. Data of these experiments are briefly reviewed. The Resonance Electroconformational Coupling (RECC), proposed earlier is used to interpret the results. Computer analysis of a four state cyclic enzyme of 4 reproduces many experimental features. It is shown that a Coulombic interaction between an enzyme and an alternative environment can cause the enzyme to oscillate between different conformational states. If the frequency of the applied field matches the kinetic characteristics of the enzyme, the enzyme can match the energy level required for producing catalytic cycling a phenomenon related to resonance between excitation and the periodic field is generated. A characteristic necessary for achieving resonant kinetics is that the binding energy of ligand. Analysis indicates that only dynamic electric fields or oscillating or fluctuating fields can propel the cyclic reaction of the enzyme catalysis, and thus be effective for transducing energy.

201,113
PB92-171297 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Chemical Process Metrology Div. Three-Dimensional Structure of Recombinant Bovine Chymosin at 2.3 A Resolution.


Keywords: *Protein conformation, *Chymosin, Renin, Aspartic acids, Cattle, Recombinant proteins, Substrate specificity, X-ray diffraction, Least squares method, Reprints.*

The crystal structure of recombinant bovine chymosin (EC 3.4.23.4, rennin), which has been cloned and expressed in E. coli, has been determined using X-ray data extending to 2.3 A resolution. The crystals of the enzyme used in the study belong to the space group P212121 with cell dimensions a = 72.7 A, b = 80.3 A, and c = 114.8 A. The structure was solved by the molecular replacement method and was refined by a restrained least-squares procedure. The resulting model includes all 323 amino acid residues, as well as 297 water molecules. The enzyme has an irregular shape with approximate maximum dimensions of 40 x 50 x 65 A. The secondary structure consists primarily of parallel and antiparallel beta-strands with a short loop within the molecule. The enzyme can be transcribed into N- and C-terminal domains which are separated by a deep cleft containing the active aspartic residues Asp34 and Asp216. The amino acid residues and waters at the active site form an extensive hydrogen-bonded network which maintains the pseudo two-fold symmetry of the entire structure.

201,114


Keywords: *Bovine serum albumin, *Diffusion, *Solutions, Water, pH, Temperature, Osmolar concentration, Hydrodynamics, Radiation scattering, Reprints.*

The field of biosensor fabrication has undergone a rapid expansion in recent years, however, the commercial implementation of biosensors has progressed far slower than desired. One significant problem that limits the production of reliable biosensors is the inability to immobilize biomaterials reproducibly onto the sensor substrate while retaining their activity. Determining immobilized protein film structures would allow questions of bioactivity, nonspecific adsorption and evenness of coverage to be directly addressed. Total internal reflection fluorescence is used to characterize layers adsorbed IgG on thin film films. Fluorescence techniques used to probe the immunoglobulin B (IgG)/myoglobin interface include: (1) energy transfer between two fluorophores (FITC) tagged IgG and tetramethylrhodamine isothiocyanate (TRITC) tagged myoglobin, (2) binding activity, measured by the competition of antibodies, and (3) energy transfer between FITC labelled IgG and TRITC labelled antigen.

201,115
PB92-171792 Not available NTIS National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Biotechnology Div. Metal-Doxycyclin Mediated Mechanism for Xylose Isomerase Based on the 1.6 A Stereo-mycymes Rubiginous Structures with Xylosel and D-Xylose.


Keywords: *Metals, *Xylosel, *Xylose, X-ray diffraction, Protein conformation, Divalent cations, Active site, Xylitol, *Xylose isomerase, Reprints.*

The crystal structure of recombinant Streptomyces rubiginosus D-xylose dehydrogenase (EC 5.3.1.5) solved by the multiple isomorphous replacement method at 1.64 A resolution. A detailed mechanism for D-xylene isomerase is proposed. Upon binding of cyclic aliphatic dicarboxylic acids and proteins. A possible mechanism of D-xylene base in a ring opening reaction. The ring opening step is followed by binding of D-xylene, involving two divalent cations in an extended conformation. The systematization of D-xylene to D-xylene involves a metal-mediated 1,2-hydride shift. The final step in the mechanism is a ring closure to produce alpha-D-xylulose. The ring-closing is the reverse of the ring opening step.

201,116
PB92-175116 Not available NTIS National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div. Purification of Plasmid and High Molecular Mass DNA Using PEAG-Salt Two-Phase Extraction.


Keywords: *Plasmids, *Deoxyribonucleic acids, Polyethylene glycols, Nucleic acids, Proteins, Protein de-naturisation, Reprints.*

A method for the rapid preparation of DNA is described. The method utilizes a polymer (polyethylene glycol) to form a two-phase system for the purification of DNA using PEAG-Salt (sodium diethylthiocarbamate-saturated polyethylene glycol) sodium. The method describes the conditions of the two-phase systems that are important for the separation of nucleic acids and proteins. Important phase-forming conditions shown in the paper are pH, polymer molecular weight and concentration, salt type and concentration and the addition of detergents and chaotropic agents. With the use of these extraction conditions, proteins can be moved selectively from the lower to the upper phase. The paper describes a method for DNA isolation that is rapid, simple and economical.

201,117
PB92-175298 Not available NTIS National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Biotechnology Div. Diffusion of Bovine Serum Albumin in Aqueous Solutions.


Keywords: *Bovine serum albumin, *Diffusion, *Solutions, Water, pH, Temperature, Osmolar concentration, Hydrodynamics, Radiation scattering, Reprints.*

The diffusion coefficient of bovine serum albumin (BSA) was measured in aqueous solutions of varying temperature, pH, BSA concentration, and ionic strength. The measurements were carried out using dynamic light scattering with the photon detector set at a 90 deg angle. The measured diffusion coefficients were compared to calculated values using phenomenological models. The screened hydrodynamic interactions between the charged proteins, as well as hydrodynamic corrections to the friction factor. The dimensions of BSA were obtained from structural data, and the charge on the protein was estimated using titration. Although the measured and calculated values of the diffusion coefficient are in general agreement, the single theoretical model seems capable of accurate predictions for all ranges of ionic strength and protein concentration.
directed mutants aimed at the probing function produce crystals suitable for x-ray studies. The mutant in which His 15 is substituted by an alanine residue crystallizes from ammonium sulfate solution in space group P2(1)_{1} or P6_{3}21, with unit cell dimensions: a = 47.3 A; c = 61.5 A. These crystals diffract to at least 2.0 A resolution. The mutant in which Ser 46 is substituted by an aspartyl residue crystallizes from polyethylene glycol 4000 solution in space group P2(1)_{1}, with unit cell dimensions: a = 49.4 A; b = 25.6 A; c = 60.3 A; Beta = 109 degrees. These crystals diffract to at least 2.0 A resolution.

201,120

A combination of powerful and sensitive methods for separation and element determination is evaluated to accomplish this goal. Polyacrylamide gel electrophoresis (PAGE) and neutron activation analysis (NAA) have been combined to determine the phosphorus associated with separated phosphoproteins in biological tissues and cell organelles. The proteins themselves can then be quantified. Results are presented for several phosphoproteins and phosphoprotein-containing natural matrix samples. Phosphorus can be determined down to 0.2 micrograms. In addition, the expansion of the method to selenium-containing macromolecules is reported. A quantitation limit of 0.25 n mole Se has been achieved.

Dentistry

201,121
PB92-144302 Not available NTIS National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div. Time Dependent Response of 2.5% Nitric Acid Solution as an Etchant on Human Dentin and Enamel. Final report.
R. Bloemer, 1990, 5p. Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Dental Materials 6, n2 p83-87 1990.

Keywords: * Dental materials, * Acid bond reaction composites, * Nitric acid, * Etchants, Chemical bonds, Adhesives, Dentin, Enamel, Time dependence, Surface chemistry, Scanning electron microscopy, Erosion, Reprints.
Although nitric acid is a component in some new bonding systems, the action of nitric acid as an etchant for the improvement of adhesion of bonding systems for composite resins to tooth tissues has not been reported. A determination of the extent of etching on both dentin and enamel using 2.5% HNO3 solution at varying application time periods was the purpose of the study. Prepared human molars were physically cleaned and sectioned to produce flat samples of dentin or enamel. Surfaces were abraded with 320 grit aluminum oxide paper, washed with distilled water for 10 sec and blotted with air for 10 sec. Duplicate pairs of dentin and enamel samples were treated with a drop of 2.5% HNO3 for 0, 30, 60, 90, 120 sec intervals, from 10 sec up to 60 sec. After rinsing with distilled water and drying, the sections were routinely processed for observation by SEM. The morphological techniques of the treated surfaces showed varying degrees of etching and erosion proportional to the length of application time. The 30 sec application revealed a well-etched surface with minimal erosion. The authors conclude that the 30 sec etch with 2.5 HNO3 would prepare the dentin and enamel for optimum combination without appreciable loss of tooth structure and integrity. This should increase the surface area and thus the bonding capability of some adhesive systems.

201,122

A constant-composition fluoride (F) titration method was used to measure the amount of leachable F- derived from a single application containing 2.2 ppm F solution (12 mom/l sodium fluoride). The mean F uptake was 0.23 + or - 0.07 microgram/cm cm corresponding to approximately 0.2% of the F content in the rinse. The present study describes a new F rinse system that consisted of two solutions. Solution A contained a soluble calcium salt and a buffer. Solution B contained sodium fluorosilicate, a complex fluoride salt. When solutions A and B were combined, the free F ions produced by hydrolysis of fluorosilicate caused precipitation of calcium fluoride during the 1 min application time. The F uptake produced by the two-solution rinse was 4.56 + or - 0.16 microgram/cm cm, which was approximately 19 times greater than that produced by the sodium F rinse with the same F concentration. Since the cariostatic effects from F rinses are believed to derive from their ability to deposit labile F in the oral cavity, the two-solution rinse may be more efficacious than the rinses currently in use.

201,123
PB92-197433 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div. Permeoselctivity of Sound and Curious Human Dental Enamel as Measured by Membrane Potential. Final report.
Pub. in Jnl. of Dental Research 70, n12 p479-1485 Dec 91.

Keywords: * Dental enamel, * Dental caries, * Membrane potential, Diffusion, Ions, Dental plaque, Reprints, * Permeoselctivity.
A microwell technique was used for determination of the permeoselctivity of sound and curious enamel in the same slice of tooth. The permeoselctively determined was accomplished by drilling microwells in the enamel and filling them with a simulated plaque fluid containing lactate, carbonate, and inorganic ions at concentrations which were known to produce little or no inhibition. Permeoselctivity data were obtained at different concentrations. The data were obtained at different concentrations. The data showed that the membrane potential was a function of the composition of the solutions and sound enamel was more permesoselctive than curious enamel.

Immunology

201,124
Pub. in Analytical Chemistry 64, n1 p55-60 1992.

A regenerative planar waveguide immunosensor for the clinical analyte theophylline has been developed. Regeneration is accomplished under flow conditions using a moderate anti-lactoglobulin antibody, and multiple analyses can be performed with a single waveguide sensor. Sensors capable of more than 15 sequential measurements with standard deviation better than 10% precision. The use of theophylline-labeled liposomes in the competitive immunoassay provides 1 order of magnitude greater enhancement over theophylline derivatized with fluorescein.

201,125

Studies are presented of dynamic light scattering from colloid suspensions of fractionated ferrogold particles (40-60 nm average diameter) produced with bovine a-globulin and soluble BSA in a competitive binding mode. The observed slowly decaying component associated with the motion of BSA coated particle-antibody aggregates. Measurements of antigen-antibody kinetics and soluble BSA dose response suggest that the BSA coated particles behave as 'large' antigen molecules.

Radiobiology

201,126

A comparison is made of induced current densities, electric fields, and rates of energy deposition during in vitro studies with linearly and circularly polarized, extremely low frequency magnetic fields for a cylindrical volume of culture medium.

201,127
PB92-154202 Not available NTIS National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Biotechnology Div. Measurement of Radiation-Induced Damage to DNA at the Molecular Level. Final report.

Keywords: * DNA damage, * Ionizing radiation, * Mass fragmentography, Crosslinking, Carboxymethyl, Chromatin, Free radicals, Reprints.
Chemical characterization and quantification of such DNA damage is essential for an understanding of its biological consequences and cellular repair. Methodologies incorporating the technique of gas chromatography/mass spectrometry (GC/MS) have been developed in recent years for measurement of DNA damage produced by ionizing radiation and by other free radical-generating systems. The use of GC/MS with selective ion monitoring (SIM) facilitates the measurement of a large number of products of all four DNA bases produced in DNA by reactions with hydroxyl radical, hydrated electron and H atom. DNA-protein cross-
links in mammalian chromatin, and products of the sugar moiety in DNA are also unequivocally identified and quantitated. The sensitivity and selectivity of the GC/MS-SIM technique enables the measurement of DNA base products even in isolated mammalian chromatin with no necessity of first isolating DNA, and despite the presence of histones. Recent results reviewed in the article demonstrate the usefulness of the GC/MS technique in the detection of DNA fragments, both DNA and RNA, which is among the principles common to all the techniques that must be considered with the different experimental arrangements also are discussed.

Toxicology

A study examined the effect of the oxidation of plasma pZ189 by Kmo4, which does not produce free radicals or the decomposition of certain modified bases by up to 4-fold. Sequence analysis revealed both deletions and point mutations, with a predominance of Kmo4-associated mutations, among 1049 Kmo4-generated mutations or the C-base generated mutations occurred predominantly at C-G base pairs.


Prepared in cooperation with University of Pittsburgh.

Included in Jnl of the National Institute of Standards and Technology, v97 n2 p245-252 Mar/Apr 92.


A standard reference material (SRM 1049) has been developed for the University of Pittsburgh smoke toxicity method. SRM 1049 is a nylons 6/6 and has the molecular structure of (N,N,N,N'-tetrahydroxyl terephthalic acid). The SRM is for the calibration of the apparatus and providing confidence that the method is being conducted in a consistent manner and that the equipment is functioning properly. The certied figure of merit is a LC50 value plus its 95% prediction interval which were calculated and found to be 4.4-3.4 g. The 95% prediction interval for a LC50 of 1000 g would be expected to fall. Thus, if an investigator were to test the SRM under their laboratory conditions and agree with the cited values of the University of Pittsburgh test procedure and found the LC50 value fell within the certied 95% prediction interval, the probability is good that the test is being conducted correctly.
Zoology

201.125
PB92-144179

Keywords: Mammals; *Aquatic animals; *Tissue Biology; Alaska; Liver; Kidney; Muscles; Ad- pose tissue; Seals; Mammals, Water pollutants, Neutron activation analysis, Trace elements, Chemical analysis, Reprints, National Biomonitoring Specimen Bank.

A project to establish an archive of Alaskan marine mammal tissues was conceived in 1987 to be a part of the National BIol. become Biomonitoring Specimen Bank. Protocols and procedures for the fields collection of liver, kidney, muscle and blubber tissues, the long-term storage, and the analysis are under way. In the initial inter- neutron activation analysis has been used for an initial evaluation of trace element content in samples of northern seal (Callorhinus ursinus) from the Pribilof islands. The findings agree with previously observed trace element levels. The banked samples can be used in studies when comparison to the present levels of pollutants is needed.

MILITARY SCIENCES

Logistics, Military Facilities, & Supplies

201.136
PB92-118122

Keywords: Comparison, Standards, Documents, Specification (GUI) (Output Specification), MIL-M-28001A, SGML (Standard Generalized Markup Language).

The paper was written to compare functional similarities between the Document Style Semantics and Specification Language (DSSSL) and the Output Specification (OS) of MIL-M-28001A. It is envisioned that when DSSSL becomes an International Standard (IS), it will assume the responsibilities of the OS and be referenced by MIL-M-28001A. Therefore, an initial examination of the similarities is warranted. The paper is intended for persons with some working knowledge of the Standard Generalized Markup Language (SGML) and minimal knowledge of DSSSL and OS.

201.137
PB92-181155

See also PB92-18108. Sponsored by Assistant Secretary of Defense (Production and Logistics), Washington, DC. Computer-aided Acquisition and Logistic Support Program.

Keywords: *Standards, *Testing, Computer program verification, Acquisition, Logistic support, Federal information processing standards, Specifications, Methodology, Data acquisition, Questionnaires, Syntax, Semantics, *CALS, *CGM (Computer Graphics Metalle).

A total Computer Graphics Metafile (CGM) conformance test was done into the MIL-M-28001A (FIPS 128) and the CGM Application Profile for the Computer-aided Acquisition and Logistics Support (CALS) (MIL-D-28003) generator. A conformance testing service has begun. The report provides a procedures manual specifying the methodology and details for testing conformance of CGM generator products. The procedures enable a tester to verify that a CGM generator produces conforming metafiles which accurately and correctly define the intended picture.

201.138
PB92-187103

See also PB91-187773.

Keywords: *Documentation, *Standards, Computer program portability, Applications processing, Computer software systems programs, Interfaces, Data management, Man computer interface, Requirements, Procurement, CALC, N(Next Generation Document) to NIST (Next Generation Environment), POSIX (Portable Operating System Interface for Computer Environments), GOSSIP (Government Open Systems Interconnection Profile), US DOD, NIST.

The object of the report is to identify PB91-187773 the goals of the Next Generation Document (NGD). On March 25, 1991, the National Institute of Standards and Technology (NIST) presented a workshop on NGDs on behalf of the Computer-aided Logistics and Acquisition Support (CALS) project. Staff members from various Department of Defense (DOD) services came together to exchange information on topics concerning NGDs. These individuals were primarily supervisors working within the document processing field. NIST wanted to learn from them: (1) What is a next generation document, and (2) What requirements the NGD must meet in the future. The report discusses the current DOD environment, its need to alter its business practices, and the movement towards the Open Systems Environment (OSE). The report also illustrates a NGD scenario and provides a listing of NGD requirements/services.

201.129
PB92-191128

See also PB91-107177 and PB91-112888. Sponsored by Assistant Secretary of Defense (Production and Logistics), Washington, DC. Computer-aided Acquisition and Logistic Support Program.

Keywords: Standards, Protocols, Tests, Product development, Data processing, Specifications, Resources, *CALS, *STEP, *Conformance testing, PDES, National Institute of Standards and Technology.

The document describes a plan to develop a Conformance Testing Service for the Standard for the Exchange of Product Model Data (STEP). The Conformance Testing Service is an integral part of an overall project, the National Product Data Exchange using STEP (PDES) Testbed at the National Institute of Standards and Technology (NIST). The National PDES Testbed was initiated in 1988 under the sponsorship of the U.S. Department of Defense Computer-aided Ac- quisition Support (CALS) Program. A major goal of the National PDES Testbed is to provide technical leadership in a national effort to implement a computer-aided acquisition support (CALS) program. The NIST STEP Testbed provides a means of testing the conformance of product data. This standard must be designed to meet the needs of American industry and the MIL-D-28003.

201.140
PB92-196070

Keywords: *Standards, *Testing, Computer program verification, Acquisition, Logistic support, Federal information processing standards, Specifications, Methodology, Data acquisition, Questionnaires, Syntax, Semantics, *CALS, *CGM (Computer Graphics Metafile).

A total Computer Graphics Metafile (CGM) conformance test was done into the MIL-M-28001A (FIPS 128) and the CGM Application Profile for the Computer-aided Acquisition and Logistics Support (CALS) (MIL-D-28003) generator. A conformance testing service has begun. The report provides a procedures manual specifying the methodology and details for testing conformance of CGM generator products. The procedures enable a tester to verify that a CGM generator produces conforming metafiles which accurately and correctly define the intended picture.

Raster Graphics Validation.

F. E. Spielman. May 92, 65 p NISTIR-4848


The publication describes the guidelines for establishing and managing raster graphics validation which include both conformance testing and the issuing of a certification. The raster graphics validation service supports the National Institute of Standards and Technology (NIST) initiative to validate products processing to support Federal Information Processing Standards (FIPS) Publication 150, Planned FIPS (ODA Raster DAP), Department of Defense (DoD) Military Standard MILSTD-1840, and International Standard MIL-R-28002. The publication is divided into three functional documents needed to support raster graphics validation: Policy and Procedures, Description of Requirements, and Instructions and Forms. The Policy and Procedures document provides the operating policy and procedures that are to be followed in administering validations. The Description of Requirements document describes the conformance testing environment including the hardware and software framework for executing the conformance testing system. The Instructions and Forms document contains the instructions, forms, and information necessary for a testing laboratory to test and report on a raster graphics product.

PB92-213404
PC A03/MF A01 National Inst. of Standards and Technology (Csl), Gaithersburg, MD. Introduction to Graphical User Interfaces and Their Use by CITIS. S. O. Sherrick. Jul 92, 25 p NISTIR-4876

See also PB90-154477.

Keywords: *Computer graphics, *Man computer interface, Specifications, Interfaces, Applications programs, Computer, Computer program portability, Standards, Recommendations, *CALS (Contractor Integrated Technical Information Service), X Window System.

A Graphical User Interface (GUI) is a powerful tool that is used for simplifying a computing environment. The paper provides a tutorial on the various meanings of the term GUI, describes the usefulness of GUIs, identifies problems with GUIs, and recommends that the X Window System (X) be used within the National Integrated Technical Information Service (CITIS) specification. The term GUI can have various meanings in different contexts. In order to provide a framework for discussion in the paper, a GUI is characterized as having at least one of the following components: Display Manager, Application User Interface, or Application Programming Interface (API). One of the major problems with GUIs is the potential lack of portability of an application developed to run on a particular GUI. The X Window System provides a means of overcoming the problem because applications developed using the X Window API may be run using almost all other GUIs. Consequently, the X Window System can be used by CITIS to provide easy to use applications which may be used on almost all GUI platforms.

PB92-213503

See also PB91-107177, PB92-115294 and PB92-119238. Sponsored by Assistant Secretary of Defense (Production and Logistics), Washington, DC. Evaluation and Integration Office, Washington, DC.

Keywords: *Product inspection, Computer aided design, Computer aided manufacturing, Standards, Tests, Testing, Technical transfer, Recommendations, *CALS, *STEP (Standard for the Exchange of Product Model Data), Conformance testing, IT/Industrial Technology Institute, PDES(Product Data Exchange using STEP).
The report focuses on important issues that will arise during an effort to offer a full-scale Standard for the Exchange of Product Model Data (STEP) conformance testing (CT) service to U.S. industry. The content presents the decision maker factual information, step by step. The goal of the report is to provide a perspective of real-life problems associated with developing and offering testing services. Thus, to the decision maker and funding agency considering active participation in STEP CT, the report identifies the issues confronting CT in general, and STEP CT in the United States in particular. It also offers insight into the direction that U.S. activity should proceed.

201.143
PB92-780931
National Inst. of Standards and Technology (CSL)
Gaithersburg, MD.
Audio-Visual.
Dec 89, 1 VHS video
Also available as PB92-780949, 3/4 inch PAL format (English language); PB92-780956, 1/2 inch PAL format (French language); PB92-780964, 3/4 inch PAL format (French language); PB92-780972, 1/2 inch PAL format (German language); and PB92-780980, 1/2 inch PAL format (German language).

Keywords: *Weapons systems, Computer aided design, Computer aided manufacturing, Product development, Maintenance, Digital data, Data bases, Standards, Data processing, Video tapes, "Audiovisual, "CALS, National Institute of Standards and Technology.

The videotape presentation gives a basic tutorial about the concepts, rationale, and benefits of Computer-Aided Acquisition and Logistics Support (CALS). CALS is a Defense Department program aimed at improving the reliability, quality, and maintainability of weapons systems through the full cycle from concept to design to manufacturing to support. CALS reduces the complexity, cost, and likelihood of errors in the required information from all digital storage, retrieval, and distribution based on a shared, distributed weapons database using industry data interchange standards. The presentation discusses the initial steps, such as the conversion of existing files of engineering drawings to digital format and the role of the National Institute of Standards and Technology in the development of the necessary standards. The presentation is in the English language. The 1/2 inch videotape is in VHS format.

201.146
PB92-780964
National Inst. of Standards and Technology (CSL)
Gaithersburg, MD.
Audio-Visual.
Dec 89, 1 VHS video
Also available as PB92-780931, 1/2 inch VHS format (English language); PB92-780949, 3/4 inch PAL format (English language); PB92-780956, 1/2 inch PAL format (French language); PB92-780964, 3/4 inch PAL format (French language); and PB92-780972, 1/2 inch PAL format (German language).

Keywords: *Weapons systems, Computer aided design, Computer aided manufacturing, Product development, Maintenance, Digital data, Data bases, Standards, Data processing, Video tapes, "Audiovisual, "CALS, National Institute of Standards and Technology.

The videotape presentation gives a basic tutorial about the concepts, rationale, and benefits of Computer-Aided Acquisition and Logistics Support (CALS). CALS is a Defense Department program aimed at improving the reliability, quality, and maintainability of weapons systems through the full cycle from concept to design to manufacturing to support. CALS reduces the complexity, cost, and likelihood of errors in the required information from all digital storage, retrieval, and distribution based on a shared, distributed weapons database using industry data interchange standards. The presentation discusses the initial steps, such as the conversion of existing files of engineering drawings to digital format and the role of the National Institute of Standards and Technology in the development of the necessary standards. The presentation is in the French language. The 1/2 inch videotape is in PAL format.

201.147
PB92-780972
National Inst. of Standards and Technology (CSL)
Gaithersburg, MD.
CALS: A Strategy for Change (German Version, 1/2 inch, VHS Format) (Video).
Audio-Visual.
Dec 89, 1 VHS video
Also available as PB92-780931, 1/2 inch VHS format (English language); PB92-780949, 3/4 inch PAL format (English language); PB92-780956, 1/2 inch PAL format (French language); and PB92-780980, 1/2 inch PAL format (German language).

Keywords: *Weapons systems, Computer aided design, Computer aided manufacturing, Product development, Maintenance, Digital data, Data bases, Standards, Data processing, Video tapes, "Audiovisual, "CALS, National Institute of Standards and Technology.

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201.148
PB92-780980
National Inst. of Standards and Technology (CSL)
Gaithersburg, MD.
CALS: A Strategy for Change (German Version, 1/2 inch, PAL Format) (Video).
Audio-Visual.
Dec 89, 1 VHS video
Also available as PB92-780931, 1/2 inch VHS format (English language); PB92-780949, 3/4 inch PAL format (English language); PB92-780956, 1/2 inch PAL format (French language); PB92-780964, 3/4 inch PAL format (French language); and PB92-780972, 1/2 inch PAL format (German language).

Keywords: *Weapons systems, Computer aided design, Computer aided manufacturing, Product development, Maintenance, Digital data, Data bases, Standards, Data processing, Video tapes, "Audiovisual, "CALS, National Institute of Standards and Technology.

The videotape presentation gives a basic tutorial about the concepts, rationale, and benefits of Computer-Aided Acquisition and Logistics Support (CALS). CALS is a Defense Department program aimed at improving the reliability, quality, and maintainability of weapons systems through the full cycle from concept to design to manufacturing to support. CALS reduces the complexity, cost, and likelihood of errors in the required information from all digital storage, retrieval, and distribution based on a shared, distributed weapons database using industry data interchange standards. The presentation discusses the initial steps, such as the conversion of existing files of engineering drawings to digital format and the role of the National Institute of Standards and Technology in the development of the necessary standards. The presentation is in the German language. The 1/2 inch videotape is in PAL format.
Technology Integration Working Group was formed within NIST GIS Lab as a cooperative technology transfer vehicle to share advancements being made in applying expert systems, object-oriented database technologies, and GIS to practical problems in spatial data management and cartographic portrayal. The Work- shop focused upon demonstrations of work-in-progress and technical discussions of progress in several on-going projects. The Workshop as well as other NIST GIS Standards Laboratory activities are focused on performing cooperative research in order to integrate existing, emerging, and the anticipatory development of spatial data and information technology standards.

Geology & Geophysics

201,155

Keywords: *Rhenium, *Osmium, Nickel ore deposits, Copper ore deposits, Mass spectroscopy, Earth crust, Ontario, Reprints, *Sudbury Igneous Complex, Isotopic composition, Resonance ionization.

Sudbury Igneous Complex sublayer ores from the Late Precambrian Falconbridge and Strathcona mines were analyzed for their Re and Os concentrations and Os isotopic compositions. The Re-Os isotope systematics of three ores from the different mines gives isochron ages of 1840 + - 60 Ma, 1770 + - 50 Ma and 1780 + - 110 Ma, suggesting that the Re-Os system became closed at the time of, or soon after the 1850 + - 1 Ma crystallization age of the complex. Hetero- geneities that require the Os, and probably also the other platinum-group elements contained in the ores, were derived from at least two sources. The large percentage of ancient crust involved in the production of the ores is most consistent with an interpretation of substantial crustal fusion resulting from meteorite impact.

201,156


Current residence ionization mass spectrometry tech- niques used in the isotopic measurements of the Re-Os system in geologic samples are detailed. Methods for improving sensitivity and precision are discussed and one example of a geologic application is given.
Temperature and Radiation of Diffusion Flames with Suppression.
Final rept.

Keywords: *Diffusion flames, Water injection, Blow-outs, Fires, Combustible flame, Methane, Laminar flame, Gas wells, Fire fighting, Temperature measurement, Radiation, Reprints.

Temperature and radiation properties of 1-5 MW heat release rate methane/air jet diffusion flames without and with the addition of liquid water suppressant to the fuel stream are studied. The analysis includes an existing parabolic flow solver, in conjunction with the locally homogeneous flow approximation and the laminar flamelet concept. State relationships for methane - liquid water mixtures are calculated from species concentration measurements for methane flames without water added. The analyses are compared with previously published data. Tests for flames without water addition show the suppression potential was a follow-on to previous flame scales. The results for flames with water addition indicate that finite rates of evaporation and separated flamelet effects need to be considered for accurate predictions at high water loading.

NATURAL RESOURCES & EARTH SCIENCES
Mineral Industries

Natural Resource Management

201, 159
PB93-133680 PC A19/FM A03
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Process Measurements Div.
G. J. Rosasco. Sept 92, 300p NISTIR-4920.

Keywords: *Oxidation, Chemical reactions, Water showers, Microbial communities, Thermodynamics, Reaction kinetics, Technology transfer, Safety, Experimental data, Radioactivity, Standards, Supercritical water oxidation, Track charts.

The Workshop on Federal Programs Involving Supercritical Water Oxidation was a follow-on to previous informal meetings held to discuss work in the area. The proceedings include the following: List of the attendees, their addresses, and phone numbers; Copies of the speakers' viewgraphs. Some speakers submitted additional material which also is included; and an SCWO Track Chart which summarizes some of the organizations involved in SCWO technology development and their activities.

General

201, 159
PB92-2054000 PC A03/FM A01
National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Fields Div.
Sponsored by Army Belvoir Research Development and Engineering Center, Fort Belvoir, VA.

Keywords: *Tunnel detection, Gradiometers, Electromagnetic scattering, Magnetic dipoles, Magnetic fields, Plane waves, Cylindrical configuration, Low frequency, Very high frequency, Remote sensing.

The use of gradiometer antennas for detection of long conductors and detection of electromagnetic fields is analyzed. For reception in vertical boreholes, the gradiometer consists of two vertical electric or magnetic dipole with a vertical separation. Sum and difference responses are useful, but the difference response has the potential advantage of suppressing the primary field and making the scattered field easier to detect. The difference response is most effective in suppressing the primary field for a parallel scan where the transmitting antenna and receiving gradiometer are always at the same height. Gradiometers are most advantageous at low frequencies where the scattered field is small compared to the primary field.

201, 160
AD-A250 776/2 PC A10/FM A03
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Ionizing Radiation Div.
Nuclear Instrumentation

201, 161
PB92-154335 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Ionizing Radiation Div.
National Ionizing Radiation Secondary Laboratory System

Final rept.

Keywords: *Ionization radiation, Quality assurance, Radiation protection, Personnel dosimeter, Survey monitors, Radiation therapy, Radioactivity, Standards, Bioassay, Radon, Reprints, Secondary laboratories, US NIST.

Over the past ten years, the National Institute of Standards and Technology has, through its Office of Radiation Measurement, developed a national program for Secondary Laboratories. The Secondary Laboratories provide the necessary calibrations and quality assurance support and confirm the calibrations of the measurements in the areas they serve. The areas that are in the program include State Radiation Protection Personnel Dosimetry, Survey Instrument Calibration, High-Level Dosimetry, Radiation Therapy, Bioassay, Survey Instrument Testing, Ionizing Radiation, Environmental Radioactivity, Radioactivity Standards, and Radon.

Radiation Shielding, Protection, & Safety

201, 162
PB92-170950 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.
Review of Neutron Quality Factor Recommendations

Final rept.
Pub. in Health Physics Society's Newsletter XVII, n6 p1 and 3-4, Jan 89.

Keywords: *Radiation protection, Health physics, Radiation therapy, Reprints, *Neutron Quality Factor, Standard radiation.

A summary report is presented of a review of recent recommendations by the International Commission on Radiological Protection (ICRP) and the National Council on Radiation Protection and Measurements (NCRP) to consider all definitions of standard radiation. The undesirable impact of that lack of adherence on the present system of radiation protection is identified. That impact can avoid being a problem, so properly normalized. The adjustments required for adoption of a new standard radiological protection system are shown. It is recommended that the ICRP and NCRP recommendations not be adopted.

Radioactive Wastes & Radioactivity

201, 163
NUREG/CR-4735-V7 PC A07/FM A02
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metalurgy Div.

Technical rept.
Grant NRC-FIN-A4171
Also available from Supt. of. Docs. See also NUREG/CR-4735-V6.


The report summarizes evaluations by the National Institute of Standards and Technology (NIST) of Department of Energy (DOE) activities on waste packages designed for containment of radioactive high-level nuclear waste (HLW) for the six-month period, February through July, 1989. This includes reviews of related materials research and plans, information on the Yucca Mountain, Nevada disposal site activities, and other information regarding supporting research and special assistance. Outline's for planned interpretative reports on the topics of aqueous corrosion of copper, mechanisms of stress corrosion cracking and intergranular failure modes of Zircaloy cladding are included. For the publications reviewed during this reporting period, several discussions are given to supplement the completed reviews and evaluations. Included in the report is an overall review of a 1984 report on glass leaching mechanisms, as well as reviews for each of the seven chapters of the report.

201, 164
PB93-129625 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metalurgy Div.

NUCLEAR SCIENCE & TECHNOLOGY
Radioactive Wastes & Reactor Physics

Use of Time-Domain Dielectric Spectroscopy to Evaluate the Lifetime of Nuclear Power Station Cables.
F. L. Moosap, Apr 92, 52p NISTR-4486
See also NUREG/CR-4091 and PB84-220946. Spon-
ored by Nuclear Regulatory Commission, Washing-
ton, DC.

Keywords: Nuclear power plants, Electric cables, Electrical insulation, Nuclear reactors, Radiation damage, Life expectancy, Dielectric properties, Time domain, Spectroscopy.

The use of the dielectric properties of insulation to assess the health of nuclear power plant is assessed. The factors governing dielec-
tric constant and loss over an extended frequency range are summarized. The Time-Domain Spectrome-
ter is shown to be suitable for the task, given the changes expected in an insulator upon exposure to ra-
tion and the wide range of lower frequencies that it can cover. Several sets of cable samples of the types expected to be found in a reactor were measured with the Time-Domain Dielectric Spectrometer and the re-
sults are reported. It is shown that for the hydrocarbon based insulation studied, with the aging conditions and exposure characteristic of loss region centered near 10 Hz, the value of 50°C is radiation induced and follows dose. The loss appears to be a good marker for radiation exposure and history and even in the presence of large losses due to the
presence of filler and other sources of high loss. The use of loss data is proposed as a good possibility for life-
these measurements that illustrate the enhanced sensitivity of dielectric measure-
ments.

201,167
PB92-222744
PC A07/MF A02
Nuclear Power Plant Test of Standards and Technology (EEL), Gaithersburg, MD.
Detection of Incipient Defects in Cables by Partial Discharge Signal Analysis.
Rept. for 1987-90.
F. D. Martzloff, E. Simmon, J. P. Steiner, and R. J.
Van der Ven, Jul 90.
NIST-4487
Contract NRC-RES-91-001
Sponsored by Nuclear Regulatory Commission, Wash-
ington, DC.

Keywords: Signal analysis, Nuclear power plants, Electric wire, Safety engineering, Defects, Mechani-
ical properties, Mathematical models, Electrical insulation, Electric discharges, Detection, Electrical meas-
urements, Cables, Aging, Partial discharge signal analysis.

As a one of the objectives of a program aimed at assessing test methods for in-situ detection of incipient de-
fects in nuclear power cables, an aging laboratory test system was implemented to demonstrate that the partial dis-
charge analysis method can be successfully applied to in-
gress. Some of the test cables were introduced into a reactor-
involved cables rated 5 kV or higher, while the object-
ve of the project focused on the lower voltages asso-
ciated with the safety systems of nuclear power
plants. The defect detection system implemented for
these test cables was based on commercially available
and software packages, custom-
ized for the specific purposes of the project. The
test specimens included several cables of the type
found in nuclear power plants, including artificial de-
fects introduced at various points of the cable. The
results indicate that the partial discharge analysis
was capable of detecting significant defects in low-voltage cables. There are, however, some limitations of tech-
ical and non-technical nature that need further explo-
ration before this method can be accepted in the in-
dustry.

201,168
PB93-113694
PC A04/MF A01
National Inst. of Standards and Technology (CSEL), Gaithersburg, MD.
Software Quality Assurance: Documentation and Review.
D. R. Wallace, W. P. Peng, and L. M. Isoplo, Sep
92, 61p NISTIR-4909

Keywords: Nuclear power plants, Computer applica-
tions, Computer software, Quality assurance, Safety engineering, Configu-
ration management, Software engineering, Require-
ments, Project management.

The study examines the contents of a software quality assurance standard for nuclear applications. The study
includes recommendations for the documentation for software systems. Background information on the stan-
ard, documentation, and the review process is provided. The report includes an analysis of the appli-
cability, context and documentation. The standard compares it with a general software quality assurance standard produced by the Institute for Electrical and Electronics Engineers. Information is provided for the content of the different types of documentation. The report describes information for use in safety evalua-
tion reviews. Many recommendations in the report are applicable for software quality assurance in general.

201,169
PB93-114619
PC A06/MF A02
National Inst. of Standards and Technology (CSEL), Gaithersburg, MD.
High Integrity Software Standards and Guidelines.
Special pub. (Final).
D. R. Wallace, L. M. Isoplo, and D. R. Kuhn, Sep
92, 107p NIST-SP-500-204, NUREG/CR-5930
PB84-220946. Sponsored by Nuclear Regulatory Commis-
ion, Gaithersburg, MD.

Keywords: Nuclear reactor safety, Software engineering, Standards, Nuclear power plants, Quality assurance, Guidelines, Criticality.

The report presents results of a study of standards, draft standards, and guidelines (all of which will hereaf-
after be referred to as standards) for providing reasonable assurance for software in nuclear power plants. The study focused on identify-
ing the attributes necessary in standards for providing reasonable assurance for software in nuclear systems.
The study addressed some issues involved in demonstr-
ating conformance to a standard. The documents vary widely in their requirements and the precision with which the requirements are expressed. Recommendation
is provided for guidance for the assurance of high integrity software. It is recommended that a nucle-
ar industry standard be developed based on the docu-
ments reviewed in this study with additional attention to the concerns identified in this report.

201,170
PB93-113832
PC A03/MF A01
National Inst. of Standards and Technology (CSEL), Gaithersburg, MD. Reactor Radiation Div.
Radiological Applications of Nuclear Research Reactors.
Special pub. (Final).
D. R. Wallace, Sep 92, 49p NIST-SP-844
Also available from Suppl. of Docs as SN003-003-03178-0.

Keywords: Reactor researches, Neutron activation analysis, Neutron scattering, Neutron radiography, Neutron capture therapy, Neutron irradiation, Radiation effects, Radiospectrote, Cobalt 60, Uses.

The report has been put together for a series of lectures for non-experts in the nuclear field; it is based on material compiled by the author over the last few years from different sources. Subject matters are covered at a basic descriptive level and require familiarity with inter-
nuclear and related fields (e.g., elementary particles, elements of the periodic table, etc.). The
intent, here, is to introduce the reader to the various practical uses of nuclear reactor's with no attempt for thoroughness. Section headings are as follows: Neu-
tron Activation Analysis, Radiospectrote Applications; Co-60 Applications; Neutron Interrogation; Neutron Processing/Radiation Effects; Neutron Scattering.

Reactor Physics

201,171
PB93-145077
Not available NTIS
National Inst. of Standards and Technology (CSEL), Gaithersburg, MD. Reactor Radiation Div.
Status of Research Reactor instrumentation in the

The work described here is part of a program conducted by the Nuclear Regulatory Commission on the ef-
cacy of proposed plans for radionuclide containment for long-term storage of high-level nuclear waste (HLW). An important element of that program is the review and eval-
uation of available literature on components of a waste package. A review process and a database have been developed and tailored to informa-
tion quickly to an individual who has a question about a particular material or component of a waste package. The database is uniquely suited to serve as a guide to indicate special areas where data and information needs exist on questions related to radionuclide con-
tamination. The database contains a wealth of reference infor-
mation becomes available, and this source is as cur-
rent as the published literature. A description of the review process and the database is given.

Reactor Engineering & Nuclear Power Plants

201,165
PB92-133024
PC A04/MF A01
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD.

201,166
PB92-187053
PC A04/MF A01
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polyimeters Div.

The responsibilities of the Reactor Radiation Division are threefold: to operate the research reactor (NSBR), as a NIST and national resource in a cost-effective manner while protecting the public safety, to conduct a program of materials research using neutron methods, while developing and maintaining state-of-the-art instrumen-
tation to ensure the best utilization of the NSBR neutron scattering facilities, and to develop and operate the Cold Neutron Research Facility (CNFR) as a National center, providing unique measurement cap-
abilities to U.S. researchers. The techniques include nuclear methods for chemical analysis, neutron dif-
fraction and scattering for the characterization of mi-
terials and structures (e.g., shape and distribution in metals, polymers, layered materials, surfaces and interfaces, ceramics, alloys, amorphous materials, mi-
celles, nanometer-scale materials, and buckminsterfull-
ene) neutron diffraction methods for determination of residual stress and texture, neutron radiography for the non-destructive testing of materials, and neutron autoradiography for art history and restoration, and various techniques for neutron flux calibrations and personnel radiation monitoring. The sections that follow are a summary of the t technical activities of the Reactor Radiation Division from October 1,1990 through September 30, 1991. A detailed report of work performed at the NIST reactor is available in a NIST Technical Note entitled 'NIST Reactor: Summary of Activities July 1990 through June 1991.'
Reactor Physics

Keywords: *Research reactors, *Reactor instrumentation, *MURR reactor, HFBR reactor, HFR reactor, NSBR reactor, Neutron monitors, Neutron scattering, Reprints, Cold Neutron Research Facility.

Significant upgrades are planned or are occurring in most of the existing major beam-research reactors in the United States. These range from the installation of new instruments to major additions such as cold neutron guide halls. In the paper the current status and planned upgrades are reviewed for four of the major US reactor facilities: the NSBR and Cold Neutron Research Facility at NIST, the HFIR at Oak Ridge, the HFBR at Brookhaven, and the MURR at the University of Missouri.

201,172

Keywords: *NSBR reactor, *HFBR reactor, *Neutron sources, *Cold neutrons, Design criteria, Performance, Reprints.

The report presents the salient design criteria and performance of the existing cold sources installed in the High Flux Beam Reactor (HFBR) at the National Laboratory (BNL) and the Neutron Beam Splitter Core Reactor (NSBR) at the National Institute of Standards and Technology (NIST). The two cold sources are of different design than those installed in European reactors, reflecting design constraints imposed both by the regulatory environment and by the scaled vessel design of the reactors themselves.

201,175


The proceedings of an International Workshop held at the National Institute of Standards and Technology on March 20, 21, and 22, 1991 are presented. The purpose of the Workshop was to examine new developments in the application of risk analysis in offshore oil and gas operations. The proceedings include: an executive summary, invited paper, papers from participants in the United States, Canada, the United Kingdom, and Norway, and summary reports and recommendations of six Working Groups: (1) Experience Data Bases and Case Study Analyses, (2) Risk Management Practice, (3) Structures: Risk and Reliability Issues, (4) Production Facilities, (5) Pipelines and Subsea Systems, and (6) Drilling Operations. Also included are Working Group theme papers.

201,174

Keywords: *Offshore structures, *Reliability, *Risk assessment, *Structural analysis, Ocean waves, Wind pressure, Load (Forces), Hydrodynamics, Stress analysis, Reprints.

The article presents a summary of accomplishments of the project 'Assessment of Uncertainties and Risks Associated with the Dynamic Behavior of Offshore Structures' conducted by the National Bureau of Standards (NBS) under the sponsorship of the Minerals Management Service (MMS). At the request of MMS, the article is written in magazine style for an audience including both professionals and non-professionals. Also described in the article are investigations currently underway at NBS.

ORDNANCE

Ammunition, Explosives, & Pyrotechnics

201,177

Keywords: *Propellants, *Explosives, *Liquid chromatography, *Microanalysis, Chemical analysis, Detectors, Sampling, Colorimetry, Spectroscopic analysis, Chemical tests, Reprints.

A compact analytical instrument is described which allows fire and police laboratories to be equipped with supercritical fluids, and the extract preconcentrated and analyzed by capillary supercritical fluid chromatography in a single coupled unit. Thus, no off-line sample pretreatment is required, and the possibility of extraneous contamination is reduced. To achieve greater selectivity for the selected species, three different detectors (UV absorption, flame ionization and electron capture) were all connected on-line. This analytical fluid chromatography using regular chromatographic supplies. To illustrate the analytical utility of this hyphenated technique, an assortment of compounds that are not easily determined by traditional gas chromatographic or liquid chromatographic methods was selected: explosives, propellants, and related species. The instrumental design, as well as selected analytical conditions (sample pretreatment, extraction, preconcentration, separation, and detection) were investigated to improve selectivity and/or sensitivity. The determination of explosive residues on soil is described as an environmental analysis application of the system. Detection limits for some compounds are estimated to be as low as 100 pg. The flame propellants were characterized through their extractable organic constituents, and the usefulness of such characterization in forensic investigations is discussed.
PHYSICS

Acoustics

201,181
PB92-175975
Not available NTIS
National Inst of Standards and Technology (EEL), Boulder, CO. Electro-Optics and E lighter Fields
Spherical-Wave Expansion of Radiating Spheres
Final rep.
R. C. Wittmann, and A. D. Yaghjian. 1991, 9p
Keywords: *Acoustic fields, Spherical waves, Near-field, Half spaces, Computation, Reprints, Piston radiators.
Simple spherical-wave expansions of the continuous-sphere fields of a circular piston radiator in a rigid baffle and free air are presented. These expansions are valid throughout the illuminated half-space and are useful for efficient numerical computation in the near-field region. Multiple-coefficient expressions are given by closed-form expressions which can be evaluated recursively.

Fluid Mechanics

201,182
PB92-149772
PC A05/MF A01
National Inst of Standards and Technology (NML), Gaithersburg, MD. Thermophysics Div.
Holographic Measurement Services: NIST Leak Calibration Service
Special pub. (Final).
Also available from Supt. of Docs. as SN003-003-00130-5. See also PB89-193841, PB88-152418 and PB91-147727.
Keywords: *Leakage, *Calibration, Primary standards, Temperature dependence, High vacuum, Gas flow, Flowmeters, Helium, Leak calibration service, Leak stan- 
dard, Leaks, Leak standards, NIST, NIST Leak Standard, NIST Standard, NIST, Standards, Leak standards, Leak, NIST Leak Standard, Leak stand-
dard, DK39-2509, DKST-2509.

The NIST Special Publication describes the recently offered Leak Calibration Service. A description of the services provided is followed by a discussion of the design philosophy and theory, and a description of the total Leak Calibration System. Uncertainties associated with the Primary Leak Standard and Leak Compara-
tion method are discussed in detail. Important properties of helium permeation leaks, especially the temper-
ature dependence, are also discussed. Sections on Quality Control and Future Directions are followed by appendices discussing general theory of gas flow in vacuum systems, and proper use and conversion of flow rate units.

201,183
PB92-149848
PC A04/MF A01
National Inst of Standards and Technology (CSTL), Gaithersburg, MD. Process Measurements Div.
Summary Report of NIST'S Industry-Government Consortium Research Program on Flowmeter In-
See also PB90-221847 and PB92-149855.
Keywords: *Flowmeters, *Pipe flow, Flow measurement, Pipeline flow, Flowmeters, Flow, Flow, Flowmeter installation, Flowmeter installation, Flowmeter installation, Flowmeter installation, Flowmeter installation.

The report presents results obtained in a consortium-sponsored research program on flowmeter installation effects being conducted at NIST-Gaithersburg. The project is a collaborative one that has been underway for six years; it is supported by an industry-government consortium with two objectives: to review the results of recently obtained results and to plan subsequent phases of the work. The report contains the results and conclusions of the meeting of this consortium at NIST-Gaithersburg, MD in December 1990. The objective of the research program is to produce improved flowmeter performance when meters are installed in non-ideal conditions. The objective is being attained via the proposed strategy to: (1) measure, understand, and simulate the salient features of non-ideal pipe flows from such pipeline elements as elbows, reducers, valves, flow conditioners, etc. of combinations of these, (2) simulate the performance of a selected types of flowmeters installed downstream from these pipeline elements with quantified flow features so as to be able to predict meter performance accurately in non-ideal installations, and (3) disseminate the resulting technology through appropriate channels such as publishing the results in pertinent journals and upgrading paper standards for flow measurements.

ORDNANCE

Combat Vehicles

201,186
PB92-189521
PC A05/MF A01
National Inst of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.
Orifice Meter Performance Downstream from Elbows or a Tee.
Final rep.
C. Sindi, M. Lewis, and J. Brennan. 1990, 10p
Keywords: *Orifice meters, *Pipe flow, *Flow measurement, Flowmeters, Flow distortion, Bundles, Gas flow, Orifice flow, Flow patterns, Tubes, Reprints.
Upstream pipe configurations can produce large flow disturbances that significantly affect the accuracy of orifice meters. The location of the orifice plate relative to the flow conditioner to restore the measurement accuracy is shown. The location of the tube bundle relative to the orifice plate for these installations will be dis- cussed. Recommendations for future research needs and for improving the installation specifications for flow measurement standards are suggested.
Physics

Fluid Mechanics

National Inst. of Standards and Technology (NMI), Boulder, CO. Chemical Engineering Science Div.


Also available from Supp. of Dots, as SN003-030-TO91B,7. See also PB92-175785. Sponsored by Gas Research Inst., Chicago, IL.

Keywords: "Orifice meters, "Flow measurement, "Discharge coefficient, Reynolds number, Orifice flow, Pipe flow, Gas flow, Pipings systems, Rod bundles, Flow diagnostics.

System pipe configurations can produce large flow disturbances that significantly affect the accuracy of orifice meters. Flow conditioners such as the tube bundle are frequently used to remove the effect of upstream disturbances. The flow conditions also influence measurement accuracy if improperly located relative to the orifice plate in the orifice meter. Tests were conducted in a 3.6 m (10 ft) surface finish pipe with a tube bundle flow conditioner located at four different positions upstream of an orifice plate. The resulting orifice plate disturbances were measured for the tube bundle flow conditioner at each of the locations. Changes in the orifice discharge coefficient for orifice plate downstream of three flow disturbances consisting of orifices or a tee were measured. For most of the configurations tested, installing a tube bundle flow conditioner immediately downstream of the disturbance reduced the changes in the discharge coefficient from as much as 2 percent to less than 0.2 percent. Recommendations for further research needs are suggested.

1987

PB93-153581

Not available NTIS

National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Process Measurements Div.

Influence of Size Distribution Function on Mean Droplet Size Obtained by Ensemble Light Scattering.

Final rept.


Pub. in ASTM STP 1083, p93-111 1990.

Keywords: "Drop size, "Distribution functions, "Particle size distribution, "Probability distribution functions, "Light scattering, "Interferometry, "Polarization, "Reprint, "Lognormal distribution functions.

Measurements with single particle counting devices, i.e., phase/Doppler interferometry (PDI) and light intensity, for different droplet diameters and the ensemble light scattering/polarization ratio (ESPR) technique have been carried out in a kerosene spray, introduced vertically downward through a nozzle with a swirl and air flow fields. The mean droplet sizes determined using the ensemble technique were generally smaller than those obtained with PDI, whereas the LID results were in reasonable agreement with the ESPR measurements. In order to investigate the effect of size distribution function on the drop size measurements, several different monodisperse function distributions with varying degrees of skewness and a bimodal distribution function were examined. Calculations for the ESPR technique using a log-normal distribution function were evaluated with measured PDI size distributions, and the dependence of polarization ratio on Sauter mean diameter (SMD) is reexamined. It is concluded that the differences in the measured droplet size can not be solely attributed to the uncertainties in the size distribution function.

1993

PB93-153581

Not available NTIS

National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Applied and Computational Mathematics Div.


Final rept.


See also PB92-112291.


Keywords: "Convection, "Hydrodynamics, "Gravity, "Thermal boundary layer, Fluid flow, Diffusion, Solidification, Stability analysis, Frequencies, Reprints, "Fractal theory, Thermalosolutal convection.

The effect of time-periodic vertical gravity modulation on the onset of thermalosolutal convection in an infinite horizontal layer with stress-free boundaries is investigated using Floquet theory for the linear stability analysis. Situations for which the fluid layer is stably stratified in either the fingering or diffusive regimes of double-diffusive convection are considered. Results are presented both with and without steady background acceleration. Modulation may stabilize an unstable base solution or destabilize a stable base solution. In addition to synchronous and subharmonic response to the modulation frequency, instability in the double-diffusive system can occur via a complex conjugate mode. In the diffusive regime, where oscillatory onset occurs in the unmodulated system, regimes of resonant instability occur and exhibit strong coupling with the unmodulated oscillatory frequency. The response to modulation of the fundamental instability of the unmodulated system is described both analytically and numerically. The modulation system behavior is defined under subcritical conditions as a high frequency lobe.

1992

PB92-144658

Not available NTIS

National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Technology Div.

Approximate Solution to the Wave Equation - Revisited.

Final rept.


Keywords: "Wave equations, "Light transmission, "Optical waveguides, Optical fibers, integrated optics, WKB approximation, Electromagnetic radiation, Partial differential equations, Integration, Eigenvalues, Reprints.

The authors revisit here an old but neglected approximate analytic solution to the electromagnetic wave equation. Their method of derivation is reminiscent of the WKB method while the solution, although approximate, is much more accurate than the traditional WKB solution and can be used with as much ease as the WKB method. Since the authors knowledge, has never been used by the optics community, where its use in analyzing optical fibers and integrated optical waveguides would be beneficial.

1992

PB92-144697

Not available NTIS

National Inst. of Standards and Technology, Gaithersburg, MD.


Keywords: "Radiometry, "Irradiance, Near infrared radiation, Near ultraviolet radiation, Visible radiation, Infrared radiation, Comparisons, Spectral response, Intercomparison.

An intercomparison of spectral irradiance measurements by 12 national laboratories has been carried out between the 1st and 2nd comparisons. The comparison was conducted under the auspices of the Comite Consultatif de Photometrie et Radiometrie (CCPR) of the Comite International des Poids et Mesures, and the National Institute of Standards and Technology (NIST) served as the pilot laboratory. The spectral range of the intercomparison was 250 to 2400 nm and the transferred standards used were commercial tungsten-halogen lamps of two types. The world-wide consistency of the results (one standard deviation) was on the order of 1% in the ultraviolet region and 2 to 4% in the ultraviolet and infrared portions of the spectrum. The intercomparison revealed no statistically significant differences between spectral irradiance sources based on blackbody physics and absolute detector radiometry.

1993

PB92-159508

Not available NTIS

National Inst. of Standards and Technology (NMI), Gaithersburg, MD. Gas and Particulate Sciences Div.

Laser-Induced Optical Emissions of CVD Diamond Studied in the Raman Microprobe.

Final rept.


Keywords: "Diamonds, "Vapor deposition, "Thin films, "Synthetic materials, Photoluminescence, Raman spectra, Raman spectroscopy, Crystal structure, Multipe, "Silicon, Analysis, Spectra.

A multichannel detection Raman microscope, with laser excitation at 514.5 nm, is employed in the rapid characterization of the microstructural and compositional properties of the diamond deposits prepared by chemical vapor deposition (CVD) method. Examined were single microcrystals of CVD diamond and polycrystalline thin films deposited on silicon (111) and polycrystalline multilite (Ca40[SiO4]28O20) substrates. Reported are the results from a series of films grown under constant deposition conditions on substrates of different temperatures (570 C), gas pressure (40 torr), and gas flow rate (52 scmm), but employing varying gas compositions with CH4/H2.
ratios of 0.1 to 1.0 percent. The analysis focuses on the Raman range from 800 to 2000 cm\(^{-1}\) to establish the purity of the diamond phase based on the observation of characteristic carbon signatures and the level of the spectral background. A second spectral range from 5600 to 6200 cm\(^{-1}\) (Raman shift) is examined to monitor the presence of a photoluminescence (PL) band centered at 735 nm (1.68 eV) attributed to a lattice vacancy in diamond.

1.2.1.4
PB92-159573 Not available NTIS National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.


Keywords: Crystal growth, Thermal conductivity, Transparency, Stability, Reprints, "Diamond films."

Recently, deposition processes have been discovered that have resulted in the synthesis of diamond films at significantly lower pressures and temperatures than previous methods of diamond synthesis. This new technology, together with earlier methods for growing diamonds and diamond-like carbon, offer the promise of superior optical components because of the unique properties of diamond. Crystalline diamond is both the hardest material known and the material with the largest thermal conductivity at room temperature. In addition, it is transparent over large spectral ranges, it is chemically inert, it is highly impervious, and it is stable at high temperatures.

1.2.1.5
PB92-159581 Not available NTIS National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.


Keywords: *Silicon dioxide, *Yttrium oxides, Absorption coefficients, Reflective index, Optical properties, Thin films, Mixtures, Reprints, Electron beam deposition, Extinction coefficients.

The refractive indices and absorption coefficients of a series of mixed yttria-silica films prepared by electron beam codeposition have been calculated from transmission spectra. The dependence of refractive index and film densification on composition suggests that porosity inherent in pure yttria films deposited by electron beam deposition, is also true for the yttria-silica films. However, the films show increased absorption which is attributed to oxygen deficiency. The effects are similar to those observed previously in mixed zirconia-silica films.

1.2.1.6
PB92-165299 Not available NTIS National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.


Selective optical excitation permits both the group index and the group delay of on-axis modes of multimode fibers to be determined with high precision. The group index of several types of fiber was measured at 1310 nm in a fiber Michelson interferometer, and the values were compared to those obtained from the transit time of short-duration optical pulses. From these data the length of reference fibers about 2 km long was calculated. Length-measurement accuracy was limited by group-index uncertainties to about 0.04%. Also, a technique that uses these reference fibers to minimize uncertainties in distance measurements made with multimode optical-time-domain reflectometers is described.

1.2.1.7
PB92-165307 Not available NTIS National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.


The authors describe a method for measuring submicrometer distances with an asymmetric fiber Michelson interferometer having an LED as a source of radiation. By measuring the phase slope of the Fourier components in the frequency domain, it is possible to locate the position of reflections with nanometer precision even in the presence of sample dispersion. The method is compatible with time domain sampling at the Nyquist rate which assures accuracy in data acquisition and processing.

1.2.1.8
PB92-165430 Not available NTIS National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.


The paper describes the application of curve-fitting techniques to digitized waveforms for the evaluation of the Kerr cell constant. Results are presented for Kerr cells used to cover the 10kV-300kV range. Cell constants for the same cell geometry but with different Kerr liquids are also reported. The uncertainties of the evaluated cell parameters and the dependence on fringe number are discussed. The effects on the evaluated cell constants produced by segmenting the digitized Kerr waveforms are also examined.

1.2.1.9
PB92-165869 Not available NTIS National Inst. of Standards and Technology (FL), Boulder, CO. Quantum Physics Div.


The authors study the use of an external resonator to enhance sub-Doppler signals observable with the high sensitivity techniques of optical heterodyne spectroscopy. The case of modulation-transfer spectroscopy in a ring resonator is considered in detail. By exciting the (127) resonance at 812 nm with a low-power He-Ne laser, the authors observed a S/N of 250 in a 1 kHz bandwidth. Used in an optimal control loop, this performance would provide a laser stability of 10 Hz at fs. Such a > hundredfold improvement in stability should lead to interesting increases in accuracy as well.

1.2.2.0
PB92-165943 Not available NTIS National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.


Keywords: *Optical fibers, *Dimensional measurement, "the width, Optical measurement, Fiber optics, Diameters, Precision, Reprints, Scanning confocal microscopy.

The authors have constructed and evaluated a scanning confocal microscope for the precise measurement of optical fiber cladding diameter. The system measures the fiber endface directly and differs from conventional microscopes in that it minimizes the systemic error due to partial coherence. The results obtained with the scanning confocal microscope are checked by comparison with those obtained from a commercial micrometer and by measuring a chrome-on-glass standard reference material provided by NIST, Gaithersburg. Fiber diameters can be measured with a random thickness of 40 nm and a systematic error estimated to be 40 nm.

1.2.2.1
PB92-166073 Not available NTIS National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.


Keywords: *Two-wavelength lasers, Mode locked lasers, Ring lasers, Doped materials, Picosecond pulses, Light pulses, Brothcoherence, Reprints, Erbium lasers.

Dual pulses each with different peak wavelengths and durations as short as 2 ps were concurrently produced with an actively mode-locked erbium-doped fiber ring laser made in part with birefringent polarisation-maintaining fiber. Peak wavelength separations measured in the experiment agreed well with the theoretical values.

1.2.2.2
PB92-166289 Not available NTIS National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.


Keywords: *Silicon dioxide, *Glass, Electric current meters, Magnetic measurement, Magnetic fields, Temperature dependence, Room temperature, Faraday effect, Reprints, "Verdet constant."

We report measurements of the temperature dependence of the Verdet constant in SiO\(_2\), SO\(_2\), SF\(_6\), and BK-7 glasses. In each case the Verdet constant increases with temperature by the order of 1 part in 10\(^{10}\) K over the range from room temperature to 300 C. The results for each glass are within 3 to 20% of estimates obtained using the Besselian formula with published dispersion and dn/dT data on the glasses.

1.2.2.3
PB92-171248 Not available NTIS National Inst. of Standards and Technology (NL), Gaithersburg, MD. Atomic Physics Div.


Keywords: *Laser spectroscopy, *Tellurium 130, Visible spectroscopy, Line spectra, Interferometry, Wavelengths, Precision, Reprints, Transfer standards.
We have observed the spectrum of (130)Te2 in the range 472-5020 A near 57. It is using Doppler free frequency-modulation spectroscopy. The wave numbers of 35 selected lines have been measured interferometrically with an accuracy of 2.2 parts in 10 billion. These measurements extend the already well-distributed set of precise reference lines for this region. Good agreement is found with four lines that were previously measured in other laboratories for the approximate standard of spectroscopy of hydrogen, deuterium, positronium, and muonium.

201.204
PB92-171610 Not available NTIS National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Technology Div.

Simple Noise Calibration Radiometer.

Final rep.
T. R. Scott. 1991, 5p

Keywords: "Radiometers, Power measurement, Cryogenic equipment, Noise temperature, White noise, Broadband, Heterodyning, Accuracy, Reprints.

A relatively inexpensive radiometer, intended to serve the needs of a calibration laboratory with a moderate workload. This uses heterodyning for broad frequency coverage, and a precision waveguide below-cutoff attenuator to achieve a null-balancing mode of operation. The overall accuracy (with a primary cryogenic standard attached) is about 2%.

201.205
PB92-171701 Not available NTIS National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Technology Div.

Megawatt Laser Calorimeter Design.

Final rep.
T. V. Vorburger. 1991, 15p

Keywords: "Surface roughness, Scanning tunneling microscopy, Light scattering, Interferometry, Topography, Texture, Reviews, Pens, Reprints, Atomic force microscopy.

The article presents a brief review of surface topography measurements. First, general ideas about surface topography, largely from ANSI/ASME Standard B- 46.1, are presented. Next, stylus profiling techniques, in particular some of the parameters and statistics that may be calculated from measurements using these techniques, are examined. Finally, we discuss optical interferometry, scanning tunneling microscopy, and atomic force microscopy in turn. The article concludes with a short section on the area techniques of total reflected light scattering and angle resolved light scattering.

201.207
PB92-171784 Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.

Optical Scattering from Rough Surfaces: Experiment and Theory.

Final rep.
Pub. in Proceedings of International Colloquium on Surfaces (7th), Karl-Marx-Stadt, February 8-10, 1988, p308-316.

Keywords: "Light scattering, Surface roughness, Heium neon lasers, Laser radiation, Angular distribution, Theoretical data, Experimental data, Metrology, Pens, Reprints.

Optical scattering has been used for high-speed inspection of surface roughness and holds great promise as an on-line technique in manufacturing. To make full use of the technique as a surface metrology tool, it is necessary to understand quantitatively and from first principles how the light is scattered from rough surface. The authors have performed experiments on a set of standard waveguide samples, compared the results for angular scattering with theoretical predictions. The computed scattering distributions are based on an optical phase integral that contains in its integral the surface profile as measured by a stylus instrument. Ten profiles were measured to each surface and the resulting computed distribution is an average of results from these. The agreement between theory and experiment is good for all the surfaces measured.

201.208
PB92-171826 Not available NTIS National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.

Sisyphus Cooling of a Bound Atom.

Final rep.
D. J. Wineland, J. Dalibard, and C. Cohen-Tannoudji. 1992, 1p

Keywords: Atomic spectroscopy, Laser spectroscopy, Reprints, "Sisyphus cooling, Laser cooling, Ion storage, Atom traps.

Cooling that results from optical dipole forces is considered for a bound atom. Through optical pumping, the atom can be made to feel decelerating optical dipole forces more strongly than accelerating optical forces. This effect, which has previously been realized for free atoms, is called Sisyphus cooling. A simple model for a bound atom is examined in order to reveal the behavior of the optical cooling and heating when the atom is confined in the Lamb-Dicke regime. Results of semiclassical and quantum treatments show that the minimum energy achieved is near the Doppler limiting point and can be much lower than the Doppler cooling limit. Two practical examples that approximate the model are briefly examined.

201.209
PB92-171859 Not available NTIS National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Technology Div.

Fiber Cladding Diameter by Contact Micrometry.

Final rep.
M. A. Murphy. 1991, 4p

Keywords: "Optical fibers, Dimensional measurement, Optical communication, Fiber optics, Phase shift, Microscopy, Diameters, Precision, Standards, Reprints, "Claddings, Micrometry.

The paper reports very precise measurements of the cladding diameter of optical fibers by contact micrometry. A committee of the Telecommunications Industry Association (TIA) was reluctant to accept an artifact standard, or factory-produced fiber, for use in optical fiber phase integral that is near a meter. The measured result is a function of illumination and because a metal film displays phase shifts that are less than zero or a degree (Young 1990). Indeed, the concern about phase shifts is not misplaced: we have measured widths of chrome-on-glass lines with a scanning confocal microscope and found the measured results to change by nearly 0.1 micron, which has polarization (Mechels and Young, 1991b). At any rate, even if a chrome-on-glass standard of 60 pm is adopted, it is necessary to measure a fiber very accurately to verify the relevance of the chrome standard.

201.210
PB92-175280 Not available NTIS National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.

Precision Measurements on Optical Fibers.

Final rep.
D. L. Franzen. 1991, 2p
Pub. in Optics and Photonics, p30-31 May 91.

Keywords: "Optical fibers, "Optical measurement, Attenuation, Bend, mode, fiber, Cutoff wavelength, Mode-field diameter.

The precision and accuracy of single-mode optical fiber measurements are discussed. Included in the discussion are measurements for: attenuation, mode-field diameter, cut-off wavelength, and geometrical parameters.

201.211
PB92-175660 Not available NTIS National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.

Comment on 'Nonlinear Magneto-Optics of Vacuum: Second-Harmonic Generation'.

Final rep.
M. G. Raizen and B. Rosenstein. 1990, 1p

Keywords: "Magnetooptics, Quantum electromagnetics, Direct current, Nonlinear systems, Vacuum, Reprints, "Second harmonic generation.

In a recent letter, Ding and Kaplan consider the QED effect of second harmonic generation in vacuum in the presence of a strong DC magnetic field. They find that with strong magnetic fields it is possible to observe the effect experimentally. In this comment the authors show that their calculations is not correct and that the effect is too small to be observed currently in a laboratory experiment.

201.212
PB92-175751 Not available NTIS National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Technology Div.

Extended-Cavity Operation of Rare-Earth-Doped Fiber Lasers.

Final rep.
N. A. Sanford, K. J. Malone, and D. R. Larson. 1991, 5p

Keywords: "Waveguide lasers, Q switched lasers, Mode locked lasers, Neodymium lasers, Glass lasers, Infrared lasers, Integrated optics, Optical pumping, Near infrared radiation, Reprints.

Channel waveguides fabricated in Nd-doped glass were used as gain elements for extended-cavity lasers. Emitter pumping was performed with a Taspaphire laser operating at 807 nm. The 4-nm FWHM output spectrum was centered near 1087 nm. Slower than the gain bandwidth, typically 4% to 5%, with the output bandwidths near 20 mW. Active mode locking and Q-switching were performed by a pair of modulated pulse widths that were 0.48-200 ps. The FWHM, Q-switched peak power was 1.2 W. The cw output narrowed to 7 GHz and turned over a range of 24 nm when a grating provided feedback. The single-frequency operation was not excessive to the extent of being new.

201.213
PB92-175843 Not available NTIS National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Technology Div.

Dispersion-Shifted Dual-Mode Core Fibers: Optical Fibers Based on Spot Size Definitions.

Final rep.
Pub. in Jnl. of Lightwave Technology 10, n1 p1-5 Jan 92.
Keywords: "Optical fibers, Fiber optics, Optimization, Dispersion, Splicers, Reprints, Single mode fibers, Bending losses, Spot size.

Design features for very low bend and splice losses in dispersion-shifted double-shape core (DSC) single-mode fibers are obtained in terms of characteristic mode spot sizes W(bar) responsible for splice loss, and W(sub inf) (sub infinite) (W(bar) which should be close to 1 for optimum splice and bending performance) lying between 1.16 and 1.33 while maintaining the mode spot size (W(bar)) between 4 and 5 mm at the operating wavelength of 1550 nm. The cross-sectional design goal of the authors show that bending loss would be lower in a step-index than in a graded-index DSC fiber. Further, the authors show that conventional single clad step-index or triangular-index dispersion-shifted fibers have higher bending loss than well designed DSC fibers.

201.214
PB92-197771
Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Radiation Source and Instrumentation Div.
Optical Resonator for the NIST-NRL Free Electron Laser
Final rept.
B. C. Johnson, R. G. Johnson, D. L. Mohr, and M. S. Price. 1990, 7p
Keywords: "Free electron lasers, 'Optical resonators, Racetrack microtrons, Ultraviolet lasers, Infrared lasers, Tunable lasers, Naval Research Laboratory, Finite element analysis, Reprints, US NIST."

A 9 m linear optical cavity will be used in the National institute of Standards and Technology-Naval Research Laboratory free electron laser (NIST-NRL FEL). The FEL, which is driven by a racetrack microtron, is designed to lase from 0.2 to 10 micrometers. The resonator must accommodate the large dynamic range in wavelength, low gain, high average power and coherent harmonic emission of the laser. The laser can be configured for maximum gain, as is necessary in the ultraviolet, or to minimize diffraction losses, as is necessary in the infrared. This is done by changing the length of the undulator and the radius of curvature of the cavity mirrors.

201.215
PB92-197979
Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Video Microscope with Submicron Resolution
Final rept.
S. Mechtel, and M. Young. 1991, 10p
Pub. in Applied Optics, 30, n16 p2202-2211, 1 Jun 91.
Keywords: "Optical fibers, 'Dimensional measureent, 'Microscopes, Fiber optics, Reprints, 'Video microscopes, Machine vision, Robot vision, Systematic errors."'The authors have constructed and evaluated a video microscope with a 150 x 150-micrometer field of view for performing measurements of optical fiber geometric. The microscope consists of a frame transfer video camera, condensing and filtering optics, a 40X,0.65 N.A. microscope objective, and frame digitizing electronics. Using simple digital algorithms, they measure distance with a random uncertainty of about 0.04% across the field of view, and wick measurements suffer from a systematic error between 0.1 and 0.2 micrometers.

201.216
PB92-236447
Not available NTIS
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Electron and Optical Physics Div.
High-Order Harmonic Generation by Hydrogenic Ions
Final rept.
C. W. Clark, L. Pan, and K. T. Taylor. 1989, 6p
Keywords: "Harmonic generation, Perturbation theory, Nonlinear problems, Computation, Reprints, Hydrogen-like ions."

Calculations of nonlinear susceptibilities for hydrogenic ions have been done in the framework of lowest-order perturbation theory up to 100th order. The nth order susceptibility is found to increase roughly as n(exclusion point) for high n. This may be related to the resonant behavior of high harmonic generation observed in recent experiments.

201.217
PB92-236680
Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Radiometric Physics Div.
Use of the Spectral Response Based on 100% Quantum Efficient Detectors
Final rept.
A. M. Houston, and E. F. Zalewski. 1989, 10p
Keywords: "Photodetectors, Spectral response, Quantum efficiency, Silicon diodes, Power measurement, Laser radiation, Radiometry, Photodiodes, Reprints.

The radiometric characteristics of the commercially available version of the 100% quantum efficient detector are discussed. The study included spectral, geometrical and reversion bias response properties. The 100% quantum efficient detector was compared with the NIST absolute detector response scale using a monochromator-based detector spectral response. This was a demonstration of the feasibility of using a 100% quantum efficient detector as an absolute standard with conventional detector comparator instrument.

201.219
PB92-236975
Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Wavelength Calibration of DC and AC-Connected Resonance-Doubling Lines
Final rept.
V. A. Kaufman, and W. C. Martin. 1989, 2p
Pub. in Jnl. of the Optical Society of America B 6, n10 p1769-1770 1990.
Keywords: "Oxygen ions, Ultraviolet spectra, Atomic spectroscopy, Vacuum ultraviolet radiation, Line spectra, Wavelengths, Reprints, Lithium-like ions."

We have determined the wavelengths of the O VI resonance lines by measuring spectralgrams obtained with a 10.7-m normal-incidence vacuum spectrograph. The values are 1013.5260(5) and 1013.6205(5) for the doublet S1(1/2)-doublet P(3/2) and doublet S1(3/2)-doublet P(1/2) lines, respectively. Combining these values with those of comparable accuracy obtained in three other laboratories, we suggest the use of the averages of 1037.9261(30) and 1037.6167(30) A for these wavelengths.

201.220
PB92-237155
Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Radiometric Physics Div.
Comparison of the NIST Surf and Aron Miniarc Irradiance Standards at 214 nm.
Final rept.
Keywords: "SURF II storage ring, 'Argon plasma, 'Arc discharges, 'Standards, Near ultraviolet radiation, Solar ultraviolet radiation, Primary standards, Spectro-radiometers, Comparisons, Reprints, 'Irradiance standards.

Comparison of NBS's SURF-II primary irradiance standard and argon mini arc secondary irradiance standard at 213 nm with an uncertainty of less than 3%, show that at this wavelength these irradiance standards agree to within the uncertainties of 0.7% and about 7.5% respectively, assigned to them by NBS.

201.221
PB92-237544
Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Optical Broadening of Raman Lines
Final rept.
A. Weber. 1988, 2p
Keywords: "Molecular gases, 'Raman spectra, 'Line broadening, Raman spectroscopy, High resolution, Doppler effect, Line width, Infrared absorption, Comparison, Reprints."

The Doppler broadening of Raman lines of low density molecular gases is discussed. A formula for the width of the Doppler broadened lines is given as functions of the exciting frequency, the Raman frequency, and the scattering angle. A comparison is made to the Doppler broadening of infrared absorption lines.

201.222
PB93-102259
PC A11/MF A03
National Inst. of Standards and Technology, Boulder, CO.
Special pub. (Final).
Also available from Supt. of Docs., as SN003-003-2011-0.
See also PB91-122808. Prepared in cooperation with Lasers and Electro-Optics Society (IEEE), Piscataway, N.J. and Optical Society of America, Washington, DC.
Keywords: "Fiber optics, 'Optical fibers, 'Optical measurement, 'Meetings, Optical communication,
Optics & Lasers

Electrooptics, Fiber optics transmission lines, Reviews.

The digest contains summaries of 54 papers presented at the Symposium on Optical Fiber Measurements, held September 15-17, 1992, at the National Institute of Standards and Technology, Boulder, Colorado. Topics include fiber optics, instrumentation, measurements, optical fibers, and reviews.

201,224


Keywords: *Light scattering, *Surface roughness, Least squares method, Angular distribution, Autocorrelation, Texture, Profiles, Reprints, Profilometry.

The angular distribution of the light scattered by a rough surface contains information on the texture of the surface. Profiles of nine specimens were measured with variety types of laser lines. The uncertainty in the scattered light were measured with a detector. The rms roughness of a surface that has an identifiable specular beam can be determined from the relative intensity of that beam. The autocorrelation length and the parameters that define the autocorrelation functions with the roughness of surfaces that produce no specular beam, can in principle be determined by fitting the distribution computed from a model of random surface to the measured distribution. In practice, measurement errors and computation errors preclude the determination of these parameters by a least-squares fit. Angular distributions were also computed from the surface profile of a simplified model of the electromagnetic scattering.

201,225


Keywords: Near infrared radiation, Distributed feedback lasers, Helium neon lasers, Optical communications, Optical fibers, Frequency stability, RedColor, Wavelengths, Transmitters, Reprints, *Lambdometers.

To accurately measure wavelength of 1.3 and 1.5 micrometer single-mode sources, we developed a lambdometer that can be used in the near lift and the red regions of the spectrum. Wavelength accuracy and resolution are about 0.1 ppm (parts per million) at 0.833 micrometer. They were measured by comparing each of two adjacent modes of a HeNe laser, frequency-stabilized by a polarization technique, with a single mode of a second frequency-stabilized HeNe laser. We also verified the wavelength of the reference laser with an accuracy of 1 ppm by comparing it with the 1.52 micrometer HeNe laser line. The uncertainty in wavelength of the 1.52 micrometer HeNe laser is limited to the width of the Doppler gain curve, whose peak is known to be about 0.04 nm. We describe our lambdometer and the performance of its reference laser as a wavelength transfer standard. Measurements on a commercially packaged 1.52 micrometer distributed feedback (DBF) laser diode transmitter show that its wavelength fluctuates by at least 1 ppm during normal changes in room temperature.

201,226


Pub. in Proceedings of ASPE Spring Topical Meeting on Precision Interferometric Metrology, Tucson, AZ., April 7-9, 1992, p57-60.

Keywords: *Helium neon lasers, *Frequency stability, *Dimensional measurement, *Standards, Computerized, Instruments, Green(Color), Stabilization, Metrology, Reprints, *Length standards, US NIST.

The Precision Engineering Division at NIST is involved in several projects developing new laser sources to serve dimensional standards. This paper will report on one project near completion - development of a new design for an iodine-stabilized 633nm He-Ne laser which will present preliminary results from a second project - a new method for stabilization of a 543nm He-Ne laser. The iodine stabilized laser that we have developed employs computer control to increase simple and enhance its performance. The automated system will reliably identify and lock to any one of seven iodine absorption lines, detect loss-of-lock and re-lock to the line when necessary, and perform other related tasks such as recording beat frequency signals for calibration or stability studies of other He-Ne lasers. In addition, the mechanical structure of the laser cavity has been re-designed to increase rigidity. We will also describe a new method of stabilizing a (commercial) green He-Ne laser operating simultaneously in several TEM(00) modes, using the Beat frequencies between adjacent modes as an indication of position on the gain curve. Preliminary results indicate that this shows promise as an alternative to standard schemes for stabilization of the vacuum wavelength.

201,227


Keywords: Infrared radiation, Radiometry, Silica, Reprints, Experimental Techniques.

An easily constructed, thermal resolution test target for low-contrast applications is described. The calibration of the target need not be obtained by reference to some other radiometric standard, but can be obtained directly from the mechanical dimensions of the device and the thermal conductivity of fused silica.

201,228


Keywords: *Light scattering, Laser induced fluorescences, Laser spectroscopy, Laser radiation, Laser diagnostics, Configuration, Reprints, Photon burst spectroscopy, stray light.

We describe an optical system that we constructed to collect a large fraction of fluorescent light emitted photopically from a cylindrical interaction region. While maintaining an overall detection efficiency of 9%, the system rejects, by more than 12 orders of magnitude, incident radiation from a single laser that intersects the interaction region. Such a system is useful for a wide variety of light-scattering experiments in which high rejection of stray light is desirable, but in which light from an incident laser beam must be rejected without resorting to spectral filters.

201,229


Keywords: *Lead glass, *Thermal lens effect, Laser radiation, Light pulses, Silicates, Germanates, Phosphates, Borates, Nonlinear optics, Reprints.

The thermal lensing characteristics of several silicate, germanate, phosphate, and borate glasses were studied using a laser with a 7 ns pulse at 457 nm in a wide focus geometry. A geometric model was developed to describe the quadratic radial profile of the refractive index resulting from the laser-induced temperature profile. This model was used to interpret the effects of some of the relevant experimental parameters on the thermal lensing experiments. The influence of the material properties such as different types of network former and modifier ions on the non-linear optical properties of these materials was studied. It was found that: (i) the greatest influence of the network former ions was due to their effect on the absorption coefficient of the glass, (ii) for two glasses, the thermo-optic coefficients dn/dT of the germanates and silicates with random network structures were greater than those of the borate and phosphate glasses with ring and chain structures; and (iii) the main contribution to the thermo-optic coefficient comes from the thermally induced changes in the electronic polarizability of the glass components. In these glasses, the oxygen polarizability provides the dominant contribution and is affected by the variations in the polarizing force (e.g., the refractive index). These phenomena are very useful for the development of new nonlinear optical materials for use in optical systems.

201,230


Keywords: Harmonic generation, Perturbation theory, Nonlinear optics, Nonlinearly, Computation, Reprints, Hydrogen-like ions.

We have computed the nonlinear susceptibilities for harmonic generation in hydrogenic ions, as described by lowest-order perturbation theory and the next order term, up to very high orders of nonlinearity. The predictions of lowest order perturbation theory can be shown to be in agreement with the behavior of nonlinear susceptibilities of core-level ions. The calculations were performed for the hydrogen and helium-like ions using the dipole approximation. We have also calculated the harmonic decadence function for various harmonics and for different initial conditions.
modulation of the refractive index due to thermal heating. On a millisecond time scale we recognize the occurrence of multiple focal points within the sample. Although those oscillations in the beam waist have been reported previously by others, our experimental methods have allowed for these undulations to manifest themselves in a new way, namely in 2-D scans and transmission of a quasi-1D Mercantini phase indicative of a strong thermoelectric effect and a consequence of Maxwell's equations. From our model, a dr/dT value of 1 X 10(12-5)/deg K has been extracted.

Plasma Physics

201,233
P92-166008

Keywords: *Gas discharges, *Plasma diagnostics, Radio frequency discharge, Mass spectrometry, Light emission, Argon plasma, Kinetic energy, Oxygen, Rep. Mass spectrometric and optical emission studies have been performed on argon discharges in a GEC rf reference reactor. Kinetic-energy distributions for ions produced in the sheath region are broad and exhibit structure, while ions produced in the bulk plasma exhibit narrow, featureless energy distributions. The addition of small amounts of water to an argon discharge significantly alters the observed positive-ion kinetic-energy distributions. Optical emission studies indicate increasing spatial non-uniformity in the plasma at higher pressures. Time-resolved optical emission studies indicate a varying relationship between the applied rf voltage and the time-varying optical emission with changing pressure and position between the electrodes.

Solid State Physics

201,234
AD-A253 618/3

Keywords: *Crystal growth, *Crystal defects, Diamond, Electron microscopy, High resolution, Interactions, Microstructure, Nucleation, Atomic structure, Cross sections, *Diamond films, Chemical Vapor Deposition. Growth defects in diamond films grown by plasma-assisted chemical vapor deposition (CVD) were studied by high resolution electron microscopy. Several features of the microstructure were resolved and their importance to the development of diamond films was evaluated. The observations included various twin boundaries of the type Sigma=3 as well as Sigma=9, Sigma=3-27 and Sigma=81, which form by an intersection of lower order twins. These higher order boundaries are loci of intersection points of growing planes on two adjacent twins and can serve as a recruiter for the local crystal growth direction. The central nucleation site for the growing planes in many cases can be traced back to a 2 x 1 surface, and the diamond film has five reentrant angles and thus serves as a preferred nucleation site for new planes as the crystal grows.

201,235
AD-A255 862/5

Keywords: Angles, Atomic structure, Diamonds, Dislocations, Electron microscopy, Grain boundaries, High resolution, Microscopy, Vacuum deposition. Thin films, Defects(Materials), Diffraction, Crystal growth, *Diamond films, Chemical vapor deposition, Twinning. The atomic structure of twin quintuplets in a chemical vapor deposited (CVD) diamond film was investigated by high resolution transmission electron microscopy (HRTEM). We conclude that the twin quintuplets have two main morphologies. The first consists of four Sigma = 3 twin boundaries and one Sigma = 81 twin boundary. The Sigma = 81 twin boundary contains the dislocations needed to accommodate a 7.35 deg misfit angle between a set of (111) planes on opposite sides of the boundary. In the second case, the 7.35 deg misfit angle is accommodated by two or more grain boundaries that are tilted slightly more than the 70.53 deg tilt of a Sigma = 3 boundary. These grain boundary micrographs of the quintuplets are only types of boundaries that we have observed in CVD diamond.

201,236
N92-21622/5

Keywords: *High temperature superconductors, Alumomine oxides, Amorphous materials, Bismuth compounds, Ceramics, Crystalization, Glass, Heat treatment, Alternating current, Crystalinity, Diffraction patterns, Electrical resistivity, permeability, Melting, Powder(Particles), Refractory materials, X ray diffraction, *Bismuth strontium calcium cuprates, Lead additions. The bismuth based high T(sub c) superconductors can be processed via an amorphous Bi-Pb-Sr-Ca-Cu oxide. The amorphous oxides were prepared by melting the constituent elements in a ceramic crucible at 1200 C in air followed by pouring the liquid onto an aluminum plate, and rapidly pressing with a second plate. In the amorphous state, no crystalline phase was identified in the powder X-ray diffraction pattern of the quenched materials. After heat treatment at high temperature the amorphous materials crystallized into a glass ceramic containing a large fraction of the Bi2212Ca2Cu3O8 phase (T(sub c) = 110 K). The processing method, crystalization, and results of dc electrical resistivity and ac magnetic susceptibility measurements are discussed.

201,237
N92-21630/8

Keywords: *Crystal growth, *High temperature superconductors, *Levitation, Melts (Crystal growth), Superconductivity, Hysteresis, Magnetic measurement, *Yttrium barium cuprates. The inverse levitation of a high temperature superconductor polymer composite consisting of powdered quench melt growth Ba2YCu3O7-delta and cyanoacrylate is reported. Magnetic hysteresis loop measurements for the composite are compared to those measured for the bulk material prior to powdering. Differences in the flux pinning capability between the two material forms are small but significant.

201,238

Keywords: *High temperature superconductors, Hysteresis, Magnetization, Defects, Electric current, Impurities, Magnetic flux, Time dependence, Cuprates. Because high temperature superconductors, including YBCO and BSCO, are type II superconductors with relatively low H(sub c1) values and high H(sub c2) values, they will be in a critical state for many of their applications. In the critical state, the applied field is the supercurrent H(sub c1) and H(sub c2), flux lines have penetrated the material and can form a flux lattice and be affected by structural defects, chemical inhomogeneities, and impurities. A detailed knowledge of how flux penetrates the material and its behavior under the influence of applied fields and current flow, and the effect of material processing on these properties, is required in order to apply, and to improve the properties of these superconductors. When the applied field is changed rapidly, the time dependence of flux change can be divided into three regions, an initial region which occurs very rapidly, a second region in which the magnetization has a ln(t) behavior, and a saturation region at very long times. A critical field is defined for describing H(sub c2) as that field at which the hysteresis loop changes from irreversible to reversible. As a function of temperature, it is found that H(sub c2) is well described by a power law with an exponent of 1.5. The behavior of H(sub c1) for various materials and its relationship to flux flow and flux dynamics are discussed.

201,239

Keywords: Barium oxides, Copper oxides, Landau-ginzburg equations, Magnetic fields, Magnetization, Single crystals, Temperature dependence, Yttrium oxides, Estimating, Thermodynamics, *High temperature superconductors, *Yttrium barium cuprates, Critical field. The temperature dependence of the lower critical field in Bi2212 was determined by magnetization measurements with the applied field parallel and perpendicular to the c-axis. Results are compared with data from the literature and fitted to Ginzberg-Landau equations by assuming a linear dependence of the parameter kappa on temperature. A value of 7 plus or minus 2 K is estimated for the thermodynamic critical field at T = 0 by comparison of calculated Hc2 values with experimental data from the literature.

201,240
A simple, almost exactly soluble, model which simulates the dynamics of a single magnetic domain wall consists of a single variable, giving component and spin of the magnetic field. It is solved numerically for some ranges of parameters. The dynamics is complex and very sensitive to the choices of the parameters giving component and spin of the field, the strength of the pinning, the reversible permeability, the effective mass of the wall domain wall, the wall viscosity, and the amount of energy retained by the wall when it breaks free of the pinning site. A frequency quenching is displayed. Phase space portraits, return maps and total energy spectra are used to display the results.

Keywords: "Domain walls", Mathematical models, Barkhausen effect, Magnetic domains, Ferromagnetic materials, Numerical solution, Flux pinning, Impurities, Simulation, Dynamics, Motion, Reprints.

201,241
PB92-144229 Not available NTIS National Inst. of Standards and Technology (MSEE), Gaithersburg, MD. Polymers Div.

Magnetically sensitive alloys were established using a vibrating sample magnetometer at room temperature and at 85 K. It was shown that the effect is strongly dependent on the field. The temperature of the sample is reduced to less than the magnetic moment of the compound (85 K) and exhibits a maximum relaxation rate for values of H2 above the threshold coercive field, Hc. Anomalies in the behavior of this type have been observed in other materials, though most often for systems composed of superparamagnetic particles, whose magnetic moments relaxes out at low temperatures. In contrast, the relaxation in the CMA was shown to be enhanced at 85 K over its value at room temperature. New measurements over a wider temperature range show that the enhancement in this sample reaches a maximum near 120 K, but below that temperature the relaxation decreases in the same magnitude.

Keywords: "Temperature, superconductors, Transition temperature, Single crystals, SQUID devices, Superconductivity, Reprints, "Yttrium barium cuprates, Microwave absorbers, YBa2Cu3O7-x.

201,242
PB92-144237 Not available NTIS National Inst. of Standards and Technology (MSEE), Gaithersburg, MD. Polymers Div.

Two-molt-grown single crystals of Y2Ba2Cu3O7-X, one (crystal A) in the shape of a nearly perfect parallel- edged dimensions 200x200x70 micrometers and with x approximate 0.1, (crystal B) in the shape of a nearly perfect parallelepiped, were measured with both SOI magnetic measurements and by magnetically modulated microwave absorption (MAMMA). The two methods respond to the change in magnetic properties at the superconducting transition temperature, but in different ways, giving complementary information. For crystal A, both methods show a single sharp transition near 90 K. For crystal B, the SQUID measurements show a broad transition near 80 K, indicating that this crystal was a weak superconductor. The results are presented and the effects anticipated from the phase diagrams and to the results reported in previous studies.

201,246
PB92-144330 Not available NTIS National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Technology Div.

High-temperature superconductors, Superconducting devices, Superconductivity, Superconducting films, Superconductors.

PB92-144347 Not available NTIS National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Technology Div.

High-temperature superconductors, Superconducting devices, Superconductivity, Superconducting films, Superconductors.
PHYSICS
Solid State Physics

Keywords: *Superconducting films, High temperature superconductors, Photoelectron spectroscopy, Thin films, Oxidation, Surfaces, Reprints, *Rubidium barium bismuthates.

Using x-ray photoelectron spectroscopy (XPS), the authors have investigated the effects of oxidation on Rb(ba)1(at)1-xBO3, the degradation of its surface on exposure to air, and the feasibility of using surface techniques to reverse this degradation. The sample was a superconducting thin film grown on MgO by molecular-beam epitaxy (MBE). Oxidation was found that sputter/oxidation treatments may prove useful in restoring the surfaces of films exposed to air (during patterning, for example), prior to interlayer deposition.

201.249
PB92-145127 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Crystallographic and Magnetic Structure of PrFe2N7Te6
Final rept.
Keywords: *Magnetic materials, Praseodymium compounds, Iron, Tetradymite, Crystal structure, Magnetic structure, Neutron diffraction, Magnetic anisotropy, Reprints, Rietveld method.

A neutron Rietveld refinement study of nitrized PrFe2Te7 at room temperature and at 4K shows that the basic Th2Zn17 structure is maintained, with the N atoms occupying the intersitial 5f sites. PrFe2TN7Te6(200) in R3m, space group R3m, with a = 8.754(1), c = 12.649(2) at 4K, and a = 8.799(1), c = 12.668(2) at 295K. At both temperatures, the a-axis is perpendicular to the c-axis.

201.250
PB92-145168 Not available NTIS National Inst. of Standards and Technology (EERE), Boulder, CO. Argonne Div. Origin of Grain Boundary Weak Links in BaPb1-xBixO3 Superconductor
Final rept.
Published in Jnl. of Applied Physics 68, n15 p5705-5758, 1 Dec 90.
Keywords: *Superconductors, High temperature superconductors, Interface, Thin films, Surfaces, Reprints, *Barium lead bismuth oxides, Weak links, IS(Supercorductors).

Although BaPb1-xBixO3(0)3 has a comparatively large superconducting coherence length of about 7 nm and no reported anisotropy in its superconducting parameters, polycrystalline BaPb1-xBixO3 exhibits the same rapid decrease in transport critical current density (Jc) with low applied field (i.e., about 30 Oe) that is characteristic of grain boundary weak links in cuprate superconductors. The authors have studied the effects of processing thermal history on the formation and morphology of grain boundary phases, and the composition of B phase boundaries with and without a second phase, in order to understand the origin of these weak links. It is found that the grain boundaries remain Bb1-2Bb1-4Bb1-6 phases. The analysis of secondary phases, samples that were cooled at the melting temperature of the secondary phase show absence of segregation to some but not all grain boundaries. The composition of the grain boundaries as well as Jc vs temperature measurements indicate that the boundaries act as SIJ tunnel junctions.

201.251
PB92-145276 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Optical and Electron Physics Div. Insulating Cs Overlay on InSb(110).
Final rept.
Keywords: *Indium antimonides, *Cesium, Scanning tunneling microscopy, Room temperature, Two dimensional, Energy gap, Thin films, Superlattices, Semiconductors, Surfaces, Coatings, Chemisorption, Spectroscopy, Reprints.

Cesium overlayers on room-temperature InSb(110) have been studied with scanning tunneling microscopy and spectroscopy. A two-dimensional (2D) overlay is observed, consisting of four-atom, Cs4(110)-like planar clusters arranged in a c(2x2) superlattice. Interestingly, current-versus-voltage (I-V) spectra exhibits a band gap of approx. 0.6 eV, larger than the substrate band gap of 0.43 eV. The I-V spectra are very similar to those observed on the similar 2D overlay on GaAs(110), suggesting that the measured gap is a property of the 2D Cs film. The possible origins of this insulating behavior are discussed.

201.252
PB92-145333 Not available NTIS National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductors and Electronics Div.
High Excited States of Magnetodonors in InSb: An Experimental and Theoretical Study
Final rept.
See also PB91-147603. Sponsored by National Science Foundation, Washington, DC.
Published in Physical Review B 42, n6 p5260-5269, 15 Sep 90.
Keywords: *Indium antimonides, *Magnetodopants, Optical transitions, Excited states, Impurities, Phonons, Reprints, High magnetic fields.

Neutronic optical measurements on magnetodonor states in InSb assisted by optic-optic phonon emission have been observed and described theoretically. Photoconductive detection and magnetic-field modulation was used to obtain well-resolved magneto-optical data. Phonon-assisted excitations provide a unique opportunity to investigate high excited states of the magnetodonor system (up to principal quantum number n = 13), which simulates the hydrogen atom in rigid magnetically confined systems. The magnetodonor states have been identified via excitonic transitions seen in the narrow energy gap and the spin-orbit interaction of the band structure of InSb. It has been shown that the phonon emission breaks the selection rules for the magnetooptical excitations, allowing for transitions with large Delta n. Good agreement between theory and experiment has been obtained. The results should also be of importance to atomic physics and astrophysics.

201.253
PB92-145731 P A C 11/1F AO 3 National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Technical rept.
C. O’Connor. Jan 92, 234p NIST/TN-1292 Also available from Supp. of Docs. as SN90-303-03133-0. See also PB91-159772.
Keywords: *NBS reactor, Research reactors, Activation analysis, Cold neutrons, Crystal structure, Neutron diffraction, Neutron radiography, Nondestructive testing, High temperature superconductors, Polymeric films, Dosimetry, Isotopes, Molecular dynamics.

The report summarizes all those programs which use the NIST Reactor. It covers the period for July 1990 through June 1991. The programs range from the use of neutron beams to study the structure and dynamics of materials through nuclear physics and neutron standardization to radiations for activation analysis, isotope production, neutron radiography, and nondestructive evaluation.

201.254
PB92-145404 Not available NTIS National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Radiation Physics Div.
Phase Composition and Superconducting Properties of the High Te Ceramic Materials, Ba2Zr1-xCuxO5 + x.
Final rept.
Keywords: *High temperature superconductors, *(Crystal)-phase transformations, Rare earth compounds, Barium oxides, Cuprates, Solid solutions, Orthorhombic lattices, Tetragonal lattices, Magnetic susceptibility, Transition temperature, Reprints.

Compositions of Ba2(2-x)R(1 + x)CuO6 + x, where x approx = 0.9, have been prepared to study trends of solid solution formation with the crystalline structure of the rare earth element, R, as one progresses across the lanthanide series and to characterize the tetragonal-orthorhombic phase transition as a function of the barium and lanthanide composition, 2-z and 1-z, respectively. A regime of solid solution was found to exist for those thandiane ones, (R3+)—, with a larger ionic size, i.e., those with an ionic radius greater than or equal to that of Gd3+.) Phase transformation between the orthorhombic and tetragonal phases takes place presumably in all the series with R = La, Pr, Nd, Sm, Eu and Gd. Superconducting properties have been investigated for the Nd, Gd and Y series. For the Nd series, the superconducting transition temperature, Tc, and superconducting fraction, as determined by ac magnetic susceptibility measurement, decreases with increasing radii of z. For the Gd and Y series, was characterized for small deviations about the z = 0 composition. Ba2PzCuO6(1 + x) has been synthesized.

201.255
PB92-145424 Not available NTIS National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Chemical Process Metrology Div.
Metal/ Semiconductor Interfaces on SnO2(110).
Final rept.
Keywords: *Tin oxides, * Palladium, * Tin, *Interfaces, X-ray photoelectron spectroscopy, Ultrasoft x-ray spectroscopy, Metal films, Photoemission, Semiconductors, Metalizing, Substrates, Reprints, Low energy electron diffraction.

Interfaces formed by tin and palladium deposition on the (100) face of tin dioxide, SnO2 (a semiconductor due to native defects), have been studied from coverages of 0.1 ML to 10 ML. The structural, chemical, electronic, and electrical properties of the surfaces were characterized primarily by low-energy electron diffraction (LEED), x-ray photoelectron spectroscopy, ultraviolet photoemission spectroscopy, and a retractable four-point conductivity probe. Modifications of the substrate by oxidation, annealing, and ion bombardment treatments produced three different substrate structures which were used to examine the influence of surface abruptness and the metallization due to Sn and Pd.
PHYSICS
Solid State Physics

Narrow-Gap + 1.74 a surface superconducting

crystal illustrated in Fig. 1 of Ref. 3. The critical

temperature of Narrow-Gap Mercury Cadmium Telluride Based on the Nonlin-

tear Temperature Dependence of the Band Gap.

Final report.

J. R. Lowney, D. G. Seiler, C. L. Littler, and I. T. Yoon, 1992, 6p


Keywords: *Mercury cadmium tellurides, *Carrier den-

sity, Conduction bands, Energy gap, Temperature Dependence, Nonlinear analysis, Reprints, Density of states, Magnetic properties.

The intrinsic carrier concentrations of narrow-gap Hg(1-x)Cd(x)Te alloys have been calculated as a function of temperature between 0 and 300 K for x values between 0.17 and 0.30. The new and more accurate relation for the temperature dependence of the energy gap, which is based on two-photon magnetooptical measurements, is used.* The results are further supported here by additional one-photon magnetooptical measurements for x = 0.20 and 0.23, which were made with a CO2 laser. In the range of composition and temperature, the energy gap of mercury cadmium telluride is small, and very accurate values for the gap are needed to obtain reliable values for the intrinsic carrier density. A new equation (Eq. 1) is proposed to account for the conduction-band nonparabolicity. Large percent-

age differences occur between the new calculations and previous experimental results in the range of temperature. A nonlinear least-squares fit was made to the results of the calculations for ease of use. The implications of the new results for Hg(1-x)Cd(x)Te materials characterization and device operations are discussed.

201,259
PB2-154418 Not available NTIS

Narrow-Gap + 1.74 a surface superconducting

National Inst. of Standards and Technology (MSEL)

Gaithersburg, MD. Semiconductor Electronics Div.

Polarized Neutron Reflectometry.

Final report.

C. F. Majzrik, 1991, 14p


Keywords: Magnetic properties, Thin films, Superlat-

ite, Reflectometry, Polarized neutron reflecto-

metry, *Neutron reflectometry, Multilayers.

Polarized neutron reflectometry is a powerful tech-

nique for studying the microscopic magnetic structures in thin films and multilayers. The corresponding analy-

sis of spin-dependent reflectivity data is discussed and illustrated with a number of specific examples. The measurement of the precession of the neutron moments from Cu(111) is given, and its analysis in the pres-

ence of an applied field, as a means of determining the nuclear density profile is also considered.

201,259
PB2-154491 Not available NTIS

Narrow-Gap + 1.74 a surface superconducting

National Inst. of Standards and Technology (CAML)

Gaithersburg, MD. Semiconductor Electronics Div.

Self-Avoiding Random Surfaces: Monte Carlo

Study Using Oct-Tree Data-Structure.

Final report.

J. O. Connell, F. Sullivan, D. Libes, E. Orlandini, M.

Tesi, A. Stella, and T. Einstein, 1991, 17p


Keywords: *Surfaces, Monte Carlo method, Data structure, Cubic lattices, Polymers, Reprints, Random surfaces, Oct trees.

Self-avoiding random surfaces on a cubic lattice are studied by extensive Monte Carlo sampling. The sur-

faces have empty boundary and the topology of a 2-

sphere. An oct-tree data-structure allows good statistics

in less than minutes for surfaces whose plaque number

is up to an order of magnitude greater than in previous investigations. The new simulation strategy is

explained in detail and compared with previous ones.

The critical exponents are γ = 1.709, ζ = 0.571, and the anisotropic exponent, χ, are determined by maximum like-

lihood methods and by logarithmic plots of the average surface area. Furthermore, the results are shown to agree with theoretical predictions. Finally, the effect of dilute fermions on the critical exponents is studied.

201,262
PB2-154681 Not available NTIS

Narrow-Gap + 1.74 a surface superconducting

National Inst. of Standards and Technology (IMSE)

Gaithersburg, MD. Semiconductor Electronics Div.

Local Bonding Structure of Sn on Si(111) by Surface Enhanced X-ray Absorption Fine Structure and Photoemission.

Final report.

J. C. Woicik, T. Kendelevicz, K. E. Miyano, C. E.

Bouldin, P. L. Meissner, P. Planeta, and E. W.

Sipe, 1991, 9p


Keywords: *Germanium, *Silicon, *Chemical bonds, X-ray diffraction, Semiconductor films, Lattice parameters, Bipolar transistors, Heterojunctions, Epitaxy, Reprints, X-ray absorption fine structure.

The combined techniques of x-ray-absorption fine structure and x-ray diffraction have been used to study the local bonding structure of Sn on Si(111). As the Sn coverage increases the bond structure changes from Sn-Si to Sn-Sn bonds. In addition, both Sn-Sn and Sn-Si bond lengths change with increasing coverage. The Sn-Sn bond lengths are 1.90 Å at 0.1 monolayers and 1.93 Å at 0.5 monolayers, while the Sn-Si bond lengths are 2.30 Å at 0.1 monolayers and 2.36 Å at 0.5 monolayers. These results are in agreement with those obtained for Ge on Si(111) and Hf on Si(111).

201,263
PB2-154707 Not available NTIS

Narrow-Gap + 1.74 a surface superconducting

National Inst. of Standards and Technology (MSEL)

Gaithersburg, MD. Semiconductor Electronics Div.

Phonon Density of States in Pr2-xCexCuO4 and Pr2CuO4.

Final report.

I. W. Sumarni, J. L. Yawn, D. A. Neuman, J. M.


Keywords: *Superconductors, Neutron scattering, In-

elastic scattering, Phonons, Reprints, *Praseodymium-


The authors report inelastic neutron scattering mea-

surements of the generalized phonon density of states

in superconducting Pr2-xCexCuO4 and insulating Pr2CuO4. Substantial decreases in the peak intensities of some of the phonon features, and an increase in the broadening of the peak observed in Pr2CuO4 suggest that the material is changed from the insulating parent compound to the superconductor. The results suggest that phonons are involved in the formation of the superconducting state in these electron-superconductor materials.

201,264
PB2-154764 Not available NTIS

Narrow-Gap + 1.74 a surface superconducting

National Inst. of Standards and Technology (NEL)

Gaithersburg, MD. Semiconductor Electronics Div.

Conservation of Bond Lengths in Strained Ge-Si

Layers.

Final report.

J. C. Woicik, C. E. Bouldin, M. I. Bell, J. O. Cross, D.

J. Tweet, B. D. Swanson, T. M. Zhang, B.

Sorensen, C. A. King, T. Hoy, P. Planeta, and J.

F. Gibbons, 1991, 9p


Keywords: *Germanium, *Silicon, *Chemical bonds, X-ray diffraction, Semiconductor films, Lattice parameters, Bipolar transistors, Heterojunctions, Epitaxy, Reprints, X-ray absorption fine structure.

The combined techniques of x-ray-absorption fine structure and x-ray diffraction have been used to study the local bonding structure of Sn on Si(111). As the Sn coverage increases the bond structure changes from Sn-Si to Sn-Sn bonds. In addition, both Sn-Sn and Sn-Si bond lengths change with increasing coverage. The Sn-Sn bond lengths are 1.90 Å at 0.1 monolayers and 1.93 Å at 0.5 monolayers, while the Sn-Si bond lengths are 2.30 Å at 0.1 monolayers and 2.36 Å at 0.5 monolayers. These results are in agreement with those obtained for Ge on Si(111) and Hf on Si(111).

201,265
PB2-154772 Not available NTIS

Narrow-Gap + 1.74 a surface superconducting

National Inst. of Standards and Technology (NEL)

Gaithersburg, MD. Semiconductor Electronics Div.

Local Bonding Structure of Ge on Ge(111) by Surface Enhanced X-ray Absorption Fine Structure and Photoemission.

Final report.

J. C. Woicik, T. Kendelevicz, K. E. Miyano, C. E.

Bouldin, P. L. Meissner, P. Planeta, and E. W.

Sipe, 1991, 9p


Keywords: *Silicon, *Antimony, *Interface, *Chemical bonds, Photoelectron spectroscopy, Photoemission, Metalizing, Surfaces, Timers, Reprints, Extended x-ray absorption fine structure.

The combined techniques of surface extended x-ray absorption fine structure (SEXAFS) and high-resolution core and valence photoelectron spectroscopy...
have been used to study the local bonding structure of the Sb/(Si)11 interface. From photoemission, the authors find that the Sb atoms adsorb in a unique environment that completely saturates the dangling bonds of the Si/(Si)11 surface. In this study, the surface components of the Si 2p core-level spectrum. The Sb-induced Si 2p core level is found to be shifted 0.20 ± 0.02 eV towards higher binding energy with an intensity that corresponds to the top monolayer of surface atoms. The SEXAFS de-

201.267 PB02-159045 Not available NTIS National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metalurgy Div.

Magnetic Aftereffect in Compositionally-Modulated Ni/Cu Multilayers Prepared by Electrodeposition and By Sputtering.

Final rept.

Keywords: *Magnetization, Electrodeposition, Sputtering, Relaxation, Copper, Nickel, Reprints, Magnetic viscosity, Multilayers.*

A relaxation of the magnetization following a rapid change in the magnetic field has been found in compositionally-modulated Ni/Cu multilayer produced by sputtering. This finding demonstrates that the relaxation process is not simply determined by the amorphous state of the material, but rather is an inherent property of the multilayer process.

201.268 PB02-159151 Not available NTIS National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Neutron, Electron and X-ray Scattering Study of PbZr2YCu3O8, the Prototype of a New Family of Superconductors.

Final rept.

Keywords: *Superconductors, Orthorhombic lattices, Neutron diffraction, Proteins, Reprints,* Lead yttrium zirconate cuprates, Rietveld method.

The structure of PbZr2YCu3O8 has been analyzed with powder neutron diffraction techniques and profile analysis. The results of the study confirm the general features determined by x-ray single-crystal methods. The physical has a tetragonal symmetry, but is orthorhombic, space group Cmcm with lattice parameters a = 5.393(2), b = 5.4311(2), and c = 15.73(4)(6). The orthorhombic distortion is caused by

201.271 PB02-159458 Not available NTIS National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Structure of Er/Y Superlattices.

Final rept.
See also PB02-159441.

Keywords: *Errium, *Ytrrium, *Superlattices, Molecular beam epitaxy, Neutron diffraction, Single crystals, Sapphire, Substrates, Cryogenic temperature, Reprints,*

The magnetic structure of Er/Y superlattices has been determined by neutron diffraction and SQID magnetometry on single crystal samples grown on sapphire substrates by molecular-beam-epitaxy techniques. The turn angle in the Er layers is magnetoelectrically clamped, and, in fact, locks-in to the commensurate state omega = 2p/7 below about 35 K. For the Er(13)/Y(26) superlattice the low temperature state is not 2p/7 but can be shifted to that value by a magnetic field, as the state has a net moment of 8mu/sub B/7 atoms along the c-axis.

201.272 PB02-159466 Not available NTIS National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Magnetoelectricity in Rare-Earth Superlattices and Films.

Final rept.


Elastic constraints on rare-earth superlattices and films grown by molecular beam epitaxy strongly perturb their magnetic structure compared to the bulk materials. Continuing studies of Dy(1)/Y(1) and Er(1)/Y(1) superlattices and Dy Er thin films by neutron scattering and SQID magnetometry have provided new insight into the interplay of magnetoelectric and exchange interactions in rare earths.

201.273 PB02-159565 Not available NTIS National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.

Thermal Wave Measurements of the Thermal Properties of CVD Diamond.

Final rept.

Keywords: *Thermal conductivity, *Thermal diffusivity, Diamond deposition, Ramanometry, Reprints,* Di-

201.274 PB02-159672 Not available NTIS National Inst. of Standards and Technology (IMSE), Boulder, CO. Materials Reliability Div.

Estimated T/sub c/dT and T/sub c/dsigmain the Y1Ba2Cu3O7 Superconductor.

Final rept.

Keywords: *High temperature superconductors, *Superconductors, Elastic properties, Transition temperatures, Yttrium-barium cuprate compounds, Cuprate energy, Otta model.*

For Y1Ba2Cu3O7 the authors estimated the critical-temperature pressure derivative D(sub c)/dP and the three principal uniaxial compressive stress derivatives (D(sub c)/dsub c), (D/sub c/dsub g), and (D/sub c/dsigma(sub c)).
Solid State Physics

Bound-hole transitions originating from a deep level to light-hole Landau levels have been observed for the first time in HgCdTe. Resonances have been seen in the differential transmission of a p-type Hg(0.76)Cd(0.24)Te sample subjected to CO2 laser radiation. The transitions are well described by the Pid-geon-Brown energy band model, yielding an activation energy of 32 ± 3.2 meV above the valence band edge for the deep level.

201,276
PB92-165795 Not available NTIS National Inst. of Standards and Technology (EEEL), Boulder, CO. Semiconductor Electronics Div.

PB92-165569 Not available NTIS National Inst. of Standards and Technology (EEEL), Boulder, CO. Semiconductor Electronics Div.

201,282
PB92-165593 Not available NTIS National Inst. of Standards and Technology (NIST), Boulder, CO. Materials Reliability Div.

PB92-165536 Not available NTIS National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.

201,239
PB92-165034 Not available NTIS National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.

201,277
PB92-165032 Not available NTIS National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.

201,280
PB92-165448 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Materials Reliability Div.

PB92-165632 Not available NTIS National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.

201,294
PB92-165893 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

201,281
PB92-165588 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Semiconductor Electronics Div.

201,279
PB92-165406 Not available NTIS National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.
Growth of Diamond Films by Hot Filament Chemical Vapor Deposition.

201,249
PB92-165110 Not available NTIS National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.

201,284
PB92-165955 Not available NTIS National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.

201,287
PB92-165972 Not available NTIS National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.

201,283
PB92-165836 Not available NTIS National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.

201,285
PB92-165893 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

201,288
PB92-165893 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

201,276
PB92-159821 Not available NTIS National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Beryllium Doping in MBE-Grown GaAs and AlGaAs. Final rep. J. Pellegrino, J. Griffin, L. Myers, and M. Spencer, 1990, 6p. See also PB92-154525 Sponsored by National Science Foundation, Washington, DC.

PB92-154525 Sponsored by National Science Foundation, Washington, DC.

PB92-154525 Sponsored by National Science Foundation, Washington, DC.
X-ray Absorption Near-Edge Structure of Transition-Metal Zinc-Blende Semiconductors: Correlation between Experimental Data and the Pre-Edge Feature

D. A. McKeown, 1992, 6p
Published also in Physical Review B, 45, n6:2621-2633, 1 Feb 92.

Keywords: X-ray absorption, Chalcopyrite, Sphalerite, Zinc sulfides, Semiconductors, Reprints.

X-ray-absorption near-edge structure (XANES) data were collected on sphalerite (ZnS), and for Cu and Fe in chalcopyrite (CuFeS2), where all three cations are in nearly identical coordination environments. The data have similar features, except near the edge where the edge maximum decreases in amplitude, while a pre-edge feature appears and increases in amplitude from Zn to Cu to Fe. The pre-edge feature is previously assigned to a 1s-to-3d atomic transition for Cu and Fe in the chalcopyrite structure. XANES calculations were performed for all three edges. The multi- and single-scattering contributions to the calculated XANES were found to be due to interference effects from the atomic structure surrounding the absorber, but cannot exclude the possibility that the pre-edge feature is due to atomic bond-state transitions of the absorber.

Physics

Solid State Physics

Structure of Er(Vertical Bar)Y Superlattices


See also PB90-149444. Sponsored by National Science Foundation, Washington, DC.

Published in Physical Review B, 43, 3431-3432 Dec 88.

Keywords: Superlattices, Erbium, Yttrium, Molecular beam epitaxy, Neutron diffraction, Single crystals, Magnetostriiction, Substrates, Sapphire, Reprints.

The magnetic structure of Er (vertical bar) Y superlattices has been determined by neutron diffraction and X-ray absorption spectroscopy grown on sapphire substrates by molecular-beam-epitaxy techniques. The turn angle in the Er layers is magnetically elastically clamped, and in fact locks-in to the commensurate state omega = 2pi/7 about below 35 K. For the (Er13 (vertical bar) Y2) superlattice the low temperature state is not 2pi/7 but can be shifted to that value by a magnetic field, since this state has a net moment of 8 mu(sub B)/7 atoms along the c-axis.

PB92-170132 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.

Anisotropic Magnetic Response of Rare Earths in Superlattices


Keywords: Superlattices, Dysprosium, Erbium, Yttrium, Anisotropy, Reprints, Magnetic ordering.

We have observed that Dy layers, in Dy/Y superlattices grown along the c-axis, couple together to produce long range order even though Y space layers over 120 A thick. In superlattices grown along the b-axis, however, coupling is observed in y-space layers as little as 26 A thick. The observed range and anisotropy of the interaction is discussed in terms of the fundamental response of Y to local magnetic perturbations.

PB92-170107 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.

Thermal Diffusivity of CVD Diamond Films Using Time-of-Flight Neutron Techniques


Published in Photoacoustic and Photothermal Phenomena II, p130-132 1990.

Keywords: Thermal diffusivity, Chemical vapor deposition diamond, Thin films, Radiometry, Reprints, Diamond films.

The thermal diffusivities of CVD diamond films have been measured by means of photothermal radiometry.

PB92-171255 Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Optics and Electro-optics Div.

Secondary Ion Yield Matrix Effects in SIMS Depth Profiles of Si/Ge Multilayers


Published in Surface and Interface Analysis 14, n1:771-780 1989.

Keywords: Germanium, Silicon, Auger electron spectroscopy, Thin films, Reprints, Secondary ion mass spectroscopy, Depth profiles, Multilayers.

The secondary ion mass yield of Si/Ge multilayers was investigated using the SIMS technique. Thin multilayer samples of Si/Ge, with individual layer thicknesses ranging from 20 to 1000 A, were used for studies of the secondary ion mass spectrum (SIMS) using Ar(1+), O2(1+), and Cs+ (1+) primary ion beams. Bombardment of silicon resulted in Cs+ (1+) production in the secondary ion depth profiles in which pronounced distortions were observed. Similar effects were found in secondary ion depth profiles with pronounced distortions. In each case, the SIMS depth profiles were characterized by abrupt interfacial secondary ion signal variations and an apparent shift in the secondary ion signal periodically indicating that the layers were superimposed, a condition which was not consistent with sample preparation, as verified by Auger electron spectroscopy (AES). AES depth profiling also revealed the presence of a deep-lying oxygen containing layer. From the data it was concluded that the distortions in the positive secondary ion depth profiles under A(1+) and O2(1+) were due to the oxide layer formed by the presence of oxygen induced ion yield variations induced by enhanced incorporation of ambient oxygen, during sample preparation, into the strongest secondary ion signals. Under primary ion bombardment, the SIMS depth profiles were introduced by differential incorporation of the implanted ions into the surface species and into the lower-sputtering yield silicon layers.

PHYSICS

Solid State Physics

Surface Analysis of Interfacial Properties for Thin Film and Bulk YBa2Cu3O7


Final report.


Keywords: High temperature superconductors, "Superconducting films, Auger electron spectroscopy, Grainless, Edge-on, Field emission, Surface chemistry, Electric contacts, Thin films, Interfaces, Indium, Silver, Reprints," Yttrium barium cuprates.

Auger electron spectroscopy (AES) has been used to characterize variations in contact resistances observed for these technologically important materials.

PB92-171644 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.

Temperature Dependence of Magnetic Order in UPdSn


Keywords: Palladium intermetallics, "Thin intermetallics, Temperature, Time-of-flight method, Antiferromagnetic materials, Temperature dependence, Cryogenic temperatures, Magnetic moments, Neutron diffraction, Reprints, "Uranium intermetallics, Magnetic ordering.

The intermetallic compound UPdSn has been studied by means of neutron powder diffraction on a two-axis spectrometer. At the lowest temperature, its noncollinear antiferromagnetic with magnetic space group P(sub 3)c2(sub 1), and a uranium magnetic moment of (2L0)(sub 3)(sub K) 0.04 mo (K = constant) was observed. This preliminary work is in agreement with several previous results. The structure can be described in terms of the magnitude of the uranium magnetic moment mu at the independent cations theta and phi. phi is the angle between the magnetic moment and the c-axis; theta is the angle between the in-plane component of the magnetic moment and the b-axis. There is no detectable temperature hysteresis in any of the alloys. The magnetic order and magnetic transitions among all three model parameters (mu, theta, and phi) vary continuously with temperature. There is no evidence from the authors' data of any sharp transitions below the Neel point of 43 + 0.2 K. The angle theta decreases continuously with temperature in the range, while the magnetic moment decreases continuously until it disappears just above 40 K. The angle phi decreases continuously from a value of about 35 K, where it appears to rise again. In the course of the work, the authors have also demonstrated the consistency of the results for magnetic systems, whether they are measured by the conventional reactor constant-wavelength technique or by the time-of-flight method on a pulsed spallation source.
Magnetic Susceptibility of Pr2CuO4 Monocrystals and Polycrystals.

Final rep.
M. Foldeki, H. Ledbetter, and Y. Hidaka. 1991, 3p
Pub. in Jnl. of Applied Physics 70, n10 p5736-5738, 15 Nov

Keywords: "Magnetic susceptibility, Superconductor, Copper oxide, Polycrystals, Monocrystals, Temperature, Critical current, Magnetic field, Polycrystalline, Monocrystalline, Preparation, Measurements.

The authors measured the temperature dependence of Pr2CuO4 and polycrystals with various field and temperature dependencies. The measurements were performed using different methods and techniques, focusing on the critical current and magnetization behavior of these materials. The experiment results showed that the superconducting properties of Pr2CuO4 are influenced by the crystallographic and temperature dependence, Magnetic fields, Crystal field, Reprints, Pseudoamorphy cuprates.

This work is significant for understanding the magnetic and superconducting properties of Pr2CuO4 and its derivatives, which are important for applications in high-temperature superconductivity and magnetic materials.

158
Monocrystal Elastic Constants of Orthotropic Y1Ba2Cu3O7: An Estimate.

Keywords: *High temperature superconductors, Single crystals, Debbye temperature, Bulk modulus, Elastic properties, Y1Ba2Cu3O7 crystals.*

For Y1Ba2Cu3O7, using only reported monocrystal measurements and some analysis-theory, the authors estimated the complete nine-component orthotropic-elastic stiffness matrix, the Voigt Cij matrices. Comparison with very-high-frequency tetragonal-symmetry phonon-dispersion results shows good agreement (8% on average), except for C12.

201.301
PB92-175512

Keywords: *High temperature superconductors, Critical field, Magnetic susceptibility, Magnetization, Anisotropy, Reprints, *Y*Ba*2Cu*3O*6* crystals, Weak links.*
The authors studied the weak-link nature of sintered, grain-aligned YBa2Cu3Ox, using DC magnetization and AC susceptibility. The sample was highly anisotropic for fields applied perpendicular and parallel to the grains and a plane. For fields applied perpendicular to the a,b planes, the magnetization curves show small intergranular coupling losses and the susceptibility curves show sharp coupling transitions. For parallel fields there are large coupling losses and broad transitions. From AC susceptibility measurements in parallel fields, the intergranular lower critical fields are no higher than 1.9 Oe at 76 K and 0.5 kA/m (6.3 Oe) at 4 K. In perpendicular applied fields, the fields were 0.3 kA/m (3.8 Oe) at 76 K and 1.3 kA/m (16.3 Oe) at 4 K.

201.305
PB92-175561

Keywords: *Scanning tunneling microscopy, High temperature superconductors, Strontium titanate, Magnesium oxides, Temperature dependence, Substrates, Thin films, Reprints, YBa2Cu3O7 crystals, Lanthanum alumina, Laser ablation.*

Scanning tunneling microscopy (STM) images of YBa2Cu3O7 (YBCO) thin films show different growth mechanisms depending on the deposition method and substrate temperature. The authors present images of YBCO films sputtered deposited onto MgO and SrTiO3, and laser ablated onto LaAlO3 showing screw dislocation and layered growth mechanisms. At room temperature, they observed an anomalous tunneling conductance near the edge of growth steps which causes a large apparent step-edge height in the STM image. The effect decreases with decreasing temperature, so that the step height approaches the expected value for one unit cell at 76 K. The anomalously large step-edge height near 76 K is explained in terms of changes in either the surface tunneling barrier or tunneling density of states upon cooling.

201.309
PB92-175777

Keywords: *High temperature superconductors, Critical field, X-ray relaxation, Neutron diffraction, Crystal chemistry, Reviews, Reprints, Lanthanum strontium cuprates, YBa2Cu3Ox cuprates, Bismuth strontium cuprates.*

The high temperature superconductors discovered so far belong to five chemical systems having the following general formulas: (1) BaPb1-xBixO3, (2) La2-Ma2 (Mg = Ba, 9x), (3) Ba2Cu1-x+xO2+delta, (4) Ba2-xLa1-xCuO4+delta, and (5) Bi2Ca2Sr2CuO6+delta. The structures of the superconducting compounds, and those of the related phases, have been studied by both X-ray and neutron diffraction techniques, and in the chapter the authors review the atomic and electronic structure of the most important members available up to the present time.

201.307
PB92-192103
(Order as PB92-192079, PC A05)

Keywords: *Electron microscopes, Standards, Calibration, Transmission electron microscopy, Scanning electron microscopy, Film thickness, Ellipsometry, Poly- siliciums, Oxides, Magnification standards.*

The calibration of a new submicrometer magnification standard for electron microscopes is described. The new standard is based on the width of a thin thermal-oxyde film sandwiched between a silicon single-crystal substrate and a polysilicon capping layer. The calibration is based on an ellipsometric measurement of the oxide thickness before the polysilicon layer is deposited on the oxide. The uncertainty in the derivation of a correction factor from the ellipsometric parameters is also derived.

201.309
PB92-196088
PC A06/MF A02

Keywords: *Ferroelectric crystals, Barium titanates, PZT, Nonvolatile memories, Laser ablation, Crystal structure, Thin films, Pulled laser deposition.*

The report describes the development of piezoelectric lead zirconate-titanate (PZT) and barium titanate (BT) thin films applied for hard disc drives for electronic devices such as computers. The work was done in the period from January 1989 to December 1991 in the Ceramics and Metallurgy Divisions at NIST under partial support of the Department of the Army through Harry Diamond Laboratory.

201.309
PB92-197359

Keywords: *Resonant tunneling, Hamiltonian functions, Scanning tunneling microscopy, Transition probabilities, Frequency response, Reprints, Quantum wells, FM.*

A method, originally due to Heitler, is used to extend the transfer Hamiltonian description to resonant tunneling for the purpose of calculating transition probabilities and general frequency response characteristics of coupled systems. The scanning tunneling microscope (STM) is treated as an example of a single particle system, and an irradiated cantilever well as an example of a double barrier. The saturation of the contact resistance in the STM is easily derived and a simple physical explanation for the high-frequency response of an irradiated double junction is presented. In the latter case, it is found that the true high-frequency response for high frequencies is limited by the optical properties of the outer electrodes of the double barrier.

201.310
PB92-197532

Keywords: *Antiferromagnetism, Iron alloys, Chromium alloys, Nickel alloys, Magnetic susceptibility, FCC lattices, Temperature dependence, Field theories, Neel temperature, Reprints.*

A generalized molecular-field theory is used to consider the magnetic-susceptibility-temperature behavior of some face-centered-cubic (f.c.c.) Fe-Cr-Ni alloys. These alloys represent the first reported case of the first type of antiferromagnetic behavior with a positive paramagnetic Neel temperature.

201.311
PB92-197575

Keywords: *Resonance scattering, Resonant tunneling, Inelastic scattering, Electron scattering, Electron emission of hydrogen oxide(NO), Platinum, Phonons, Reprints, Laser induced desorption, Quantum wells, Heterostructures.*

Excitation of a localized oscillator or phonon due to tunneling charge transfer into and out of electronic states linearly coupled to the oscillator is considered within several different contexts. Specifically, the basic physical content of the mechanisms responsible for phonon broadening in core-level spectroscopy, intramolecular vibrational excitation in resonant electron scattering, phonon excitation in resonant electron tunneling through quantum-well heterostructures, and hot-electron-induced resonant desorption is shown to be similar. Existing exact solutions to the scattering and tunneling problems are here adapted to resonant desorption and numerical consequences such as excitation and desorption cross-sections and thermal energy distribution are obtained. These results and insights are considered in the light of a semiclassical electron-phonon dynamics model, which previously had been developed to account for observed nonthermal, laser-induced desorption in the system NO/PH(111).

201.312
PB92-197581

Keywords: *Superconductors, Critical current, Electrical measurement, High temperature superconductors, Interlaboratory comparisons, Uncertainty, Precision, Electrons, Trends, USA, Reprints.*

The paper indicates trends in superconductor measurement technology in the USA, and discusses available methods to reduce measurement uncertainty and improve accuracy. The results of interlaboratory comparisons of critical-current measurements have indicated that a detailed sample test procedure is essential to achieve traceable laboratory measurement validation. High temperature superconductors are particularly susceptible to degradation with time, mounting, and use. These factors influence the accuracy of the measurement, and play a similar role in the measurement uncertainty as do random processes. A general reference material such as SHM-1457 or a
superconductor simulator can greatly aid in identifying sources of measurement variation. Although HTS and LTS technologies are at different stages of maturity, their respective uncertainties in critical current may be reduced using a detailed sample test procedure.

201,313
PB92-197805 Not available NTIS
National Inst. of Standards and Technology (NSI), Gaithersburg, MD. Semiconductor Electronics Div. Keywords: *High temperature superconductors, Critical Current Density, Measurement. A computer code for simulating the behavior of high-temperature superconductors as a function of temperature and current density. The code is based on a one-dimensional model and includes realistic material properties. The results are intended to aid in the design and optimization of superconducting devices. The code is available in FORTRAN 77 and can be run on a standard computer.

201,314
PB92-197912 Not available NTIS
National Inst. of Standards and Technology (NSI), Boulder, CO. National Institute of Standards and Technology (NIST), Boulder, CO. Keywords: *Superconductors, Electrical property, Temperature dependence, Critical Current Density. The research investigates the temperature dependence of the critical current density of high-temperature superconductors. The study utilized a novel measurement technique to determine the critical current density over a wide range of temperatures. The results provide valuable insights into the behavior of these materials and have implications for the design of advanced superconducting devices.

201,317
PB92-205426 PC A05/MA01 National Inst. of Standards and Technology (NSI), Gaithersburg, MD. Keywords: *Workshop on Characterization of Diamond Films, Gaithersburg, MD. A workshop on the characterization of diamond films was held in Gaithersburg, MD. The workshop aimed to bring together experts from academia and industry to discuss the latest advancements in the field and to identify future research directions.

201,320
PB92-236371 Not available NTIS
National Inst. of Standards and Technology (NSI), Gaithersburg, MD. Nuclear Magnetic Resonance in Rare-Earth Nuclei in Rare-Earth Hosts: Application to (160)Tb. A study was conducted to investigate the nuclear magnetic resonance properties of (160)Tb in various host materials. The results provide valuable insights into the behavior of this nucleus in different environments and have implications for applications in magnetic materials and spintronics.

201,321
PB92-236413 Not available NTIS
National Inst. of Standards and Technology (NSI), Gaithersburg, MD. Ceramic Devices. A review of advances in ceramic devices, focusing on their applications in various fields such as electronics, energy, and medicine. The article discusses the properties, synthesis, and characterization of ceramic materials, as well as their use in practical devices and systems. The review highlights the importance of ceramic materials in modern technology and their potential for future applications.
Preparation of Bi-Pb-Sr-Ca-Cu-O Superconducting Composites Using Glass Technology.
Final rept.

Keywords: *Superconducting composites, High temperature superconductors, X-ray diffraction, Glass, Reduced oxygen concentrations.*

High Tc Superconducting Films on Silicon Wafers. Final rept.

Keywords: *Superconducting films, High temperature superconductors, Orthorhombic lattices, Electrical resistivity, Thin films, Substrates, Silicon, Wafers, Reprints.*

Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Temperature and Pressure Div.

Magnetization of Single-Crystal Terbium at Very Low Temperatures by Nuclear Orientation.
Final rept.
See also PB89-179204.

Keywords: *Terbium, Magnetization, Temperature range 0000-0013 K, Oriented nuclear, Bulk magnetization,* Bi2CuO3, Single crystals, Magnetic anisotropy, Reprints.

We report an investigation of the magnetization of high-purity single crystal terbium below 50 mK, using the nuclear orientation of (160)Tb, which substitutionally replaces naturally-occurring, monoisotopic (159)Tb. The nuclear alignment is determined as a function of applied magnetic field, and can be related to the macroscopic magnetization of the host crystal by a suitable model. In the easy direction (a-axis), a very rapid rise is seen in the first 7 mT of applied field; this is followed by a plateau region up to 0.1 T, then a slow saturation, completed at ca. 0.4 T. Along an a-axis, a similar rapid increase to about 50% of saturation is observed below 10 mT, followed by a slow, nearly linear increase which agrees with that calculated for domain rotation using the measured crystalline anisotropy constants.

Not available NTIS National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Applied and Computational Mathematics Div.

Micromagnetics of Surface Segregation Regions in Domains Written in TbFeCo Alloys.
Final rept.

Keywords: *Magnetic domains, Scanning electron microscopy, Magnetic films, Thin films, Terbium alloys, Iron alloys. Cobalt alloys, Mathematical models, Micromagnetics,* Spin alignment, Reprints, Surface magnetochemistry, Micromagnetics.

Domains written in thin films of TbFeCo were observed with scanning electron microscopy with polarization analysis (SEMPA). The SEMPMA measurements revealed that the rare earth metal has a direct effect on the orientation of the surface magnetization which is tilted with respect to the sample normal due to saturation and oxidation processes. We modeled the magnetic structure of domains in thermal equilibrium by solving the Landau-Lifshitz-Gilbert equations. The model of the thin film has a thicker (but different from that in bulk) film. The surface magnetic properties vary for different surface layer thicknesses and magnetic parameters.
PHYSICS

Solid State Physics

Magnetic Order of Cu In Nd2-xCexCuO4.

201,327
PB92-237601 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Two-Dimensional Rietveld Magnetic Order of Dy Ions in Dy2Ba4Cu7O15.
Final rep.

Keywords: "Dysprosium ions, Neutron scattering, Two dimensional, Antiferromagnetism, Reprints, "Dysprosium barium cuprates, Magnetic ordering."

Neutron scattering has been used to investigate the magnetic ordering of Dy ions in the Dy2Ba4Cu7O15 material. A modulated saw-tooth scattering profile is observed indicative of a coupled-biayer two-dimensional (2D) system in which the Dy spins within the a-b planes are coupled antiferromagnetically, with Tc = 1.2 K. The 2D order originates from the crystallographic structure, as the c-axis spacing of the magnetic ions is about 3 times the a-b spacing. In addition, every other a-b plane is reversed by 90°, causing a cancellation of magnetic interactions which completely isolates the bilayers. We anticipate that a similar coupled-biayer 2D behavior should occur in other

R2Ba4Cu7O15 (R = rare earth element, except Er) in which nearest-neighbor spins within the a-b planes are coupled antiferromagnetically.

201,332
PB93-12550 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Neutron Powder-Diffraction Study of the Crystal Structure of YSr2Cu2O7 and Y1-xCe(x)Sr2Cu2O7.
Final rep.

Keywords: "Crystal structure, Neutron diffraction, Lattice parameters, Reprints, Yttrium strontium cupate bilayers, Yttrium calcium strontium cupate bilayers."

The structures of YSr2Cu2O7 and Y1-xCe(x)Sr2Cu2O7 have been analyzed by neutron powder diffraction techniques. Both materials crystallize with the symmetry of space group Ima2. The lattice parameters are given. In the undoped compound, the Sr ions exclusively substitute for the copper ions located on the chain sites of the 123 parent structure (YBa2Cu3O6 + x). The coordination of Co is tetrahedral (4CoO6) for the COON transition temperature with a zig-zag configuration along the c-axis of the structure. The oxygen atoms of the CoO layers were found to be disordered over two positions. A re-analysis of the compound Y2SrGa2CuO7 showed that this type of disorder is much less pronounced in this material. The disorder of the CoO4 tetrahedra results in the coexistence of two types of chains. In the structure of the doped compound Y1-xCe(x)Sr2Cu2O7, calcium substitution for strontium, which cobalt replaces coplanar on the chain sites and in the CuO2 planar sites, thus explaining the lack of superconductivity in this material. The oxygen atoms on the Co layers are more disordered than in the undoped material.

201,334
PB93-12568 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Neutron Powder-Diffraction Study of the Nuclear and Magnetic Structures of Yba2Fe3O8 at Room Temperature.
Final rep.
Pub. in Physical Review B 45, n17 p9611-9619, 1 May 92.

Keywords: "Crystal structure, Neutron diffraction, Magnetic moments, Room temperature, Antiferromagnetism, Effects of substitution of barium lattices, Rietveld method, Magnetic ordering."

The nuclear and magnetic structures of Yba2Fe3O8 have been investigated by powder neutron diffraction at room temperature. The nuclear structure of the compound has the symmetry of space group P4/mmm and lattice parameters a = 3.9170(1) and c = 11.8252(4). The configuration of the atoms in the unit cell is very similar to that of the superconductor YBa2Cu3O7, with the exception that the iron ions corresponding to the Cu-3 ions have octahedral coordination, rather than square planar, the octahedra thus are arranged in layers rather than in chains. The magnetic origin of the extra intensities and the basic spin wave dispersion is determined by polarized-neutron-diffraction measurements. The iron moments are coupled antiferromagnetically within each FeO2 layer, as well as along the oxygen layers of the unit cell. All the iron ions are the same. This configuration results in the magnetic symmetry (sub)咪m'.

201,325
PB93-12556 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Magnetic Properties of a Chemically Synthesized Bi(Pb)SrCaCuO Superconductor.
Final rep.

Keywords: "High temperature superconductors, Synthesis (Chemistry), Flux pinning, Lead additions, Magnetic susceptibility, Magnetic properties, Alternating current, Reprints, Bismuth strontium calcium cuprates."

It has been reported that the presence of lead serves to increase the fraction of high temperature phase in the Bi-Sr-Ca-Cu-O system prepared by a solid state reaction route for materials. The results obtained here were prepared by a chemical method, a lead containing bismuth strontium calcium copper superconductor (BiPb0.5Sr0.5Sr1.5Ca1.75Cu2Ox) was chemically synthesized and its magnetic properties measured. The material obtained contained a large fraction (50%) of a phase with a superconducting onset temperature near 93 K. Inspection of the AC susceptibility with a small applied transverse magnetic field indicated the presence of additional superconducting phases with lower onset temperatures. Flux pinning was found to occur at relatively low fields.

201,336
PB93-12554 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Two-Dimensional Behavior of the Rare Earth Or- ders in Oxide Superconductors.
Final rep.

Keywords: "Superconductors, High temperature superconductors, Superconductivity, The two-dimensional Ising model, Rare earths, Antiferromagnetism, Reprints, Magnetic ordering, Erbium barium cuprates, Dysprosium barium cuprates."

Neutron scattering has been used to explore the nature of the magnetic ordering of the rare earth ions in 1-2-3, 2-4-8, and 1101 high-temperature oxide superconductors. The interactions are found to be antiferromagnetic in nature and quite weak, leading to ordering temperatures which are a few Kelvin less. In the first three systems the separation of the rare earth ions is much larger along the c axis than along the a-b directions, which renders these materials both two-dimensional (2D) and magnetic. In the ErBa2Cu4O8 and DyBa2CuO7 systems, for example, a rod of scattering characteristic of 2D behavior is readily observed, while the order parameter obeys the exact solution of the 2 = 1/2, 2D Ising model. An extreme case of 2D behavior is found for the DyBa2Cu4O8 material, where a geometric cancellation of the already weak interactions occurs along the c axis, effectively decoupling the rare earth spins. The system exhibits a crossover to the 3D behavior usually found well below the ordering temperature, making it the best example of a 2D magnet known to date.

201,337
PB93-12557 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Magnetic Rare Earth Superlattices.
Final rep.
See also PB90-170341 and DE88003483. Sponsored by Department of Energy, Washington, DC.

Keywords: "Superlattices, Molecular beam epitaxy, Rare earths, Metal films, Thin films, Gadolinium, Dysprosium, Holmium, Erbium, Yttrium, Reprints, Magnetic ordering."

Advances in molecular beam epitaxy deposition techniques have recently made it possible to grow, an atomic plane at a time, single crystalline superlattices of rare earth metals on substrate materials such as magnetic rare earth, such as Gd, Dy, Ho, or Er, and metallic Y, which has an identical chemical structure. The primary goal of this research is to use the new and interesting magnetic rare earth superlattices which have been discovered in these novel superlattice systems and to consider what implications the discovery of the new phase has for our understanding of the underlying microscopic magnetic interactions. In particular, the effects of the artificial periodicity of the superlattices on magnetic order in and epistrial planes on the resulting long range magnetic order of Gd-Dy, Dy-Ho, Er-Y, and Gd-Dy superlattices are described.
The linear stability of circular Couette flow between concentric cylinders, Prandtl number, Stability, Couette flow, Reprints.

The stability of the two-phase system depends on the Prandtl number. For small Prandtl number, the linear stability of the two-phase system is given by the classical results for a two-fluid system. For increasing values of the Prandtl number, convective heat transport becomes significant and the system becomes energy less stable. The narrow-gap approximation is extended to the case of a finite gap, and both axisymmetric and non-axisymmetric disturbances are considered. The two-phase system becomes less stable as the gap tends to zero. The two-phase system is more stable with a small gap than in a single-wavenumber n = 1; the stability of these n = 1 modes is sensitive to the latent heat of fusion.

Field-Ion Microscope Image Simulations for Icosahedral Al-Mn

New computer simulations of field ion microscope (FIM) images for the icosahedral phase of Al-Mn, using the Moore-schell methods, are presented and compared to the experimentally observed images. The closest agreement found thus far is for a cubic model having a 3.32 nm unit cell edge and containing an icosahedral inner motif, with all Mn and only some of the aluminum atoms included in the simulated images. (An icosahedral-motive decoloration of a perfect 3-D Penrose tiling was also tested for comparison.) The surprising result can be understood as the result of inner-cell motif domination over the parent cubic features, due to the very large unit cell size.
Analysis of single crystal X-ray diffraction data of tetragonal Ti2Ba2CuO6+δ delta is totally consistent with the neutron powder diffraction results.

Accumulation of Creep Damage Under Varying Temperature Conditions.
Final rept.

Keywords: *Creep properties, *Cyclic loads, *Thermal stresses, *Anisotropic solids, Temperature gradients, Damage, Creep, Fracture(Materials), Stress concentration, Temperature effects, Stress analysis, Reprints.

A method was developed for calculating the creep damage accumulated in a material subjected to varying temperatures under constant stress. To the extent that the creep behavior of the material may be described with the Larson-Miller parameter, and creep damage accumulates according to the life-fraction rule, the method can be extended to allow the calculation of creep damage at constant temperature. This expression was derived for a number of cases in which the temperature varies monotonically and also for cases in which the temperature cycles repetitively.

Keywords: *High temperature superconductors, Electron trousers, Transformation temperature, Isotope effect, Cuprates, Phonons, Reprints.

The effects of electronic mechanisms for electron pairing in high temperature superconducting oxides on both the transition temperature Tc and the isotope effect parameter alpha are considered. It is shown that for the higher Tc oxides, measured values of Tc and alpha together with estimates of the phonon contributions are not consistent with high-frequency electronic mechanisms. Limitations of the theory and some constraints on low-frequency electronic mechanisms are also discussed.

Green's Functions for Elastic Networks with Rigid Body Motion.
Final rept.

Keywords: *Elastic analysis, *Greens function, *Rigid structures, Dynamic response, Structural analysis, Degrees of freedom, Structural engineering, Structural members, Fourier transformation, Beams(Supports), Reprints.

A procedure based on the theory of generalized functions is applied to the calculation of impulse response functions of structural networks with rigid body motion. The degrees of freedom of two systems are considered, both of which may be viewed as representative of certain large space structures. The first system consists of structural members with no shear and bending capacity, and Timoshenko beams with no torsional capacity. The second system is a collection of Timoshenko beams, some of which do and some of which do not have torsional capacity. In both cases all members are rigidly connected at the network joints. Equations yielding impulse response functions are derived, and results of numerical calculations based on these equations are presented. The results confirm the practical feasibility of the procedure applied in this paper for the calculation of impulse response functions for relatively complex structural networks.

Structural Mechanics

201,347

Keywords: *Silicon, *Band theory, Solid-state plasma, Room temperature, Conduction bands, Valence bands, Bipolar transistors, Energy gap, Reprints, Density of states, Bandgap narrowing.

The density of states at the conduction and valence bands of silicon has been calculated at 300 K for the case of an electron-hole plasma which occurs at high injection levels in bipolar devices.

201,348
PB93-135515 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Divs. Determination of the Polarization-Depth Distribution in Polar Ferroelectric Ceramics Using Thermal and Pressure Pulse Techniques. Final rept.

Keywords: *Ferroelectric materials, Polarization, Ceramics, Slabs, PZT, Reprints, Pressure wave propagation method, Thermal pulse method.

The paper is the first of a series with the common theme of comparing thermal and acoustic pulse methods of measuring charge or polarization profiles across the thickness of slab-shaped samples that are representative of different types of materials. In this paper, thermal and pressure pulse measurements are reported of the polarization distribution in poled, ferroelectric ceramic samples. The results obtained from both methods are complementary so that there is a benefit to using both. The results also demonstrate that large deviations from uniform polarization can be induced by processing differences.

201,352
PB92-365354 Not available NTIS National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Structures Div.

Structural Mechanics

201,349
PB92-159771 Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
ble systems whose unperurbed flows have homoclinic/heteroclinic orbits. For such systems we show that certain motions with noise-induced jumps are in fact chaotic. Smale horseshoe sequences. Consequences of our result are that noise can, by itself, induce such chaotic motions. In the presence of period- or quasi-periodic excitation, noise cannot suppress chaotic motion that might otherwise occur; rather, its effect is to broaden the windows of chaotic behavior.

General 201,355
AD-P007 074/8 PC A01/MAF 01
National Inst. of Standards and Technology, Gaithersburg, MD.
Integration of the Schr"{o}dinger Equation on a Mas-
-sively Parallel Processor.
J. Parker, S. Blodgett-Ford, and C. W. Clark. 22 May 92, 4p.
This article is from 'Optical Society of America (OSA) Proceed-
ing of the Topical Meeting (5th) on Short-Wave Length Coherent Radiation: Generation and Appli-

Keywords: *Parallel processors, *Schroedinger equa-
tion, *Coherent optical radiation, Computer architec-
ture, Atomic spectra, Short wavelengths, Coherent ra-
diation, Photoelectrons, Harmonics, Ionization, Syn-
mosia, Component Reports.
We use a massively parallel computer to integrate the time-dep-
dendent Schroedinger equation for hydrogen in high-intensity 
field. We solve using Electric and Harmonic radiation spectra are presented. The behavior of atoms in strong radiation fields depends critically then the time evolution of the field. For example, it has been found that above-threshold ionization (ATI) spec-
tra show radical changes as the duration of the exci-
ting laser pulse decreases. There is also theoretical evi-
dence for novel phenomena, such as population trap-
ing, which occurs only for relatively short pulses. In order to trate problems of this sort theoretically, one 

must employ methods that accommodate general time 

variation of the radiation field. The most direct such 

method is numerical integration of the time-dependent Schroedinger equation. This would be an entirely non-

controversial approach if vast computational re-
sources were not required to implement it in prati-
c. To date there have been only a few reports of direct 

integration of the time-dependent Schroedinger equa-
tion for a three dimensional, one-electron in a radiation field.

Monte Carlo Calculation of Multiple Scattering Ef-
facts in Thermal Neutron Scattering Experiments: 
Modification to Spherical Geometry.
Pub. in Computer Physics Communications 66, 403-

Keywords: *Thermal neutrons, *Neutron scattering, Mu-

configuration, Computerized simulation, Reprints, 

MSCAT85 computer program.

The Monte Carlo program 'MSCAT85' is used to calcula-
tate multiple scattering effects in thermal neutron scat-
tering experiments. The standard sample geometry for 

the program is one or more cylinders normal to the 

scattering plane. The author describes a subroutine 

which enables the user to perform calculations on 

spherically shaped samples.

201,361
PB92-14468 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Scattering Effects Without Absorbing Sphere Im-
merged in a Field of Neutrons.
Pub. in Nuclear Instruments and Methods in Physics 


Keywords: *Neutron flux, Neutron transport theory, 

Neutron absorption, Neutron scattering, Monte Carlo 

method, Acceleration analysis, Diffusion theory, Spheres, 

Reprints.
Considered is the flux distribution within an isolated 

sphere in a field of neutrons, in the one-speed approxi-
mation. The sphere is characterized by its radius R and 

its macroscopic scattering and absorption cross sec-
tions, Sigma(sub S) and Sigma(sub A) respectively. The 

sphere is entirely within the sphere to the unper-

turbed flux (into which the sphere was placed) is 

designated f. It is shown that f is independent of the 

driving current of the external neutron field; for ex-

ample it is the same for a neutron beam as for an iso-

tropic field. For a purely absorbing sphere f is also

known and easily derived. For a purely scattering 

sphere f is unity. For a sphere which both scatters and 

absorbs neutrons f is calculated using the neutron 

transport equation. For a given size of sphere, it is 

found that f decreases (slightly) as Sigma(sub S) is 

increased at constant Sigma(sub A). An implication of 

these results is that for a given surface area of the 

scattering Neutron activation analysis experiments with neutron beams, is that the use of spherical samples should be encour-

aged whenever possible. The use of scattering mate-

rials on the other hand is not recommended because of the 

uncertainty in the correction for scattering effects which is relatively small for this shape of 

sample.

201,362
PB92-14459 Not available NTIS
National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Technology Div.
Effect of Transverse Stress on the Critical Current of 

Bronze-Process and Internal-Tin Nb3Sn.
See also DE89001497. Sponsored by Department of 

Energy, Washington, DC.
Pub. in Jnl. of Applied Physics 69, n14p436-4438, 15 

Apr 91.

Keywords: *Stress, *Superconducting wires, *Critical current, *Inducing magnets, Mi-

crostructure, Stresses, Reprints.

The effect of transverse stress on the current critical of 

two substantially different Nb3Sn superconductors, a 

bronze-process conductor and an internal-tin conduc-

tor, is considered. Photomicrographs of the internal-

conductor reveal a basic difference in their micro-

structures. The bronze-process conductor exhibits co-

lumns, whereas the internal-tin conductor is more 

equaxed and randomly oriented. The relative orientation of the bronze-process grains def

ines an anisotropy between the axial and transverse 

directions that might account for the greater sensitivity of the critical current to transverse stress reported previ-

ously. The effect of transverse stress measured on the internal-tin conductor, however, is comparable to 

that of the bronze-process conductor. Thus, these

201,362

165
data indicate that the transverse stress effect is not highly dependent on either grain morphology or fabrication process. From an engineering standpoint the similarity of the transverse stress effect for these two types of Ni3Sn superconductors represents an important simplification for setting first-order quantitative limits on the mechanical design of large superconducting magnets.

201.362
PB92-145491
Not available NTIS National Bureau of Standards (NEI), Boulder, CO, Electromagnetic Technology Div.

Superconducting Detector for Minimum Ionizing Particles

Final report

See also DE9001985.

Keywords: *Superconducting coil detectors, Transition temperature, Superconducting films, Ionizing radiation, KeV range 1-10, Thin films, X-rays, Reprints, Vortex detectors.

Although the detection of alpha-particles by thin superconducting films has been demonstrated previously, detection of the significantly smaller energy deposited by minimum ionizing particles (mips) requires independent verification. Experimental work has been reported on films for approximately 6 keV x-rays, which deposit energies comparable to mips, are used to show that the switching probability is significantly smaller than predicted by the simplest energy balance model. As a result, the simplifying assumptions of the model are in question, and it is demonstrated that practical detectors of mips will greatly benefit from, and most probably require, superconducting transition temperatures which are close to a liquid nitrogen temperature (e.g. 77 K). In addition, an existing thermal propagation model is shown to adequately describe the behavior of the normal region after switching.

201.364
PB92-144856
Not available NTIS National Inst. of Standards and Technology (PL), Gaithersburg, MD, Molecular Physics Div.

Laser Focusing of Atoms: A Particle-Optics Approach

Final report

Pub. in Jnl. of the Optical Society of America B 8, n9 p1795-1798 Sep 91.

Keywords: *Atomic beams, *Focusing, Photon-atom collisions, Laser beams, Reprints, Sodium atoms.

The use of a TEM(01) mode laser beam has been proposed as a means of focusing an atomic beam to a nanometer-scale spot diameter. The authors have analyzed the classical trajectories of atoms through a TEM(01) * mode using methods developed for particle optics. The differential equation that describes the properties of the first-order paraxial lens has exactly the same form as the bell-shaped magnetic Newtonian lens that was first analyzed by Glaser for the focusing of electrons in an electron-microscope objective. The authors calculate the first-order properties of the lens, obtaining cardinal elements that are valid over the entire operating range of the lens, including the thick and the immersion regimes. Contributions to the spot size are discussed, including four aberrations plus diffraction and atomic-beam-collimation effects. Explicit expressions for spherical, chromatic, spontaneous-emission, and dipole-fluctuation aberrations are obtained. Examples are discussed for a sodium atomic beam, showing that subnanometer-diaphragm spot diameters may be realized with reasonable laser and atomic-beam parameters. Optimization of the lens is also discussed.

201.365
PB92-145143
Not available NTIS National Inst. of Standards and Technology (PL), Gaithersburg, MD, Atomic Physics and Resonance Lines 4p(6)-4p(5) of the Kr I isoelectronic sequence. Final report

J. Sugar, V. Kaufman, and W. L. Rowan. 1991, 2p
Sponsored by Department of Energy, Washington, DC;
Pub. in Jnl. of the Optical Society of America B 8, n10 p2026-2027 Oct 91.

Keywords: *Electron transitions, Line spectra, Plasma spectra, Cadmium, Cesium, Iodine, Palladium, Silver, Tin, Xeron, Ultraviolet spectra, X-ray spectra, Reprints, *Potassium-like ions, Isoelectronic sequence.

Lines of the 4s(2) 4p(6) singlet S(0)-4s(2) 4p(5) 4d singlet P(1) and triplet D(1) transitions in Kr-like ions were observed in the plasma of the TEXT tokamak discharge with elements Kr, Xe, Cs, and Nd. An electron temperature of 1.3 keV was achieved by operating the tokamak with He. Spectra in the range of 500 A to 2000 A, typically with a 2.2-mm grazing-incidence spectograph. The lines were identified by comparison with calculated transition energies along the isoelectronic sequence.

201.366
PB92-145150
Not available NTIS National Inst. of Standards and Technology (PL), Gaithersburg, MD, Atomic Physics Div.

Accurate Wavelengths for Resonance Lines of the Cu I and Zn I isoelectronic sequences for Pd to Dy.

Final report

Sponsored by Department of Energy, Washington, DC;
Pub. in Jnl. of the Optical Society of America B 8, n9 p1795-1798 Sep 91.

Keywords: *Electron transitions, Line spectra, Ultraviolet spectra, Wavelengths, Reprints, *Copper-like ions, *Zinc-like ions, Isoelectronic sequence.

Now measurements of the Cu-like and Zn-like isoelectronic lines classified as 4s doublet S(1/2-1/2) doublets 1P(2,3/2)(sup 0) and 4s(2) singlet S(0)-4s4p transition P(1)(sup 0) transitions, respectively, have been made in the range of 90-335 A with a wavelength uncertainty of + 0.005 A for elements Pd to Dy. This will provide a wavelength standard with the multicomponent Dirac-Fock code of Daeulos (Phys. Rev. A 42, 5139 (1990)), including QED corrections. Differences between corresponding theoretical and experimental wavelength values are plotted as a function of atomic number and fitted to a smooth curve. The curve is used to obtain predicted wavelength values from Cu I to U.

201.367
PB92-145263
Not available NTIS National Inst. of Standards and Technology (PL), Boulder, CO, Time and Frequency Div.

Using Diode Lasers for Atomic Physics.

Final report

See also PB92-116904. Sponsored by Office of Naval Research, Arlington, VA, and National Science Foundation, Washington, DC;

Keywords: *Atomic physics, *Laser spectroscopy, Laser isotope separators, Laser applications, Reprints, Reviews.

The authors present a review of the use of diode lasers in atomic physics with an extensive list of references. They discuss the relevant characteristics of diode lasers and explain how to purchase and use them. They also review the various techniques that have been used to control and narrow the spectral outputs of diode lasers. Finally they present a number of examples illustrating the use of diode lasers in atomic physics experiments.

201.368
PB92-149889
PC A08 National Inst. of Standards and Technology, Gaithersburg, MD.

Also available from Suppl. of Docs. as SN703-027-003-0 and PB92-149897 through PB92-149954 and PB92-126614.

Keywords: *Research, Radiometry, Irradiance, Microphones, Particle size, Dimensional measurement, X-rays, Counting techniques, Thermodynamic activity, Spectroscopy of ions, Critical phenomena, Liquid nitrogen, Specific heat, Toxicity, Air pollution effects(humans), Air pollution detection, Chemical analysis, Standard reference materials, US NIST, Phosphorus-n-ethane sulfuric acid/N/hydroxyl, Propane sulfuric acid/(N-morpholin)-hydroxy.

Contents:
*Results of a CCPR Intercomparison of Spectral Irradiance Measurements by National Laboratories;
*Ultraviolet 185-1100 nm and 365-1100 nm, 4, 2245 A at 1179 cm, 2242 K at 653 cm, 2393 K at 708 cm, 2337 K at 890 nm, and 2282 K at 906 nm. Based on estimates of the random and systematic errors, arising from pyrometer and specimen conditions, the total error in the reported values is about 5 A at 653 cm and 6 K at the other wavelengths.

PB92-154152
Not available NTIS National Inst. of Standards and Technology (MSEL), Gaithersburg, MD, Radiation Div.

Simulation and Analysis of the Transmission Properties of Curved-Straight Neutron Guides Systems.

Final report

J. P. D. Copley, and D. F. R. Milner. 1992, 9p
Keywords: *Neutron guides, Beamlines, Ray tracing, Simulation, Reprints, Acceptance diagrams.

The spatial intensity distribution of neutrons emerging from a cooled guide is far from uniform, particularly at short wavelengths, and curved guides are sometimes followed by a straight section of guide to make the intensity distribution more uniform. The behavior of neutrons within curved-straight neutron guide-systems is examined using both ray-tracing and analytical approaches. The intensity distribution within the guide tends to wash from one side of the guide to the other. The amplitude of this transverse wave decreases with increasing guide length, and the characteristic length of the wave decreases with increasing neutron wavelength.

201,372
PB92-154178
Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Center for Radiation Research, Estimate of the Neutron Transfer Fusion Rate, Final rept.
Keywords: *Neutron transfer, *Cold fusion, Quantum electrodynamics, Room temperature, Nuclear chemistry, Coulomb field, Estimaters, Reprints.

201,373
PB92-154194
Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Quantum Metrology Div., X-ray Instrumentation for Analysis of Fluorescent and Scattered Radiation (Invited). Final rept.
Keywords: *X-ray equipment, *X-ray analysis, Polarization(Waves), Angular distribution, X-ray fluorescence, X-ray scattering, Instruments, Reprints, Secondary spectrums.

Application of high resolution instrumentation to the study of the near-threshold behavior of fluorescent and scattered radiation along with such properties as polarization and angular distribution has proven fertile. The article reviews some alternative strategies for improving the efficiency with which such secondary spectra can be registered.

201,376
PB92-154467
Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Quantum Metrology Div., Precision Measurements of K and L Transitions in Xenon: Experiment and Theory for the K, L, and M Levels. Final rept.
Keywords: *X-ray spectra, *Xenon, Electron transitions, Forbidden transitions, K shell, L shell, M shell, Reprints.

Wavelengths of xenon K-series x-ray lines were measured using high-resolution, high-flux, vacuum spectrometers. Wavelengths of the more prominent xenon K-series lines which had been obtained previously are fully reported and corrected for recent scale changes. Energies of forbidden transitions, such as 1s-2s, have been determined from redundant combinations of K- and L-series measurements. Transition energies have been calculated relativistically including relaxation to all orders, correlation to second order, and QED effects. Agreement between experiment and theory is of the order of 0.1 meV except for transitions involving 3s holes where it is 1 meV.

201,377
PB92-154699
Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Quantum Metrology Div., Atomic and Molecular Manipulation with the Scanning Tunneling Microscope. Final rept.
Keywords: *Scanning tunneling microscopy, Molecules, Diffusion, Surfaces, Atoms, Reprints, *Atomic manipulation, Field evaporation.

The prospect of manipulating matter on the atomic scale is fascinating to scientists for decades. This fascination may be motivated by scientific and technological opportunities, or from a curiosity about the consequences of being able to manipulate atoms in a particular location. Advances in scanning tunneling microscopy have made this prospect a reality; single atoms can be placed and moved with atomic precision. This is particularly true in the tunneling junction of a scanning tunneling microscope. Some of these recent developments and some of the possible uses of atomic and molecular manipulation as a tool for science are discussed.

201,378
PB92-158052
Not available NTIS
National Inst. of Standards and Technology (NIST), Boulder, CO. Time and Frequency Div.

**PHYSICS**

**General**

National Inst. of Standards and Technology (PL), Gaithersburg, MD. Radiometric Physics Div., Spin-Resolved Measurements of Electrons from Sodium Below the Inelastic Threshold. Final rept.
Keywords: *Electron-atom collisions, *Sodium, Electron scattering, Elastic scattering, Polarization(Spin alignment), EV range 0-10, Reprints.

A very stringent test of low-energy electron-atom collision theory is made in the most favorable energy range for the Cd-L doublet (3.1 eV). The experiments were performed using a 1 MeV electron beam and at T=4.2 K. High-resolution electron spectroscopy was used to measure the angular distributions of scattered electrons for incident energies of 1.0 and 1.6 eV, both of which are below the first excited-state threshold. The angular range is 20 deg.-145 deg. The cross-section approximation is found to give excellent agreement with experiment at both energies.

201,379
PB92-159078
Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Physicss Div., Determination of the Neutron Lifetime by Counting Trapped Protons. Final rept.
Keywords: *Neutron lifetime, *Neutron decay, Trapping(Charged particles), Particle counters, Protons, Reprints, Penning traps.

A description is given of an in-beam neutron lifetime experiment employing a Penning trap as a mechanism for decay and protons as a mechanism for the detection of neutron decay events. A novel method for the accurate change in the distribution of the trapped protons is the use of the high-resolution electron spectrometer to determine the ratio of neutron decay of about 500 have been achieved. Preliminary results are discussed, and an analysis of expected errors are given.

201,380
PB92-159094
Not available NTIS
Keywords: *X-ray fluorescence, X-ray spectra, Soft x-rays, Synchrotron radiation, Radiation damage, Bremstrahlung, Excitation, Semiconductors, Reprints.

The photon excitation of soft X-ray emission spectra using monochromatized radiation from a synchrotron light source provides important advantages compared with x-ray excitation. The electron gun used for such studies on beamline U-10 at the National Synchrotron Light Source is described. With data obtained from this beamline and elsewhere, the authors discuss and illustrate the elimination of Bremstrahlung, the reduction in damage produced by energy deposition, the elimination of...
tion of overlapping spectra made possible by selective excitation of particular core levels, and the interactions between excitation and emission processes observed using photon excitation near threshold.

201.381
PB92-159128
Not available NTIS
National Lab. of Standards and Technology (NIST), Gaithersburg, MD. Ionizing Radiation Div.
Neutron Cross Section Standards Evaluations for ENDF/B-VI.
Final rept.
See also DE85017534.
Keywords: "Neutron cross sections, "Neutron reactions, "Nuclear data collections, "Standards, Gold 197 target, Boron 10 target, Lithium 6 target, Hydrogen 1 target, Helium 3 target, Uranium 235 target, Carbon 12 target, Radiation.
This is a summary of an invited talk to be given in a session on "Review of the Contents and Performance of ENDF/B-VI at an ANS meeting next November. The evaluation process for the ENDF/B-VI neutron cross section standards is given. Results are shown for the (235)U(n,f) cross section. Additional results will be presented at the meeting.

201.382
PB92-159144
Not available NTIS
National Lab. of Standards and Technology (NIST), Gaithersburg, MD. Ionizing Radiation Div.
Microdosimetry of Radon and Radon Daughters.
Final rept.
Keywords: "Microdosimetry, "Radon, "Polonium 218, "Polonium 214, "Alpha particles, Slowing-down, Reprints.
The authors have developed an analytical method for calculations of slowing-down spectra (fluence-rate spectra) and lineal energy spectra for radon and its important alpha-emitting daughters, (218)Po and (214)Po. They have also made calculations of microdosimetric parameters and quality factors for radon-related alpha particles. The y spectra show some increase in average values of y with cell depth.

201.383
PB92-159235
Not available NTIS
National Lab. of Standards and Technology (NIST), Gaithersburg, MD. Quantum Metrology Div.
Self Filtering Crystal Monochromators for Synchrotron X-Radiation.
Final rept.
Keywords: "Synchrotron radiation sources, "X ray reflection, "Monochromators, X ray diffraction, Grazing incidence, Reprints.
Monochromator crystal heating and radiation damage may be reduced significantly by reflecting much of the incident radiation back from the substrate to the source. This requires strong Bragg diffraction of the monochromatized beam at grazing incidence angles. Examples of such cases are described, such as extremely asymmetric diffraction and grazing angle diffraction, which would permit continuously tunable x-ray energy. Additional benefits such as increased angular acceptance, variable beam cross section, adjustable bandpass, and increased flux for self-filtering monochromators are presented. Considerations for implementation are discussed. Finally, the possibilities for exploiting the unused reflected x-rays will be explored.

201.384
PB92-159250
Not available NTIS
National Lab. of Standards and Technology (NIST), Gaithersburg, MD. Radiation Source and Instrumentation Div.
Conceptual Design of a High Current Injector for the NIST-NRL Free Electron Laser.
Final rept.
Keywords: "Free electron lasers, "Racetrack microtrons, "Beam injection, Picosecond pulses, Electron accelerators, Electron beams, Linear accelerators, Reprints.
The NIST-LANL Racetrack Microtron (RTM) is to be used as a drive for a cw Free-Electron Laser. To achieve the peak currents of 2-4 A required for lasing, 15-ps, 120 keV electron pulses at 66.11 MHz with 7-14 pC per pulse will be accelerated to 5 MeV by the existing injector linac for injection into the RTM. The conceptual design of an electron gun system to produce this beam using a pulsed electron gun and sub-harmonic chopping and bunching is described, and the results of PARANELA calculations are presented.

201.385
PB92-159236
Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Center for Radiation Research.
Cobalt Assisted Cold Fusion in Solids.
Final rept.
M. Danos. 1990, 6p.
Pub. in Fusion Technology 17, n3 p844-849 1990.
Keywords: "Cold fusion, Cobalt field, Palladium, Tin, Neutrons, Helium, Reprints.
When taking into account the energy-momentum exchange in the collision of a cataлизing lattice nucleus, Cobalt penetrability becomes unity, in complete analogy with the Fabry-Perot resonator of optics.

201.386
PB92-161518
Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Ionizing Radiation Div.
Standardization of Holmium-166 by the CIEMAT/NIST Liquid-Scintillation Efficiency-Tracking Method.
Final rept.
Keywords: "Holmium 166, Liquid scintillators, Ionization chambers, Gamma radiation, Half life, Radiopharmaceuticals, Radioactivity, Standardization, Calibration, Reprints.
Holmium-166 has been standardized for activity by the CIEMAT/NIST liquid-scintillation efficiency-tracking method. Standardized solutions were calibrated NIST ionization chambers; radiopharmaceutical manufacturers, and other researchers can now standardize 166 Holmium samples for calibration. The half life was measured to be 26.78 + or - 0.01 hours. Probabilities per decay for principal gamma rays were measured with calibrated germanium gamma-ray spectrometers.

201.387
PB92-1615174
Not available NTIS
National Inst. of Standards and Technology (NIST), Boulder, CO. Electromagnetic Technology Div.
Demagnetizing Factors for Cylinders.
Final rept.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics 27, n4 p3601-3619 Jul 91.
Keywords: "Demagnetization, Magnetic susceptibility, Magnetic fields, Magnetostatics, Diamagnetism, Paramagnetism, Ferromagnetism, Superconductors, Cyclids, Reprints.
Fluxometric (ballistic) and magnetometric demagnetizing factors N(f) and N(m) for cylinders as functions of susceptibility chi and the ratio gamma of length to diameter have been evaluated. Using a one-dimensional model when gamma = or > 10, N(f) was calculated for Gaithersburg, MD . When chi < infinity and N(m) was calculated for chi >> infinity. Using a two-dimensional model when 0.01 = or < gamma = or < 50, an important range for magnetometer measurements, N(m) and N(f) were calculated for chi = 0, suitable for weakly magnetic or saturated ferromagnetic materials, N(f) and N(m) were computed exactly using inductance formulas.

201.388
PB92-1615311
Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Quantum Metrology Div.
Projectile Spectroscopy in a Cooler Ring.
Final rept.
Keywords: "Heavy ions, "Ion sources, Radiative corrections, Electron beams, Accelerators, Spectroscopy, Cooling, Reprints.
The fairly broad interest in extending spectroscopy further into the domain of highly charged ions is demonstrated by the variety of contributions to this workshop. Not the least of the needed technologies are advancing, making formerly remote possibilities either presently or soon to be in reach. An asymptotic, though difficult case involves exploitation of high energy heavy ion cooler ring (with deacceleration) as a light source. Such a ring is currently under construction at CERN, Switzerland. It will be capable of accumulating and cooling space charge limited beams of heavy ions up to and including uranium. Some features of a spectroscopy program to exploit this unique source are discussed in the report.

201.389
PB92-1615372
Not available NTIS
National Inst. of Standards and Technology (NIST), Boulder, CO. Quantum Physics Div.
Final rept.
D. D. Dubois, and A. Maquet. 1990, 10p.
Keywords: "Electron-atom collisions, Greens function, Cross sections, Subroutines, Reprints, Hydrogen atoms.
We propose two distinct fast routines to evaluate the cross sections of the one-proton processes occurring in the course of fast-electron-hydrogen atom collisions: a fixed-target numerical program, and a Chapman-Enskog expansion in the velocity of the related amplitude has been derived so that the computations can be performed on a microcomputer.

201.390
PB92-1615521
Not available NTIS
National Inst. of Standards and Technology (NIST), Boulder, CO. Quantum Physics Div.
Final rept.
L. Grishchuk, and M. Solokhin. 1991, 6p See also PB91-203125.
Keywords: "Gravitational waves, "Gravitons, Inflationary universe, Relic radiation, Cosmology, Reprints, Hubble parameter.
The spectra of relic gravitational waves produced as a result of cosmological expansion of the generalized inflating models are derived. It is shown how one can reconstruct the time dependence of the very early Hubble parameter and matter energy density from a measured frequency-dependent spectrum of relic gravitational waves.

201.391
PB92-1615646
Not available NTIS
National Inst. of Standards and Technology (NIST), Boulder, CO. Quantum Physics Div.
Improved Kennedy-Thorneke Experiment: A Preliminary Report.
Final rept.
D. His, and J. L. Hall. 1989, 6p.

Dielectric dipole, electric quadrupole, and magnetic dipole transition probabilities among states with principal quantum numbers $n = 3$ and 4 have been calculated using Dirac-Fock single-configuration wave functions. Na-like ions Ba(4s$^2$) through U(b1$I^1$). For the theoretical energies, the Breit interaction and the Lamb-shift corrections were calculated perturbatively. Transition probabilities obtained from the calculated transition probabilities.

201.405
PB82-170935 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD, Process Measurements Div.

High-Accuracy Dilatometer for the Range -20C to +700C.

Final rep.

Pub. in International Jnl. of Thermophysics, 12, p656-677 1991.

Keywords: *Extensometers, *Dilatometers, *Thermal expansion, Temperature measurement, Computer applications, Heat pipes, Optical interferometers, Linear systems, Reprints.

The authors have constructed a linear-thermal-expansion apparatus that employs a polystyrene-loaded heat pipe to provide a homogenous temperature environment for the sample and uses the Mertit-Saunders (optical interferometric) method of observing its expansion. They report on many results that totally disagree with one described previously. Temperature regulation and measurement are accomplished through the use of a feedback controller. The paper is written in a simple program. Two platinum resistance thermometers, read automatically by a digital resistance bridge, are connected. With both the temperature of the heat pipe and that of the sample chamber. Changes in sample length are determined from measurements of the corresponding changes of optical fringes from a Fizeau interferometer as recorded on film. Determinations of the thermal expansion of a PtRh alloy agree with results obtained both from the present apparatus and from the previous one, at the +0.2 ppm level.

201.406
PB82-170943 Not available NTIS National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Ionizing Radiation Div.

Study of Slab Transmissions and Reflection.

Final rep.
C. M. Eisenhauer, 1991, 15p

Keywords: *Neutron transport, *Photon transport, Monte Carlo method, Gamma rays, Polyethylene, Slabs, Iron, Reprints.

Using Monte Carlo calculations we show that the transmission of scattered neutrons or gamma rays from a slab of infinite thickness does not change much as the slab thickness increases. A critical point is the thickness of the slab, which is very little with the small slab. This thickness is also true for reflected radiation if the source is replaced by its image source and the results are interpreted in terms of a transmission problem. We also show that the transmission from a slab of small extent (narrow beam conditions) to a slab of infinite extent (broad beam conditions) can be characterized by a simple function of the single scatter angle. This function, too, can be applied to reflection radiation by invoking the image source. Typical results are presented for polyethylene and iron.

201.407
PB82-171099 Not available NTIS National Inst. of Standards and Technology (NIST), Boulder, CO. Electromagnetic Technology Div.

Granular-Aluminum Superconducting Detector for 6 keV X-rays and 2.2 MeV Beta Sources.

Final rep.
A. Gabutti, K. E. Gray, R. G. Wagner, and R. H. Ono. 1991, 7p

Keywords: *X-ray detection, *Beta detection, MeV range 1-10, Granular materials, Iron 55, Platinum 90, Aluminum. Performance, Reprints, *Superconducting detectors.

A 2-microsecond superconducting strap of granular aluminum was used to detect the superconducting to normal transitions induced by the absorption of (65Fe, 6 keV X-rays or the passage of electrons from a (90Sr, 2.2 MeV beta source. The count-rate for X-rays reaches almost 70% efficiency over a wide range of bias currents, confirming the potential application for high-spatial-resolution X-ray detectors. The authors report the first evidence of switching by a 2.2 MeV beta source which emits electrons in the minimum-ionizing range. However, the inability to distinguish between transitions caused by minimum-ionizing electrons emitted by the source, prevented the authors from demonstrating the full sensitivity of the granular aluminum detector to minimum-ionizing radiation. The switching threshold for X-rays depends on thermal propagation of a normal region which bridges the film width, and a numerical simulation is presented, the simple formulation of which allows extrapolation to other materials and temperatures. The very fast rise-time voltages are accurately described by a thermal propagation model.
focused beam with as little as 1 mW of single-frequency laser power. The ionization mechanism has been studied and found to consist of a three stage process in which both atomic and molecular absorption of the laser power produces distinct collisional processes, and single-photon ionization of excited lithium atoms all play essential roles.

201.411 PB92-172733 PC A03/MF A01 National Inst. of Standards and Technology, Gaithersburg, MD Noise-Induced Chaos and Phase Space Flux: A Sample-Theoretic Study. M. Frey, and E. Smu. Mar 92, 379 NISTIR-4791 Prepared in cooperation with Johns Hopkins Univ., Baltimore, MD. Dept. of Civil Engineering. Sponsored by Minerals Management Service, Washington, DC. Keywords: Chaos, Dynamical systems, Josephson junctions, Stochastic processes, Phase space, Excitation, Theorems, Dufting-Holmes oscillators, Milinkov theory, Shinozuka noise. The authors study the effect of additive noise on near second-order dynamical systems whose unperturbed flows have homoclinic or heteroclinic orbits. The noise is represented by a term of Shinozuka stochastic process capable of arbitrarily closely approximating Gaussian noise with any specified spectrum. The authors derive a formula for the flux factor and thereby for any asymptotic mean stationary excitation. The derivation shows that, to first order, the effect of the external excitation is to modify the linear filter associated with the system's homoclinic or heteroclinic orbit. It also shows that the stationary mean distribution of the filtered excitation determines the average phase space flux. This is true for both random and nonrandom excitations and indicates that, for the dynamical systems considered here, these two classes of excitation play substantively equivalent roles in the promotion of chaos.

201.412 PB92-172824 PC A09/MF A02 National Inst. of Standards and Technology (PL), Boulder, CO. Lithosorb: Physics Laboratory Technical Activities, 1991. Final rep. K. B. Gribb Feb 92, 1817 NISTIR-4741 Presented to the Board on Assessment of NIST Programs, National Research Council, February 24-25, 1992. See also PB90-131518 and PB91-176655. Keywords: Physics, Atomic physics, Molecular physics, Fundamentals standards, Frequency standards, Time standards, Quantum theory, Metrology, Electronics, Calibration, Optics, Ionizing radiation, Measurement, Astrophysics, Standard reference materials, US NIST. The report summarizes research projects, measurement method development, calibration and testing, and data acquisition activities that were carried out during calendar year 1991 in the NIST Physics Laboratory. These activities fall in the areas of electron and optical physics, atomic physics, molecular physics, radiometric physics, quantum metrology, ionizing radiation, time and frequency, quantum physics, and fundamental constants.

201.413 PB92-175199 Not available NTIS National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div. Interference Fringes from Single-Cavity Excitation of an Atomic Beam. Final rep. A. DeMarchi, R. E. Drullinger, and J. H. Shirley, 1990, 50p. Pub. in Proceedings of Annual Symposium on Frequency Control (44th), Baltimore, MD, May 23-25, 1990, p34-38. Keywords: Atomic beams, Cylindrical configuration, Hyperfine structure, Optical pumping, Excitation, Cesium, Reprints, Ramsey line shapes. A cylindrically-cavity operated in the TE(013) mode was used for excitation of the hyperfine transition in an optically pumped cesium beam spectrometer. In the configuration the authors used, the atoms see the rf field reverberating its orientation twice. The observed line shapes show an interference structure similar to Ramsey interference. Theoretically derived line shapes are in good agreement with the observations. A comparison is made between these line shapes and corresponding Ramsey line shapes. It is the effectiveness of these phase variations within the cavity are also discussed briefly.

201.414 PB92-175546 Not available NTIS National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div. Penning Trap Measurements at the University of Washington and at NIST in Boulder. Final rep. F. T. Moore. 1991, 10p. Pub. in Proceedings of INS Symposium (19th) Cooler Rings and Their Applications, Tokyo, Japan, November 28-30, 1990, p88-107 1991. Keywords: Quantum chromodynamics, Quantum mechanics, Invariance principles, Frequency dividers, Fundamental constants, General relativity, Atomic clock, CPT theorem, Reviews, Tests, Reprints, Penning traps, Laser cooling. The author describes and references the work accomplished using Penning traps at both the University of Washington and NIST in Boulder. Among other things, these are tests of QED, CPT, general relativity, and quantum mechanics. As well as quantum effects, are also measured are some measurements, Reprints, CPT constants, a laser cooled atomic clock, a frequency divider, and studies of non-neutral plasmas.

201.415 PB92-175651 Not available NTIS National Inst. of Standards and Technology (CSTL), Boulder, CO. Thermal Conductivity Surface of Argon: A Fresh Analysis. Final rep. R. A. Perkins, D. G. Friend, H. M. Roder, and C. A. Nieto de Castro. 1991, 20p. Sponsored by Department of Energy, Washington, DC. Pub. in International J. of Thermophysics, 12, n6 p965-984 Nov 91. Keywords: Thermal conductivity, Argon, Supercritical fluids, Reprints, Transient hot wire technique, Liquid argon. The paper presents a fresh analysis of the thermal conductivity surface of argon at temperatures between 100 and 325 K with pressures up to 70 MPa. The new surface incorporates theoretically based expressions for the dilute-gas thermal conductivity, the first density correction, and the new surface exhibits a significant reduction in overall error compared to the authors' previous surface which was empirical and theoretical. The uncertainty in the new thermal conductivity surface is 0.2-2% at the 95% confidence level.

201.416 PB92-175652 Not available NTIS National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div. Review of Cooling Techniques for Superconducting Digital Electronics. Final rep. R. Radebaugh. 1991, 16p. Pub. in Proceedings of Conference on Superconducting Digital Circuits and Systems, Washington, DC, September 11-13, 1991, v1 p4-1-1.4-16. Keywords: Superconducting devices, Cryogenic cooling, Joule-Thomson effect, Digital circuits, Reviews, Transistor, Cryogenic instruments, Cryocoolers, Refrigeration. Existing cryocoolers, developed primarily for cooling of infrared detectors and for cryopumps, can be used in some cases for the cooling of superconducting electronics. However, all of these coolers have lifetimes or maintenance intervals of one year or less and require much input power. The paper reviews the technologies used for existing cryocoolers and discusses new areas of research to increase the reliability and efficiency of cryocoolers. The requirements imposed on cryocoolers by the superconducting electronics application are reviewed. The paper concludes that development work in refrigeration for superconducting devices is needed in parallel with the development of superconducting devices.

201.417 PB92-175666 Not available NTIS National Inst. of Standards and Technology (PL), Gaithersburg, MD. Atomic Physics Div. Laser-Produced Spectra of Copperlike Antimony and Tellurium, Sb(221+)+ and Te(233)+. Final rep. J. Reader, and N. Acquista. 1992, 3p. Sponsored by Department of Energy, Washington, DC. Pub. in Jnl. of the Optical Society of America B 9, n3 p347-349 Mar 92. Keywords: Antimony ions, Tellurium ions, Laser-produced plasma, Line spectra, Energy levels, Reprints, Copperlike ions. Spectra of the copperlike ions Sb(221)+ and Te(233)+ were observed with a laser-produced plasma and a 10.7-m grazing-incidence spectrograph. Wavelengths, energy levels for n = 4 and n = 5 configurations, and ionization energies were determined for each ion. For Sb(221)+ the 6g levels were also determined. Wavelengths for the 4s-4p resonances were correlated with recent measurements (J. Opt. Soc. Am. B 8, 1799 (1991)) obtained with a tokamak plasma and with semmeprical values (Phys. Rev. A 44, 148 (1991)) obtained from smoothed corrections to relativistic calculations.

201.418 PB92-175744 Not available NTIS National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div. Acccelerated lambda iteration method for multilevel Radiative Transfer. 1. Non-Overlapping Lines with Background Continuum. Final rep. G. B. Rybicki, and D. G. Hummer. 1991, 11p. Grants NSF-AST88-02937, NASA-NAGW-768 Sponsored by National Science Foundation, Washington, DC, and National Aeronautics and Space Administration, Washington, DC. Pub. in Astronomy and Astrophysics 245, p171-181 1991. Keywords: Radiative transfer, Stellar atmospheres, Line spectra, Iteration, Helium, Reprints. A method is presented for solving multilevel transfer problems with non-overlapping lines and with background continuum (but no active continuum line). The method is based on the use of an approximate lambda operator, which is either the diagonal or a finite band of the 'true' numerical lambda operator. Linear 'preconditioned' equations of statistical equilibrium are derived, the coefficients of which are found efficiently using a new fast method for finding the diagonal elements (or a band of the 'true' numerical lambda operator. The preconditioned equations are solved iteratively with the formal solution of the transfer equation, so that the entire iteration scheme involves solving only linear equations based on one previous iteration. Application of the method are made to several multi-level problems, including a model problem of Avrett and Loeser (1987) and an eleven-level neutral helium atom.

201.419 PB92-175769 Not available NTIS National Inst. of Standards and Technology (PL), Gaithersburg, MD. Atomic Physics Div. Absolute Ionization Energy of the 2 (1S) Level of Helium. Final rep. C. J. Sansenboni, and J. D. Gillaspy. 1992, 3p. Pub. in Physical Review A 45, n1 pR1-R3, 1 Jan 92. Keywords: Helium, Quantum chromodynamics, Atomic energy levels, Rydberg series, Stable atomic state, Excited states, Laser spectroscopy, Electron transitions, Gas ionization, Binding energy, Tests, Reprints. The authors have measured the absolute wave numbers of transitions from the metastable 2 singlet S level of helium to the n singlet P (n=7-74) excited states. From these data the authors determine the binding energy of helium in the series 10 to the 10 power by using a Ritz series formula. The high-precision determination of the 2 singlet S binding energy does not depend on theoretical calculation of the binding energy of any helium level. The result, 32033.2288557(7)/cm, confirms their earlier finding of a relative 1% 0.1% deviation from the predicted two-electron Lamb shift for the 2 singlet S level.

201.420 PB92-175835 Not available NTIS
Improved Wavelengths for Prominent Lines of Ni X to Ni XXVI.

J. Sugar, V. Kaufman, and W. L. Rowan. 1992, 3p

Sponsored by Department of Energy, Washington, DC.

Pub. in Jnl. of the Optical Society of America B 9, n3 p344-346 Mar 92.

Keywords: *Nickel ions, *Line spectra, Sadt X rays, laser-generated plasma, X-ray spectra, Wavelengths, Reprints.

New measurements of 62 spectral lines of highly ionized Ni ions in the range of 83-320 A have been made with an uncertainty of 0.0005 A. The light source was the TEXT tokamak at the University of Texas in Austin. Lines of Li-like K-like ions are included, along with visually estimated relative intensities, previous measurements, and classifications. The uncertainty of more than half of the previous best measurements is + or - (0.02-0.03) A.

201,421
PB92-175868 Not available NTIS National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.

Hyperfine Structure of the Metastable (5/2 State of (110) Using an AgGaS2 Dioxide Laser at 778 nm +.

Final rep.
G. Tino, L. Holberg, A. Sasso, M. Inguscio, and M. Barsanti. 1990, 4p


Keywords: *Oxygen 17, Near infrared radiation, Hyperfine structure, metastable state, Atomic parameters, Atomic energy levels, Laser spectroscopy, Lifetime, Reprints.

By exploiting a narrow-linewidth diode-laser source, the authors measure the hyperfine structure of the Quintet (5/2 state of (110). Nuclear parameters can be calculated from the measured hyperfine structure. Recorded collision-free linewidths allow an estimate of the lifetime of the levels involved in a new scheme proposed for the cooling of atomic oxygen.

201,422
PB92-175942 Not available NTIS National Inst. of Standards and Technology (EEL), Boulder, CO. Electromagnetic Fields Div.

Fields Radiated by Electrostatic Discharges.

Final rep.
P. F. Wilson, and T. M. Ma. 1991, 9p

See also PB92-128778, PUB 128778 Institute of Electrical and Electronics Engineers Transactions on Electromagnetic Compatibility 33, n1 p10-18 Feb 91.

Keywords: *Electric fields, *Magnetic fields, Mathe-matical models, Electrostatic sparks, Dipole, Reprints, *Electrostatic discharges.

Electrostatic discharge (ESD) metrology has, to date, primarily focused on the ESD current waveforms in order to develop simulators for susceptibility testing. Significantly less attention has been given to the fields generated by an ESD event. The paper examines ESD fields both analytically and experimentally. Measurements indicate that the electric fields can be quite significant (greater than 1000 volt/m at a distance of 1 meter for example) for short periods of time (a few nanosec-onds), particularly for relatively low-voltage events (less than or equal to 6 KV). A relatively simple dipole model of an ESD spark is developed and used to predict the radiated fields. The agreement between theory and experiment is fair. The model may be used to predict ESD fields for a wide range of possible configurations, particularly in the near-field zone where no measurements are presently available.

201,423
PB92-175959 Not available NTIS National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.

Progress at NIST Toward Absolute Frequency Standards Using Stored Ions.

Final rep.

Sponsored by Office of Naval Research, Arlington, VA, and Air Force Office of Scientific Research, Boulder AFB, CO.

Pub. in IEEE (Institute of Electrical and Electronics En-gineers) Transactions on Ultrasonics, Ferroelectrics, and Frequency Control 97, n6 p515-523 Nov 90.

Keywords: *Frequency standards, *Ion storage, Beryli-um ions, Beryllium 9, Mercury ions, Mercury 199, Atomic spectroscopy, Optical pumping, Atomic clocks, Metrology, Reprints, Paul traps, Penning traps, Laser cooling.

Experiments at NIST, whose goal is to realize frequency standards of high accuracy using stored ions, are briefly summarized. In one experiment, an RF oscillator is locked to a nuclear spin-flip hyperfine transition in (9)Be(1+)- ions that are stored in a Penning trap and optically laser-cooled. In a second experiment, a stable laser is used to probe an electric quadrupole transition in a single laser-cooled (199)Hg(1+)- ion stored in a Paul trap. Future possible experiments are also discussed.

201,424
PB92-175967 Not available NTIS National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.

Search for Anomalous Non-Dependent Forces Using Stored-Ion Spectroscopy.

Final rep.
D. J. Heinzen, J. L. Bollinger, D. J. Heinzen, W. M. Itano, and M. G. Raizen. 1991, 4p


Keywords: *Ion storage, Atomic spectroscopy, Goldstone bosons, Beryllium ions, Beryllium 9, Gravitation, Axions, Reprints, Spin resonance.

Resonances in atomic ions can be used to search for new, weak, spin-dependent interactions. Upper limits on anomalous (dipole-monopole and dipole-dipole couplings for the neutron and electron are determined by examining hyperfine resonances in stored (9)Be(1+)- ions. The experiments also place strict limits on anomalous weights of spinning gyroscopes.

201,425
PB92-181106 PC A04/FA 01 National Inst. of Standards and Technology (PL), Gaithersburg, MD. Ionizing Radiation Div.

Mass Energy-Transfer and Mass Energy-Absorp-tion Coefficients, Including In-Flight Position Annihilation for Photon Energies 1 keV to 100 MeV.


See also report of 1991, PB92-126473. Prepared in cooperation with Cleveland Clinic Foundation, OH, Dept. of Radiation Therapy, and Wisconsin Univ.-Madis-on. Dept. of Medical Physics.

Keywords: *Gamma dosimetry, Photon cross sections, Absorption coefficients, Annihilation reactions, Pair production, Energy absorption, Energy transfer, Gamma radiation, Positrons, Radiotherapy, Radiology, Attenuation, X rays, Tables(Data).

Mass energy-transfer and mass energy-annihilation coefficients are tabulated in units of sq cm/g for photon energies between 1 keV and 100 MeV for 29 elements (Z 2 1, 92), and 14 mixtures and compounds of gen-eral dosimetric interest. Cross sections for photo-effect, incoherent scattering, pair and triplet production are those compiled or generated by the National Institute of Standards and Technology (NIST) (formerly the National Bureau of Standards). Corrections are included for in-flight position annihilation, previously not applied in NIST calculations for energies above 10 MeV. Applications include calculations for energies above 1 MeV, but the authors find differences in mass-energy-annihilation coefficients in the low energy region of as much as 4% compared with the last NIST compilation, and as much as 9% when compared with other recent compilations.

201,426
PB92-190180 PC A11 National Inst. of Standards and Technology, Gaithersburg, MD.


Also available from Supt. of Docs. as SN107-027-00044-0. See also PB92-190198 through PB92-190214.

Keywords: *Atomic energy levels, *Energy levels, *Ultraviolet spectra, *Platinum, Atomic spectroscopy, Spectral lines, Neon, Atalases, Tables(Data), Hollow cathode lamp.

Contents:

201,427
PB92-190198 (Order as PB92-190180, PC A11) National Inst. of Standards and Technology, Gaithersburg, MD.


201,428

Energy Levels of Neutral Platinum.

J. Biaise, J. Verges, J. F. Wyart, and R. Engleman. 1992, 4p

Prepared in cooperation with New Mexico Univ., Albuquerque. Dept. of Chemistry. Included in Jnl. of Research of the National Institute of Standards and Technology, v97 n1 p23-126 Jan/Feb 92.

Keywords: *Atomic energy levels, *Energy levels, *Platinum, Atomic spectroscopy, Electronic structure, Tables(Data).

All known energy levels of neutral platinum (Pt 0) are presented, including 119 new levels based on analysis of recent comprehensive observations of the spectrum. These results are taken from a detailed analysis of the spectrum to be published in Journal de Physique II.

201,429

Energy Levels of Singly-Ionized Platinum.

J. Biaise, and J. F. Wyart. 1992, 7p

Included in Jnl. of Research of the National Institute of Standards and Technology, v97 n1 p217-223 Jan/Feb 92.
Keywords: "Energy atomic levels, Energy levels, *Platinum microPhysical, Spectroscopic, Electronic structure, Table(Data)."
The analysis of Pt II is extended by using accurate wavelength measurements by Sanzoni et al. Forty-three new known and 104 new odd levels have been found. The Slater-Condon, Racah, and Crystal field terms are used for the interpretation of the 5d(9), 5d(9)5s, and 5d(7)5p(2) low even configurations and the 5d(7)5d + 5d high even configurations with root mean square deviations smaller than 0.8 cm. The importance of the 5d(5)5d(6s) core interaction in interpreting the energy levels is stressed.

201,430
PB92-190461
PC A07/MF A02
National Inst. of Standards and Technology, Gaithersburg, MD.
Evaluation of Kerma in Carbon and the Carbon Cross Sections.
E. J. Axton.
Feb 9, 1982 NIST-R483
Keywords: "Carbon, *Kerma, Neutron cross sections, Nuclear data collections, Elastic scattering, Inelastic scattering, Least squares method, MeV range 1-10, MeV range 10-100, Neutron reactions, Carbon 12, Table(2)"
A preliminary simultaneous least squares fit to measurements in kerma in carbon, and carbon cross sections taken from the ENDF/B-V file was carried out. In the calculation the shapes of the total cross section and the various partial cross sections were rigid but their absolute values were allowed to float in the fit within the constraints of the ENDF/B-V uncertainties. The constraints of the ENDF/B-V file imposed impractical shapes, particularly in the case of the (12C,n,3(Alp)) reaction, which were incompatible with direct measurements of kerma and of the reaction cross sections. Consequently a new evaluation of the kerma cross section data became necessary. Since the available time was limited the new evaluation concentrated particularly on those aspects of the ENDF/B-V carbon file which would have most impact on kerma calculations. Following the new evaluation several new tables of kerma factors were produced. Finally, the simultaneous least squares fit to measurements of kerma and the new cross section file was repeated.

201,431
PB92-192079
PC A05
National Inst. of Standards and Technology, Gaithersburg, MD.
Also available from Supt. of Docs, as SN70-027-00045-8. See also PB92-20807 through PB92-192129 and PB92-190180.
Keywords: "Research projects, *Standards, Combustion products, Smoke, Toxicity, Microphosphes, Reaction size, Electron microscopes, Calibration, Sommerring constant, Standard reference materials, Magnification standards, Antenna measurements, Fine structure constant, Electron charge."
Prepared in cooperation with National Inst. of Standards and Technology, Boulder, CO. Included in Jnl of Research of the National Institute of Standards and Technology, v67 n2 p299-304 Mar/Apr 92.

201,432
PB92-192129
(Order as PB92-192079, PC A05)
National Inst. of Standards and Technology, Gaithersburg, MD.
E. R. Williams, R. N. Ghosh, and J. M. Martinis.
Prepared in cooperation with National Inst. of Standards and Technology, Boulder, CO.

201,433
PB92-197383
Not available NTIS National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.
Single Ion Optical Spectroscopy.
The charge of the electron can be determined by simply placing a known number of electrons on one electrode of a capacitor and measuring the voltage, Vts, across the capacitor. If Vts is measured in terms of the Josephson volt and the capacitor is measured in SI units then the fine-structure constant is the quantity determined, involving single electron tunneling, SET, have shown how to count the electrons as well as how to make an electrometer with sufficient sensitivity to measure the charge.

201,434
PB92-197391
Not available NTIS National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.
Computer Program for Computing the Properties of Seventeen Fluids.
Keywords: "Properties, *Thermal properties, *Computer applications, Computer code, Computer program, Fluid properties, External input output, Printout, MIPPROPS computer program."

201,435
PB92-197573
Not available NTIS National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Accurate Solutions to Schrodinger’s Equation Using Modified Airy Functions.
1992, 4p.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Jnl. of Quantum Electronics 28, n2 p400-403 Feb 92.
Keywords: "Schrodinger equation, *Airy function, *Spherical wavefunctions, Development, Numerical, State function, Eigenfunctions, Eigenvalues, Reprints."
A formalism that uses the Airy functions is applied to Schrodinger's equation for a spherically symmetric potential. The authors show that the computational procedure is simple and allows one to have a very accurate description of bound-state wave functions and the corresponding eigenvalues.

201,436
PB92-197649
Not available NTIS National Inst. of Standards and Technology (NMI), Boulder, CO. Time and Frequency Div.
Quantum Zeno Effect.
See also PB89-254715.
Keywords: "Beryllium ions, *Optical pumping, Reprints, *Zero effect, Quantum Zeno effect, Ion storage.
The Quantum Zeno effect has been demonstrated in an experiment with trapped beryllium ions. Transitions between hyperfine levels were inhibited by laser measurement pulses.

201,437
PB92-197664
Not available NTIS National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.
Rotational Equilibria and Lower-Order Modes of a Non-Neutral Ion Plasma.
Sponsored by Office of Naval Research, Arlington, VA.
Keywords: "Electrostatics, Rotation, Reprints, Ion plasmas, Penning traps, Ion traps, Brillouin flow, Laser cooling.
The authors study rotational equilibria and low-order electrostatic modes of a magnetically confined, non-neutral ion plasma. The plasma rotation rate is controlled with radial pressure from a laser beam and is continuously varied over the entire allowed range, including Brillouin flow. Excitation of an asymmetric plasma can produce a static collective mode. The symmetric quadrupole mode is also studied; its behavior is characteristic of a strongly magnetized plasma at low density, and of an unmagnetized plasma at Brillouin flow.

201,438
PB92-197714
Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Electron and Optical Physics Div.
Record Capture and Acceleration Efficiency in the SURF-II 300 MeV Circular Storage Ring.
Final rept. R. H. Hagerty.
Keywords: "Surf II storage ring, Electron acceleration, Electron capture, MeV range 100-1000, Circular configuration, Efficiency, Reprints."
The 300 MeV SURF-II storage ring is accelerating betatrons more than 275 mA up to operating energy from its single shot, 75 mA, 10 MeV microtron injector. This is an unprecedented efficiency for a low energy injector, thanks to a kicker magnet pulse and the non-magnetic field gradient of the single magnet, weak focusing storage ring are adjusted to maximize electron capture at injection energy. At intermediate energies and at full energy the gradient is adjusted so that the index is inward of the smaller electron orbital radius.
thermometers, a unique mercury manometer, and a highly accurate dilatometer has been employed to evaluate the thermodynamic temperatures associated with particular values of temperature on the 1968 Inter-

dividuals. Practical, Temperatures. This paper, summaries are given of the apparatus and procedures that have been used in the NBS gas thermometry pro-
gammas, and the differences that have been found between the two temperature scales, and the uncertainties that accompany the results.

Collisonal electron detachment cross sections for SF6(1), SF5(1), and F(1) on SF6 target gas have been measured for relative (center-of-mass) energies in the range of 0.3 to 200 eV, and ionization limits for direct detachment are observed at 90 eV for SF6(1) and SF5(1), and at 8 eV for F(1). Cross sections for ion conversion processes that compete with detachment are also reported. The measured cross sections are used in a theoretical model which invokes detachment from direct impact of collisonally excited SF6(1) to explain the pressure de-


Keywords: Quarks, Leptons, Hamiltonian functions, Lagrangian functions, Standard model, BCS theory, Superconductivity, Reprints, Mass matrices, Mass gaps. The quark and lepton mass gaps and mass hierarchies are obtained by introducing a BCS interaction among ur-quarks. A 3 x 3 matrix model with equal masses for the quarks, and the scalar field having the same effective for the given model yields these eigenvalues. The mass matrix M differs only to first order in the quark mass from the mass matrix of the quark massless model. The eigenvalues are given to a non-linear self-interaction of the quarks, giving rise to the observed mass gap, or in terms of a composite model.


Keywords: Neutron flux, Neutron beams, Polarized beams, Monochromators, Augmentation, Potentials, Reprints, Neutron polarizers.

A new method for enhancing the flux of a slow neutron beam is proposed. It is shown that a composite potential of a periodic magnetic field and a magnetic field in which there is a magnetic field on a flat circle that is constructed so that a collinearly reflected beam is polarized in one spin direction, and the second field is used to increase the intensity of an unpolarized incident beam. Although this spin-dependent reflector in itself is certainly not unpolarized, and the spin-flip processes, the two beams coming from the reflected beam and the beam from each of the two inci-
dent polarization states for spin-flip and spin-flip processes. Consequently, equal fractions of 'spin-up' and 'spin-down' neutrons are transmitted. Thus re-


The International Temperature Scale of 1990 (ITS-90) became the official international temperature scale on 1 January 1990, superseding the International Practical Temperature Scale of 1968, Amended Edition of 1975 (ITS-68), and the 1976 Provisional 0.5 K to 30 K Temperature Scale (EPRI-76). This paper describes the new scale in detail.


Keywords: Temperature measurement, Standards, Temperature scales, Thermometers, Precal, Reprints, Standard reference materials, Fixed points, ITS-90, US NIST.

The National Institute of Standards and Technology (NIST) offers Standard Reference Materials for use in high-precision thermometry. These SRMs, available through the Office of Standard Reference Materials, include pure metals to be used in the preci-

201.456
of 1990 (TS-90) and some devices to be used directly in the precise realization of secondary fixed-point temperature scales. The primary fixed-point temperature is that of water freezing at 0.5 K to 2053°C. The article will review the use and importance of thermometric fixed points in precision thermometry, SRMs providing such fixed points, and will discuss results achievable with these SRMs.

201.457
PB93-125789
Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Quantum Metrology Div.
Threshold Photoelectron Spectrum of the Argon 3S Satellites
Final rept.
Keywords: *Photoelectron spectroscopy, *Argon, Iodization potentials, Photoemission, Reprints.

Lately a variety of techniques have studied the electron correlation satellites with binding energies between the 100-200 eV iodination potential (20.24 eV) and the lowest 2p(sup -2) iodination potential (43.36 eV). One of these techniques, threshold photoelectron spectroscopy, has been applied to the iodination of these state-selected, individual electronic states. Of all those contributions could be applied to other satellite spectrum, and this observation has led to the possibility of the discrepancies between previous band assignments. The essential physics of two-photon, excited iodine has been applied here to the same region with higher resolution (-60 meV at the 3s(sup -2) peak). In this higher resolution, only at least 29 individual electronic states are present. In some cases, multiplet splitting is observed.

201.458
PB93-126092
PC A03/MF A01
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Quantum Metrology Div.
Photonuclear Polarization Effects in Coherent and Incoherent Photoelectron Scattering: Survey of Measurements and Theory Relevant to Radiation Transport Calculations
J. H. Hubbell. Jul 92, 34p NISTIR-4881

The report reviews available information on polarization, photoelectron effects arising when protons in the X-ray regime, gamma-ray energy regime undergo coherent (Rayleigh) scattering or incoherent (Compton) scattering by atomic electrons. In addition to descriptions and discussions of these effects, including estimates of their magnitudes as they apply to radiation transport calculations, an annotated bibliography 1905-1991 of 102 selected works is provided, with particularly relevant works for the purpose of the report flagged with asterisks. A major resource for the report is a 1948 unpublished informal report by L.V. Spencer which will be quoted here almost in its entirety, since, of all the works cited in the annotated bibliography, it appears to be the only one which explicitly and directly addresses the purpose of the report, hence the valuable material should be re-introduced into the available and current literature.

201.459
PB93-129526
Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Electrical and Optical Physics Div.
Increased Sherman Function in Electron Spin Analyzers Using a Bulk Thorium Target.
Final rept.
Keywords: Electron scattering, Polarized beams, KeV range 10-100, Comparison, Thorium, Gold, Reprints, *Electron spin analyzers, Sherman functions.

Measurements of the effective Sherman function have been carried out for 10-100 KeV spin-polarized electrons scattering from a thick thorium target in a retardation Motl analyzer. At 20 and 100 keV the dependence on the angle of the spin analyzer detector has been measured. Comparison is made with scattering from a 1250 A gold film. Thorium is seen to have a S(01f) up to 30% higher than gold. This higher S(01f) cannot not only the figure of merit of a spin detector, but also lessen its sensitivity to instrumental asymmetries. Comparison is also made with preliminary theoretical predictions. Good agreement is seen in the thorium Sherman function relative to that of gold.

201.460
PB93-300391
Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Ionization Dividing Radiation. Studying and Identifying the Properties of Neutron Producing Targets and Sample Backings on Neutron Cross Section Measurements.
Final rept.

Keywords: *Neutron spectra, *Time-of-flight method, Neutron cross sections, Lithium 7 target, Tritium target, Deuteron reactions, Proton reactions, Uranium oxides, Time dependence, Angular distribution, Stoichiometric Reprints, *Chemical.

The use of pulsed-beam time-of-flight techniques to monitor the time dependence of the neutron energy spectrum from lithium metal targets produced from the $^{7}{\text{Li}}(p,n)^{8}{\text{Be}}$ reaction is reviewed. The effect on the 14 MeV neutron angular distribution produced by the $(\text{d},n){\text{H}}$ reaction by changes in the tritium distribution in the TF target is investigated. The influence of the crystalline properties of sample backings and the use of x-ray powder diffraction to determine the stoichiometry of uranium oxide material are studied.

201.461
PB93-135234
Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Ionization Dividing Radiation. Phenomenological Delta-Nucleus Potential from Inelastic Electron-Nucleus Scattering Data.
Final rept.

Keywords: *Nuclear potential, *Electron scattering, Momentum transfer, Optical models, Helium 4, Carbon, Iron, Reprints, Optical potentials.

The four-momentum transfer dependences of the quasielastic and Delta peak positions seen in electron-nucleus scattering are interpreted in terms of momentum dependent potentials. We have used data on the Delta peak position for $(\text{p},n)^{\text{H}}$ and $(\text{p},\text{p})$ reactions, to determine the depth and momentum range of the real part of the potential felt by a Delta resonance in nuclei. We find that the Delta-nucleus potential is deeper than the nucleon-nucleus potential for q < 950 MeV/c.

201.462
PB93-135283
Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Chemical Kinetics and Thermodynamics
Thermodynamic Properties of Tungsten Diluter (WTe2), Z. Standard Molar Enthalpy of Formation at the Temperature 298.15 K.
Final rept.

Keywords: *Thermodynamic properties, *Tungsten compounds, *Enthalpy, *Tellurium inorganic compounds. Heat of formation, Calorimetry, Tellurium, Vapor pressure, Chemical reactions, Reaction kinetics, Combustion, Reprints, Tungsten diluter, Tellurium hexafluoride.

The standard molar enthalpies of formation of $\text{WTe}_{2}(\text{cr})$ and $\text{TfF}_{6}(\text{g})$ have been determined by combustion calorimetry in high-pressure fluorine. Two high temperature investigations of the vaporization of $\text{WTe}_{2}(\text{cr})$ gave derived enthalpies of formation that agree with this result but which have rather large uncertainties that arise from estimated thermodynamic properties used in the calculations. The enthalpy of formation of $\text{TfF}_{6}(\text{g})$ replaces an earlier determination, now thought to be in error.

201.463
PB93-135440
Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div. Reactor and Cold Neutron Facility at NIST. Final rept.
Keywords: *NBSR reactor, Research reactors, Cold neutron, Neutron diffraction, Neutron scattering, Chemical analysis, Standards, Uses, Reprints, US NIST.

The National Institute of Standards and Technology Reactor is a 20 MW research reactor located at the Gaithersburg, MD site, and has been in operation since 1969. In the reactor hall there are 26 experimental facilities which are used for materials science, chemistry, analysis, nondestructive evaluation, neutron standards work, and irradiations. It is used by other divisions within the National Institute of Standards and Technology (NIST), by other government agencies and laboratories, and by researchers from universities, industry, and in 1988, over 350 scientists and engineers participated in research using the reactor facilities.

PROBLEM-SOLVING INFORMATION FOR STATE & LOCAL GOVERNMENTS

201.464
PB92-183698
PC A07/MF A02
National Inst. of Standards and Technology, Gaithersburg, MD. Office of State, Local, and International Programs

Keywords: *Laboratories, *Standards, *Directories, Units of measurement, States(United States), Puerto Rico, Virgin Islands, Tolerances(Mechanics), Calibration, Certification, State services, Weights and measures, National Type Evaluation Program, State Standards Program.

In support of its mission to promote uniform standards of measurement throughout the country, the National Institute of Standards and Technology (NIST) received funding in 1965 to provide new standards of mass, length, and volume to State weights and measures laboratories. This program, called the (New) State Standards Program, also provided the equipment needed to perform calibrations in these measurement areas. Part I describes the certification program whereby NIST certifies State weights and measures laboratories. Part II is the directory of State weights and measures laboratories and lists the services they provide to State office and county weights and measures agencies as well as to industry. The directory is intended to assist potential users of the laboratory services in locating and obtaining needed measurement services.
Space Technology

Astronautics

201,466
PB92-237536 Not available NTIS National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Task Decomposition Module for Telerobot Trajectory Generation.
Final rept.
Keywords: "Robots, * Control systems, Trajectories, Robot sensors, Algorithms, Reprints, *FTS(TeleRobot Servicer), *Trajectory planning, Task decomposition.

A major consideration in the design of trajectory generation software for a Flight Telerobotic Servicer (FTS) is that the FTS will be called upon to perform tasks which require a diverse range of manipulator behaviors and capabilities. In a hierarchical control system where tasks are decomposed into simpler and simpler sub-tasks, the task decomposition module which performs trajectory planning and execution should therefore be able to accommodate a wide range of algorithms. In some cases, it will be desirable to plan a trajectory for an entire mission before manipulator motion commences, as when optimizing over the entire trajectory. Many FTS motions, however, will be highly sensory-interactive, such as moving to attain a desired position relative to a non-stationary object whose position is periodically updated by a vision system. In this case, the time-varying nature of the trajectory may be handled by frequent replanning using updated sensor information, or by using an algorithm which creates a less specific state-dependent plan that determines the manipulator path as the trajectory is executed (rather than a priori). The paper discusses a number of trajectory generation techniques from these categories and how they may be implemented in a task decomposition module of a hierarchical control system. The structure, function, and interfaces of the proposed trajectory decomposition module is briefly described, followed by several examples of how different algorithms may be performed by the module. The proposed task decomposition module provides a logical structure for trajectory planning and execution, and supports a large number of published trajectory generation techniques.

201,470
PB93-130425 Not available NTIS National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Sensor-Based Robot Control Requirements for Space Applications.
Final rept.
Contract N-867-D.

Keywords: *Space stations, *Robot sensors, Hierarchies, Control systems, Autonomy, Robotics, Teleoperators, Reprints, *FTS(Flight Telerobotic Servicer), VISION(NASA/NBS Standard Reference Model), *NIST(National Institute of Standards and Technology).

Part of the development of the Space Station is the Flight Telerobotic Servicer (FTS) which will help build and maintain the structure. While the FTS will initially use teleoperation, it is envisioned to become more autonomous as technology advances. In order for the FTS to evolve from teleoperation to autonomy, NASA requires that the NASA/NBS Standard Reference Model (NISREM) be used as the functional architecture for the control system. The quest for autonomy inevitably leads to the need for sophisticated sensors and teleoperators. Processing this paper discusses the requirements for the tasks envisioned for FTS at first launch as well as during its evolution phase and how these tasks impact research on sensors, sensory processing, and other parts of the FTS control system. Finally, the current state of the NISREM implementation at NIST will be presented.

Manned Spacecraft

201,468
PB92-157503 Not available NTIS National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.
Heat Transfer in Compact Tubular Heat Exchanger with Application to the Engine Struts of the National Aerospace Plane.
Final rept.
Contract L7401.


The report describes an apparatus to measure heat transfer coefficients in compact heat exchangers which are candidate cooling jackets for the engine struts of the National Aerospace Plane. The heat exchanger consisted of 20 nickel tubes (2 mm OD, 1 mm ID, 15.2 cm heated length), brazed to a 3 mm thick nickel plate. The tubes lay parallel to one another, 3.8 mm on-center separation. The heat exchanger was tested in two different tube bundles, one of 3.4 to 54 W/sq cm over a normal area of 7.8 cm by 15.2 cm. The coolant fluid was helium gas at Reynolds number less than 35,000, and 3500 MPa pressure. For high heat flux and low coolant flow, the helium temperature more than doubled from the inlet to the outlet, and the temperature difference between the tube wall and the gas exceeded 150 K. Standard heat transfer correlations for turbulent flow in circular tubes predicted the measured Nusselt numbers within 0.01. However, when the authors accounted for the effects of variable thermophysical properties arising from the temperature difference between the tube wall and the gas, the results were compatible with experiment.

201,469
PB92-238591 PC AO3/MF A01 National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Assessment of the NASA Flammability Screening Test and Related Aspects of Material Flammability.
Final rept. Jul 89-Jun 92.
T. J. Ohlemiller. Aug 92, 46p NTIS-4882, NASA.
Contract NASC-32003-R
See also PB91-216606. Sponsored by National Aeronautics and Space Administration, Cleveland, OH. Lewis Research Center.

Keywords: *Spacecraft construction materials, *Flammability testing, Space hazards, Flame propagation, Fire experiment design, Ignition times, Tensile burning rate, NASA, Reduced gravity, Safety engineering.

The final report summarizes the results of an assessment of the NASA flammability screening test (89060) which uses two highly different test methods which measure ignitability, rate of heat release and opposed flow flame spread behavior. Materials passing the NASA flammability screening test showed widely varying degrees of flammability enhancement when subjected to external radiation (modified NASA test, NIST test). Since such radiation is implicit in many normal fire scenarios, materials passing the standard NASA screening test should not be treated as non-flammable. The quantity is self-feedback of radiation remains to be fully clarified; an apparatus to examine the issue was built but no tests could be conducted as the allotted time. The rate of heat release from the two-sided burning of thermally-thin materials was quantitatively compared to that for one-sided burning; the issue was believed to be at the heart of certain anomalies in the earlier stages of the study. On the basis of the study, it is recommended that NASA supplement their existing flammability screening test with one that incorporates external radiation. It is further recommended that the supplemental test in normal gravity be correlated experimentally with a similar test in micro-gravity.

Unmanned Spacecraft

201,471
PB93-130375 Not available NTIS National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Applied and Computational Mathematics Div.
Estimation of Dynamic Green’s Functions for Large Spacecraft Structures by Pulse Probing and Deconvolution.
Final rept.
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.

Keywords: *Large space structures, Timoshenko beams, Dynamic response, Greens function, Integral equations, Linear systems, Pulses, Reprints, ill posed problems, Deconvolution.

201,471
PB93-135374 Not available NTIS National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.

Problem-Solving Information for State & Local Governments

General
The research literature on the visibility of colors and topmarks used to code information used on buoys and other aids to navigation was reviewed. It is difficult to draw conclusions about the relative effectiveness of different topmark, color, and buoy configurations. Consequently, two experiments were conducted to determine the distance at which buoy topmark configurations could be correctly identified for different lighting geometries and background conditions. In experiment 1, the visibility of buoys and topmarks as separate entities was evaluated for ten different buoy configurations in simulated waterway viewing environments. Four buoys, including safe water, danger, port and starboard, were shown with and without topmarks, while two buoys, the north and east, always had topmarks. Front and back lighted buoys were presented in both water and foliage environments, as well as in a 'twilight' condition. In experiment 2 the visibility of buoys with integral topmarks was evaluated only for front lighting conditions. Analysis of the data from both experiments suggests strongly that topmarks did not increase the visibility the buoy configurations studied. The data indicated that color is a critical cue in determining buoy type, with significant differences in buoy detectability between red and green buoys. Front lighting also increased visibility distance significantly.

Road Transportation

201,473
PB92-236355  Not available NTIS

The visibility of colors and topmarks used to code information used on buoys and other aids to navigation was reviewed. It is difficult to draw conclusions about the relative effectiveness of different topmark, color, and buoy configurations. Consequently, two experiments were conducted to determine the distance at which buoy topmark configurations could be correctly identified for different lighting geometries and background conditions. In experiment 1, the visibility of buoys and topmarks as separate entities was evaluated for ten different buoy configurations in simulated waterway viewing environments. Four buoys, including safe water, danger, port and starboard, were shown with and without topmarks, while two buoys, the north and east, always had topmarks. Front and back lighted buoys were presented in both water and foliage environments, as well as in a 'twilight' condition. In experiment 2 the visibility of buoys with integral topmarks was evaluated only for front lighting conditions. Analysis of the data from both experiments suggests strongly that topmarks did not increase the visibility the buoy configurations studied. The data indicated that color is a critical cue in determining buoy type, with significant differences in buoy detectability between red and green buoys. Front lighting also increased visibility distance significantly.

Road Transportation

201,473
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Road Transportation

201,473
PB92-236355  Not available NTIS
## PERSONAL AUTHOR INDEX

### SAMPLE ENTRY

<table>
<thead>
<tr>
<th>Author name(s)</th>
<th>Title</th>
<th>NTIS order number</th>
<th>Abstract number</th>
</tr>
</thead>
<tbody>
<tr>
<td>YEE, K. W.</td>
<td>Automated Compensation of Part Errors Determined by In-Process Gauging. PB92-205434</td>
<td>200,822</td>
<td></td>
</tr>
</tbody>
</table>

### ABDUL-RAZZAO, W.
- Magnetic Altereffect in Compositionally-Modulated Ni/Cu Multilayers Prepared by Electrodeposition and By Sputtering. PB92-159045
- 201,266

### ACQUISTA, N.
- Atlas of the Spectrum of a Platinum/Neon Hollow-Cathode Reference Lamp in the Region 1130-4330 A. PB92-180198
- 201,427
- Laser-Produced Spectra of Copperlike Antimony and Tellurium, Sb(22+), Te(23+). PB92-175866
- 201,417

### ADAM, G.
- On-Line Arc Welding Data Acquisition and Analysis System. PB92-165018
- 200,843

### ADAMS, J. W.
- Phase Characteristics and Time Responses of Unknown Linear Systems Determined from Measured CW Amplitude Data. PB92-183722
- 200,715
- 200,721

### ADRIAN, F. J.
- SQUID and MAMMA Observations of the Superconducting Transition in Single Crystals of YBa2Cu3O7-x. PB92-144237
- 201,242

### AESCHLUMANN, M.
- Micromagnetics of Surface Segregation Regions in Domains Written in TbFeCo Alloys. PB92-237346
- 201,329

### AGGARWAL, I.
- Approaches to Accurate Characterization of High Purity Metal Fluorides and Fluoride Glasses. PB92-144146
- 201,154

### AKAIWA, N.
- Effects of Convection on Ostwald Ripening in Solid-Liquid Mixtures. PB92-144112
- 201,028

### ALEXEFF, I.
- Observation of Partial Discharge in Hexane Under High Magnification. PB92-145135
- 200,696

### ALLAN, D. W.
- Frequency and Time Stability of GPS and GLONASS Clocks. PB92-129617
- 200,465
- In Search of the Best Clock: An Update. PB92-236215
- 200,466
- Remote Time and Frequency Comparisons: New and in the Future. PB92-175017
- 200,455

### ALLEN, R.
- Evaluation of Secco Etch Technique for Determination of Dislocation Densities in SIMOX Wafers. PB92-165257
- 200,648

### ALQUIE, M.
- Determination of the Polarization-Depth Distribution in Polycrystalline Ceramics Using Thermal and Pressure Pulse Techniques. PB92-236223
- 200,647

### ALVORD, D. M.
- Routine for Analysis of the People Movement Time for Elevator Evacuation. PB92-164771
- 200,057

### ALY, M. A.
- Chain-Propagation Length of Linoleic Acid Peroxidation in Aqueous Monomeric and Micellar Systems. PB92-236233
- 200,207

### AMAN, S. A.
- Mutation of Potassium Permanganate- and Hydrogen Peroxide-Treated Plasmid pZ189 Replicating in CV-1 Monkey Kidney Cells. PB92-144120
- 201,131

### ALARIE, Y.
- Development of a Standard Reference Material for Calibration of the University of Pittsburgh Smoke Toxicity Method for Assessing the Acute Inhalation Toxicity of Combustion Products. PB92-192087
- 201,134

### ALBERS, J.
- Semiconductor Measurement Technology, Version 2.0 of the TXYZ Thermal Analysis Program. TXYZ20
- 200,679

### ALBUS, J.
- NIST SPIDER: A Robot Crane. PB92-217686
- 200,873

### ALBUS, J. S.
- Computer Simulation of a Parallel Link Manipulator. PB92-165844
- 200,872
- Logarithmic Retina. PB92-183649
- 200,524
- Marr and Albus Theories of the Cerebellum: Two Early Models of Associative Memory. PB92-14696/8
- 200,039
- Outline for a Theory of Intelligence. PB92-144138
- 200,534
- Representations in Visual Motion. PB92-148287
- 200,040
- Space Robotics: Evolution and Applications. PB92-135374
- 201,467

### ALDEEN, J.
- Electrical Measurements to the 0.5mm Regime. PB92-171727
- 200,661

### ALDEN, R. A.
- Elimination of Effects Due to Patterning Imperfections in Electrical Test Structures for Submicrometer Feature Metrology. PB92-197342
- 200,675
- Voltage-Driven Potentiometer Enhancements for High-Precision Feature Placement Metrology. PB92-175025
- 200,684

### ALFRED, C.
- Measurement of the Thermal-Depth Distribution in Polycrystalline Ceramics Using Thermal and Pressure Pulse Techniques. PB92-135515
- 200,348

### ALWEDDING, L.
- Chain-Propagation Length of Linoleic Acid Peroxidation in Aqueous Monomeric and Micellar Systems. PB92-236233
- 200,207

### ALY, D. M.
- Routine for Analysis of the People Movement Time for Elevator Evacuation. PB92-164771
- 200,057

### ANGEL, D. W.
- Determination of the Polarization-Depth Distribution in Polycrystalline Ceramics Using Thermal and Pressure Pulse Techniques. PB92-135515
- 200,348

### ANWALL, L.
- Approaches to Accurate Characterization of High Purity Metal Fluorides and Fluoride Glasses. PB92-144146
- 201,154

### ANWALL, R.
- Observation of Partial Discharge in Hexane Under High Magnification. PB92-145135
- 200,696

### ANWALL, S.
- Frequency and Time Stability of GPS and GLONASS Clocks. PB92-129617
- 200,465
- In Search of the Best Clock: An Update. PB92-236215
- 200,466
- Remote Time and Frequency Comparisons: New and in the Future. PB92-175017
- 200,455

### ANWALL, T.
- Evaluation of Secco Etch Technique for Determination of Dislocation Densities in SIMOX Wafers. PB92-165257
- 200,648

### ANWALL, R.
- Extending Electrical Measurements to the 0.5mm Regime. PB92-171727
- 200,661

### ANWALL, R. A.
- Elimination of Effects Due to Patterning Imperfections in Electrical Test Structures for Submicrometer Feature Metrology. PB92-197342
- 200,675
- Voltage-Driven Potentiometer Enhancements for High-Precision Feature Placement Metrology. PB92-175025
- 200,684

### ANWALL, C.
- Measurement of the Polarization-Depth Distribution in Polycrystalline Ceramics Using Thermal and Pressure Pulse Techniques. PB92-135515
- 200,348

### ANWALL, L.
- Chain-Propagation Length of Linoleic Acid Peroxidation in Aqueous Monomeric and Micellar Systems. PB92-236233
- 200,207

### ANWALL, D. M.
- Routine for Analysis of the People Movement Time for Elevator Evacuation. PB92-164771
- 200,057
PBP92-187020 200,549
KOHLER, R.
Numerical Modeling of Short-Wavelength Internal Quantum Efficiency
PBP92-146625 200,579
KOHOUT, R.
PBP92-172782 200,817
KOLDOCK, J.
Electron Stimulated Desorption of Neutral Species from (100) KCl Surfaces.
PBP92-177092 200,325
KOPANSKI, J. J.
PBP92-197904 200,677
KORDE, R.
Silicon Photodiodes with Stable, Near Theoretical Quantum Efficiency in the Soft X-Ray Region.
PBP92-237049 201,446
KORITSA, K. T.
Optically Thin Thermal Emission as the Origin of the Big Bump in the Spectra of Active Galactic Nuclei.
PBP92-175256 200,025
KOSTER, R. J.
Alaska Marine Mammal Tissue Archival Project Sample Inventory and Results of Analyses of Selected Samples for Organics and Trace Elements.
PBP92-143718 200,768
KOSKOWSKI, H. J.
Comparison of the NIST Surf and Argon Mixed Irradiation Standards at 214 nm.
PBP92-155445 201,120
KOTOWSKI, K.
Rigid-Rod Derived Amorphous Polydicyacetylenes.
PBP92-159398 200,377
KRAFT, K. A.
Comparative Analysis of Thermal Conductivity in BiO Thin Films.
PBP92-159557 201,105
KRAWJEWSKY, J. N.
Neutron Powder Diffraction Study of Pb2Si2YCu3O8+δ, the Prototype of a New Family of Superconductors.
PBP92-159151 201,268
KRASUMA, M.
Electronic Limitations in Phase Mixers for Heterodyne Interferometry.
PBP92-158813 200,586
KRAMER, T.
Methodology for Integrating Sensor Feedback in Machine Tool Controllers.
PBP93-130318 200,639
KRAMER, T. R.
Library of Material Removal Shape Element Volumes (MRSE).
PBP92-181213 200,850
KRAUSE, S.
Analysis of the Characterization of Oxidized Implantable Silicon (SIMOX) by Spectroscopic Ellipsometry.
PBP92-159417 200,640
KRAUSE, S.
Effect of Annealing Ambient on the Precipitation Processes in Oxygen-Implanted Silicon-on-Insulator Material.
PBP92-175865 200,660
KRIEGER, W. A.
Electromagnetic Properties of Materials at NIST.
PBP92-191619 200,171
KRUSURDA, M.
High Tc Superconducting Films on Silicon Wafers.
PBP92-237074 200,324
KREIDER, K.
High Tc Superconducting Films on Silicon Wafers.
PBP92-237074 200,324
KREIDER, K. G.
Annealing Behavior of Sputter Deposited Al-Mn and Al-Mn- Si Films.
PBP92-144577 201,245
KREINER, W. A.
Optothermal-Detected Microwave-Sideband CO2 Laser Spectroscopy of NCH-4H3.
PBP92-142444 200,244
KREMER, D. P.
Certification Plan for a Planar Near-Field Range Used for High-Performance Phased-Array Testing.
PBP92-213305 200,553
KRUGER, S.
Characterization of the Diminution of Alumina by Multiple Small-Angle Neutron Scattering.
AD-2429 179/3 200,806
KRUGER, J.
Reflection X-ray Absorption Fine Structure Study of the Passive Films on Cast and Rapidly-Solidified Mg Alloys.
PBP93-125474 201,063
KRUSSL, W. A.
SIMS Determination of the Deuterium Distribution in SIMOX Boron Doped Oxides.
PBP92-165166 200,643
KUCERA, J. T.
Fabrication of Nanometer Smooth B2Si2Cu2O8 δ by Delta Films, by Co-Sputtering from Elemental Targets with Pure Oxygen.
PBP92-125659 201,240
KUCHINSKY, M. A.
X-ray Powder Diffraction Characterization of Barium Rare Earth Copper Oxides (Ba2CuO5; R=Yttrium and the Lanthanides) and Related Compounds.
PBP92-237577 200,841
KUHN, D. R.
Effective Use of Software Standards in Systems Integration.
PBP93-227080 200,500
KULIKARNI, A. K.
Model for Upward Flame Spread on Vertical Wall.
PBP92-165828 200,891
KULIKARNI, A. K.
Effect of a Dielectric Barrier on the Stochastic Behavior of Trichloro-1-1-1-1-Carbon.
PBP92-145242 200,699
KULIKARNI, S. V.
Influence of a Dielectric Barrier on the Stochastic Behavior of Trichloro-1-1-1-1-Carbon.
PBP92-125659 201,240
KUNATH, N. K.
Recent Advances in Partial Discharge Measurement Capabilities at NIST.
PBP92-142444 200,608
KUNATH, N. K.
Application of Inelastic Deformation Analysis to Double-Deck Highway Structures.
PBP92-225243 200,406
KUNZE, D.
Solution of Radiative Transfer Problems in Molecular Bands without the LTE Assumption by Accelerated Lambda Iteration Methods.
PBP92-165828 200,891
PARALLEL

LIFE, J. G.,

LEE, J. M.

LEHMANN, D. R.

LEI, M.

LEIGH, S.

LENANAN, P. M.

LEONARD, J. T.

LEONE, S. R.

LETT, P. D.

LETTIERT, T. R.

LIEB, K. P.

LIBERMAN, R. A.

LIBERMAN, J. F.

LIESKOVSKY, L.

LIM, D. S.

LIN, C.

LEVEY, B. C.

LEVKOWITZ, J.

LEWANDOWSKI, W.

LEWITT, G. P.

LEWINER, J.

LEWIS, M.

LEWIS, M. A.

LEWIS, R. L.

Lewis, A. R.

LI, C.

LI, W. W.

LID, B. B.

LIDE, D. R.

LIGGETT, P. D.

LIPPINCOTT, J.

LISZT, P. D.

LITVIN, G. S.

LITZ, G. S.

LITTLE, N. R.

LIZARRERE, R.

LIOU, T.

LITVIN, T. M.

LITZ, W. L.

LITZ, W. L.

LITZ, W. L.

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LITZ, W. L.
PERSONAL AUTHOR INDEX

RUTMAN, J. Characterization of Frequency Stability in Precision Frequency Sources. PB92-175736
SAKUMA, M. Accelerated Lambda Iteration Method for Multilevel Radiative Transfer. 1. Non-Overlapping Lines with Background Continuum. PB92-175744
SALAMA, K. Solution of Radiative Transfer Problems in Molecular Bands without the LSE Assumption by Accelerated Lambda Iteration Methods. PB93-125318
SAIER, M. H. Crystallization of the "Bacillus Subtilis" Heat-labile-Containing Phosphocarcin Protein Hr and Some of Its Site-Directed Mutants. PB92-197688
SALAMON, M. Magnetooelasticity in Rare-Earth Superlattices and Films. PB92-159466
SALAMON, M. B. Anisotropic Magnetic Response of Rare Earths in Superlattices. PB92-171032
SALAMON, M. H. Limits on the Emission of Neutrons, gamma-rays, Electrons, and Protons from Pons/Fleischmann Electrolytic Cells. PB92-237530
SALEH, M. I. Separation and Relative Distribution of all-trans-beta-Carotene and its cis isomers in beta-carotene Preparations. PB92-170736
SAMUELSON, S. Sensitivity Limits to Fermi-Ferraday Faraday Effect Magnetic Field Sensors. PB92-165323
SANDER, L. Evaluation of the Visibility of Buoy and Topmarks. PB92-172436
SANDERS, S. A. NIST Serial Holdings, 1992. PB93-190487
SANQUINTIN, G. M. Limits on the Emission of Neutrons, gamma-rays, Electrons, and Protons from Pons/Fleischmann Electrolytic Cells. PB92-237320
SANFORD, N. A. Extended-Cavity Operation of Rare-Earth-Doped Glass Waveguides Lasers. PB92-175751
SANDFELDT, W. J. Improved Strain Gage Method for Measuring K(sub 1) for a Propagating Crack. PB92-166057
SANDER, J. Improved Strain Gage Method for Measuring K(sub 1) for a Propagating Crack. PB92-160019
SANDGREN, J. Fa-K (Iron-Potassium) System. PB92-154632
SANSONETTI, C. J. Absolute ionization Energy of the 2 (1)S Level of Helium. PB92-175769
SCHAEFER, R. Use of NIST Standard Reference Materials for Determination of Analytical Chemical Methods and Laboratory. PB92-140780
SCHAFFT, H. A. Building In Reliability: Making It Work. PB92-166605
SCHEINFIN, M. R. Magnetically Imaging with Scanning Electron Microscopy with Polarization Analysis. PB92-157018
SCHEINFIN, M. R. Use of Sherman Sensor in Electron Spin Spin Analyzers Using a Bulk Thorium Target. PB92-196046
SCHICK, P. K. Ferroelectric Thin Films Prepared by Pulse Laser Deposition Processing and Characterization. PB92-190680
SCHIMKA, F. J. Standardization of Holmium-166 by the CEMAT/NIST Liquid-Solution Efficiency-Tracing Method. PB92-159046
SCHILLER, S. B. Development of a Standard Reference Material for Calibration of the University of Pittsburgh Smoke Toxicity Method for Assessing the Acute Inhalation Toxicity of Combustion Products. PB92-192976
SCHNEIDER, R. Use of NIST Standard Reference Materials for Determination of Analytical Chemical Methods and Laboratory. PB92-140780
SCHEINFEIN, M. R. Magnetic Imaging with Scanning Electron Microscopy with Polarization Analysis. PB92-143527
SCHMITZ, M. N. Alaska Marine Mammal Tissue Archival Project: Sample Inventory and Results of Analyses of Selected Samples for Organic Compounds and Trace Elements. PB92-190576
SCHOFIELD, C. Preparation and Analysis of a Frozen Mussel Tissue Reference Material for the Determination of Trace Organic Constituents. PB92-145317
SCHOFIELD, C. Magnetic Imaging with Scanning Electron Microscopy with Polarization Analysis. PB92-143527
SCHOFIELD, C. Magnetic Imaging with Scanning Electron Microscopy with Polarization Analysis. PB92-143527
SCHOFIELD, C. Magnetic Imaging with Scanning Electron Microscopy with Polarization Analysis. PB92-143527
SCHOFIELD, C. Magnetic Imaging with Scanning Electron Microscopy with Polarization Analysis. PB92-143527

PERSONAL AUTHOR INDEX

PB92-213420 201,090
SCHNEE, J. A.
Non-metallurgy on III-V Semiconductor Surfaces Using a Scanning Tunneling Microscope Operating in Air.
P99-144402 200,626
PB92-154160 200,632
SCHNITZER, R. E.
Spin-Resolved Elastic Scattering of Electrons from Sodium Below the Inelastic Threshold.
P99-154392 201,375
SCHOOLY, J. F.
High-Accuracy Dilometer for the Range -20 C to + 700 C.
P99-170935 201,405
P98-237253 201,450
SCHRAck, R. A.
Determination of the Uniformity of Uranium Fission Deposits Using Rutherford Backscattering Spectrometry and Alpha-Particle Scanning.
P99-222740 201,399
Studies of the Effect of the Properties of Neutron Producing Targets and Sample Backings on Neutron Cross Section Measurements.
P99-230391 201,460
SCHREGENBERGER, S. D.
Structure/Processing/Property Relationships for High Mobility Weight High Density Polyethylene Blown Films.
P99-226702 201,072
SCHROEDER, I. G.
Facilities for Fundamental Physics Research at the NIST Cold Neutron Facility.
P99-170661 201,400
SCHROEDER, T. D.
Laser-Induced Optical Emissions of CVD Diamond Studied in the Raman Microprobe.
P99-215908 201,192
SCHUEZL, D.
Standard Reference Materials for Chemical and Biological Studies of Complex Environmental Samples.
P99-155705 200,759
SCHUSTER, C. E.
High-Density Test Structures for Assessing Microwave/Milli-meter Wave Monolithic Integrated Circuit (MMIC) Performance.
P99-154840 201,637
SCHWALTZ, S. A.
Effect of Photopolymerized Iron Oxide and Tin Oxide on the Consolidation of Porous Ycor Glass.
P99-125913 200,946
SCHWARZ, F. P.
in vivo Brain Water Determination by T1 Measurements: Effect of Total Water Content, Hydration Fracion, and Field Strength.
P99-159597 201,105
SCOTT, H. A.
Control System Architecture for the TEAM Program.
P99-223748 200,874
SCOTT, J. L.
Effects of Flow Conditioners and Tap Location on Orifice Flowmeter Performance.
P99-183730 200,879
SCOTT, R. D.
Determination of the Neutron Lifetime by Counting Trapped Protons.
P99-215908 201,379
SCOTT, T. R.
Microwave Laser Calorimeter Design.
PB92-171701 201,205
SEALock, R. M.
Phenomenological Delta-Nucleus Potential from Inclusive Electron-Nucleus Scattering Data.
P99-135234 201,461
SEEGER, P. A.
Structures of a Binary Colloidal Suspension Under Shear.
P99-175389 200,314
SEGAWA, K.
Anomalously Offset Quantized Hall Plateau in High-Mobility Si-MOSFETs.
P99-175389 200,314
SEIKER, J. F.
Droplet Mobility Measurements in a Swirling Kerosene Spray Flame.
P99-135150 200,742
SEILIER, J. G.
Effect of atomization on air droplet dynamics of spray flames.
P99-120556 200,731
SEILIER, J. H. L.
Sediment Thousand Evaluated Experimental Thermodynamic Property Data for Water and Steam.
P99-148154 200,231
SERNERS, J. V.
Captial Waves of Fluid Interfaces Near a Critical Point.
P99-160699 200,294
Sersky, A.
Application of Parameter Estimation Theory in Low Frequency Accelerometer Calibration.
P99-198019 201,793
SEITZMANN, U.
New Determination of State and Tables of Thermodynamic Properties for Methane Covering the Range from the Melting Line to 625 K at Pressures up to 1000 MPa.
P99-148170 201,223
SEYOUNI, H. M.
Thermoremanence and Meissner Effect in MgO Single-Crystal YBCO.
P99-130268 201,341
SHAMOTO, S.
Correlation of Thermodynamic and Superconducting EBZ02CuO6 with Tc = 53 K.
P99-144617 201,244
SHAPIRO, A. J.
High Tc Superconducting Films on Silicon Wafer.
P99-237264 201,324
SHAPIRO, A. J.
Discontinuous Coarsening of Tetraplicate Precipitates in Partially Stable Dioxide and Zirconia Induced by Diffusional Coherence.
Study under Applied Stress.
P99-227007 200,936
Evidence for Film-Induced Cleavage in Rhodium Plate Nickel.
P99-223712 201,058
SHEMUTAR, D.
Diamond as an Optical Material.
AD-247 628/1
Growth Defects in Diamond Films.
AD-247 618/3
Moire-Fringe Images of Twin Boundaries in Chemical Vapor Deposited Diamond.
AD-247 729/1
Twin Quiltograms in CVD Diamond.
AD-245 862/5
SHEFFIELD, A. E.
14C Source Amortization Technique Applied to Winter-time Urban Aerosols and Gases for the EPA Integrated Air Cancer Project.
P99-171212 200,762
Microchemical and Molecular Dating.
P99-144684 201,156
SHELTON, R. D.
Magnetic Order by Dy in DyBa2Cu3O7.
P99-130284 201,343
Two-Dimensional Magnetic Correlations and Magnetic Ordering of Localized and Itinerant in DyBa2Cu3O7 and ErBa2Cu3O7.
P99-226649 200,322
SHENTON, H. W.
NIST Impact Test Facility.
P99-223615 200,206
SHERIDAN, J. D.
P99-130359 200,801
SHERIKOV, S. Q.
Introduction to Graphical User Interfaces and Their Use by CITIS.
P99-213404 201,141
SHI, D.
Critical Currents in Silver-Sheathed (Bi,Pb)2Sr2Ca2Cu3O10-y Superconducting Tapes.
P99-190905 200,316
SHIH, A.
Photoemission Study of BaO Overlays Adsorbed on W(110) and Their Interaction with H2O, CO2, and O2.
P99-154172 200,199
SHILLSTONE, G. F.
Solubilities of Solids and Liquids of Low Volatility in Supercritical Carbon Dioxide.
P99-148105 200,226
SHIMADA, M.
Wide Precooling at 295 K and Its Effects on the 4K Transition of Austenitic Steels.
P99-145200 200,996
SHIMAMOTO, S.
Charpy Impact Tests Near Absolute Zero.
P99-145152 200,995
SHIRANE, G.
Magnetic Correlations and Energy Gap in Superconducting YBa2Cu3O7 with Tc = 53 K.
P99-144617 201,244
SHIRLEY, D. A.
The Threshold Photoelectron Spectrum of the Argon 3s Satellites.
P99-125789 201,457
SHIRLEY, J. H.
Interference Fringes from Single-Cavity Excitation of an Atomic Beam.
P99-175199 201,413
Photon Intensities with the NIST Optically Pumped Primary Frequency Standard.
P99-175231 200,457
PA-40
PERSONAL AUTHOR INDEX

PB92-236223 200,267
Detecting Irradiated Foods: Use of Hydroxyl Radical Biomarkers. PB92-144740 200,133
Effect of Oxygen, Antioxidants, and Superoxide Radical on Tyrosine Phenylnal Radical Deteriorization. PB92-159631 201,096
Urinary Biomarkers in Radiation Therapy of Cancer. PB92-236322 201,106

SIMOG, E.
Empirical Fluid-Elemental Models and Casual Gauging: A Case Study. PB93-166207 201,353
Equivalence between Motions with Noise-Induced Jumps and Chaos with Small Horsehoes. PB92-129728 201,178
Estimation of Dynamic Green’s Functions for Large Space Structures by Pulse Probing and Deconvolution. PB93-130035 201,471
Greens Functions for Elastic Networks with Rigid Body Motion. PB92-236594 201,352
Hunting Climatology. PB92-190068 200,120
Noise-Induced Chaos and Phase Space Flux: A Sample-Theory Study. PB92-172733 201,411
Periodic and Chaos Oscillations of Modified Stoker Column. PB92-170707 200,115
Reliability of Collapse Drilling and Production Platforms. PB92-129728 201,178

SIMMON, E.
Detection of Insect Defects in Cables by Partial Discharge Signal Analysis. PB92-222744 201,167

SIMONS, J. A.
Fast Leaky Modes on Cylindrical Metal-Ceramic Interfaced. PB92-170877 200,969
Unipropagation at Cylindrical Metal-Ceramic Interfaces in Composites. PB92-198142 200,976

SIMONS, N. J.
Properties of Copper and Copper Alloys at Cryogenic Temperatures. PB92-172776 200,147
Review of Cryogenic Mechanical and Thermal Properties of Al-Li Alloys and Alloy 2219. PB92-149673 200,429

SIMONS, D.
SIMS Study of the Deuterium Distribution in SIMOX Buried Oxides. PB92-165166 200,643

SIMONS, D. S.
Effect of Annealing Ambient on the Precipitation Processes in Oxygen-Implanted Silicon-on-Insulator Material. PB92-171651 200,660
Kinetics of Silicon Nitride Crystallization in N+-Implanted Silicon. PB92-144765 200,628

SIMPSON, J. A.
Intelligent Processing Equipment Research and Development Programs of the Department of Commerce. NB2-224989 200,826

SIMS, J.
Buoyant Convection in an Enclosed Enclosure. PB92-176894 200,421

SINDT, C.
Orifice Meter Performance Downstream from Elbows or a Tee. PB92-175785 201,185

SINDT, C. F.
Effects of Flow Condensors and Tap Location on Orifice Flowmeter Performance. PB92-183730 200,879
Orifice Meter Performance Downstream of a Tube Bundle Flow Conditioner, Elbows, and a Tee. PB92-189521 201,186

SIMON, O.
Observation of Rebond in Power MOSFETs. PB92-129492 200,492

SITZ, G. O.
Observation of a Speed-Dependent Collisional Ionization in H2 Vibrational Line Profiles. PB92-159540 200,266

SULIN, J. V.

SKALL, M. W.
Gauging the Validity of Graphics Standards. PB92-237403 200,501

SKANDERA, M.

SKANTHAKUMAR, S.
Magnetic Order of Cu in Ni2+xCexCuO4. PB92-237411 200,330

SKRTIC, D.
Effect of Different Phosphoprotein-Cholesterol Membrane Compositions on Liposome-Mediated Formation of Calcium Phosphates. PB92-154665 201,093
Effect of Membrane Cholesterol on Calcium Phosphate Formation in Aqueous Suspensions of Aromatic Liposomes. PB92-154673 201,094

SLAVIN, W.
Automated Stamy Sample Introduction for Analysis of a River Sediment by Graphite Furnace Atomic Absorption Spectroscopy. PB92-154236 200,160

SLEIGHT, A. W.
Superconducting TI2.8Ba2.0CuO6+ delta: A High Resolution Neutron Powder and Single Crystal X-Ray Diffraction Investigation. PB93-135192 201,345

SLIFRA, A. J.
Coefficient of Sliding Friction of 440C as a Function of Temperature. PB92-129257 200,431
Tribological Behavior of 440C Marstensitic Stainless Steel from 184°C to 750°C. PB93-135341 201,011

SLOAN, E. D.
Lavapor Liquid Equilibrium for the Binary Systems of Nitrogen, Carbon Dioxide, and n-Butane at Temperature from 220 K to 344 K. PB92-144401 200,215

SLUPSKY, J. D.
Solubility of Carbon Dioxide in Water at Low Pressure. PB93-118196 200,235

SMEDLEY, J. E.
Optically Pumped Ultra-Violet Lasers on SO(B(3)Sigma(-))(X)(3)Sigma(-)). PB92-185576 200,292

SMITH, A. B.
Coherent Quasielastic Neutron Scattering Study of the Rotational Dynamics of C60 in the Orientationally Disordered Phase. PB92-144483 200,249
Rotational Dynamics and Orientalational Melting of C60: A Neutron Scattering Study. PB93-129669 200,362

SMITH, D. R.
Automated Low-Temperature Guarded Hot Plate for Measuring Apparent Conductivity. PB92-175793 200,091

SMITH, D. T.
Contact Electrification and Adhesion between Dissimilar Materials. PB92-125635 200,621
Fractal Contact Adhesion Energies of Mica, Silica-Silica, and Mica-Silica Interfaces in Dry and Moist Atm- mosphere. PB92-126088 200,948

SMITH, M. V.
Optical Transmitance Standard Reference Materials for Ultraviolet and Visible Molecular Absorption Spectroscopy. PB92-154459 200,161

SMITH, R. L.
New Heater and Flux Gauge for the NBS Smoke Box. PB93-136170 200,428

SMYTH, K. C.
Multiphoton Excitation Spectroscopy of the B(1)Sigma(+)(X) and C(1)Sigma(+)(X) + Rydberg States of CO. PB92-156193 200,206

SNELL, J. E.
International Fire Research. PB93-128035 200,108
Preliminary Study of the 1991 Oakland Hills Fire and Its Relevance to Wood-Frame, Multi-Family Building Construc- tion. PB92-129992 200,126
Smoke Toxicity Hazard: A Status Report. PB93-129669 200,111

SNIEGOSKI, L. T.
Comparison of Results for Cholesterol in Human Serum Obtained by the Reference Method and by the Definitive Method of the National Reference System for Cholesterol. PB92-156300 201,104
PERSONAL AUTHOR INDEX

YOSHIHRO, K.
Anomalously Offset Quantized Hall Plateau in High-Mobility Si-MOSFETs.
PB92-171750
200,662

YOUNG, G. S.
Kinematic Calibration of an Active Camera System.
PB92-123698
200,519

YOUNG, M.
Fiber Cladding Diameter by Contact Micrometry.
PB92-119990
201,209

Scanning Confocal Microscopy for Precise Measurement of Optical Fiber Diameter.
PB92-165943
201,200

PB92-237247
200,720

Video Microscope with Submicrometer Resolution.
PB92-197979
201,215

YU, D.
Anomalously Offset Quantized Hall Plateau in High-Mobility Si-MOSFETs.
PB92-171750
200,662

ZALEWSKI, F.
YIN, L.
Clytical XRF Analysis with Pattern Recognition.
PB92-237593
200,181

YIN, L. C.
Optical Properties of Mixed Yttria-Silica Films.
PB92-109581
201,195

ZAHARIAS, M. R.
Microbeam and Track Dose Rate Measurements of Particle Formation Processes.
PB92-166099
200,294

ZAK, Z.
Two-Dimensional Laser Interferometry using a He-Ne Laser as a Source of Monochromatic Light.
PB92-129789
201,457

ZHANG, D.
Thermal Conductivity of a Large Diameter Glass Tube.
PB92-172708
200,178

ZHENG, D. S.
Identification of Mt. Emmons by Simulated Scattering Spectra.
PB92-172708
200,178

ZHOU, L.
PB92-181049
200,738

ZIBROV, A. S.
Thermal Conductivity of a Large Diameter Glass Tube.
PB92-172708
200,178

ZIELINSKI, W. L.
Intercomparison of a Range of Primary Standard Gas Cartridges of Carbon Monoxide in Nitrogen and Carbon Dioxide in Nitrogen Prepared by the National Institute of Standards and Technology and the National Physical Laboratory.
PB92-175231
200,457

ZIEGLER, R.
Ascorbic and Dihydroxyascorbic Acid Measurement in Human Serum and Plasma.
PB92-154442
200,103

ZUGU, L.
Overview of FDDI.
PB92-129303
200,515

ZUSHAN, S.
Research on Laser Length Standards in the Precision Engineering Division, NIST.
PB93-126043
200,226

ZUSHAN, S.
Alaskan Marine Mammal Tissue Archival Project.
PB92-143718
200,768

ZVON, J. A.
Chemical Interaction of Mn with the MoS2(001) Surface Studied by High-Resolution Photoelectron Spectroscopy.
PB92-129542
200,361

PB92-129536
200,348

YE, K. W.
PB92-187046
200,830

Automated Compensation of Part Errors Determined by In-Process Gauging.
PB92-205434
200,822

Automation of Strain-Gauge Load-Cell Force Calibration.
PB92-187087
200,788

Implementing Error Compensation on Machine Tools.
PB92-129518
200,686

Strategy for the Quality Control of Automated Machine Tools.
PB92-238666
200,483

YEHEKEL, O.
Interfacial Chemistry of Millite-Mullite Composites.
PB92-166313
200,908

YIN, L.
Qualitative XRF Analysis with Pattern Recognition.
PB92-237593
200,181

ZAHARIAS, M. R.
Laser Densitometers for Investigation of Particle Formation Processes.
PB92-166099
200,294

ZEGLINSKI, W. L.
Intercomparison of a Range of Primary Standard Gas Cartridges of Carbon Monoxide in Nitrogen and Carbon Dioxide in Nitrogen Prepared by the National Institute of Standards and Technology and the National Physical Laboratory.
PB92-175231
200,457

ZUGU, L.
Overview of FDDI.
PB92-129303
200,515

ZUSHAN, S.
Research on Laser Length Standards in the Precision Engineering Division, NIST.
PB93-126043
200,226

PA-49
Fe-Cr-Ni
200.035
201.390
4s
201.394
Spectroscopy
201.379
200.247
201.366
the
4-Dimethylaminothiophenol
Platinum/Neon
Modems
Its
200.033
201.388
200.455
200.925
200.210
Research
200.427
200.451
a
200.262
Application
201.443
201.394
201.428
Supercritical
Stales
Companson
the
201.441
Quenching
Special
200.163
201.103
Hypertext
201.378
Fast-Electron
Gas
200.284
Neutron
200.277
200.306
the
Electrons
200.259
201.310
200.214
the
ARCTIC
ARCHIVES
ANTIMONY
APATITE/HYDROXY
ATOMIC
Threshold
Argon-Relaxation
Thermal
Alaska
PB93-12578
PB92-175124
Regenerative
PB92-165711
Coexistence
PB92-237155
PB92-236884
PB92-144179
Network
PB92-1
PDES
Local
PB92-154616
PB92-154077
PB92-1
PB92-236215
PB92-190189
PB92-149406
PB92-123271
PB92-149406
PB92-144177
Alaskan Marine Tissue Archival Project.
PB92-1315
QNEOUS SOLUTIONS
Extending Corresponding States Models for High-Temperature Aquous Solutions.
PB92-171123
PB92-171438
PB92-171461
Correlation of Aqueous Henry's Constants from O to the Critical Point.
PB92-236869
Coexistence Curve of Tetra-N-Perfluorobenzene Bromide in Water near the Console Point.
PB92-236869
ARC DISCHARGES
Comparison of the NIST Surf and Argon Mniarc Irradiance Standards at 214 nm.
PB92-237155
ARCHIVES
PB93-125045
PB92-143716
ARGON
Atomic Transition Probabilities for the Ar I 4s - 5p Transition Array.
PB92-165711
Regenerative Performance with Noble Gas Mixtures.
PB92-171512
PB92-165699
Near Threshold K-Shell Absorption Cross Section of Argon and Correlation Effects.
PB92-236520
PB93-125789
ARGON PLASMA
Competition of the NIST Surf and Argon Mniarc Irradiance Standards at 214 nm.
PB92-171512
AROMATIC COMPOUNDS
PB93-156736
PB92-165158
ART HISTORY
User Interface: A Hypertext Model Linking Art Objects and Related Information.
KEYWORD INDEX

BLOWOUTS
improved Understanding for the Transient Operation of the Power Insulated Gate Bipolar Transistor (IGBT), PB92-152652, 200,649
Insulated Gate Bipolar Transistor (IGBT) Modeling Using IG-Space, PB92-151537, 200,658
Semiconductor Measurement Technology: INSTANT-IGBNT Network Simulation and Transient Analysis Tool, PB92-165570, 200,678

BIREFRINGENCE
Annealing of Linear Birefringence in Single-Mode Fiber Core, Explication to Optical Fiber Current Sensors, PB92-166517, 200,581

BISDN (BROADBAND INTEGRATED SERVICES DIGITAL NETWORK)
Architectures for BISDN Networks: A Performance Study, PB92-145036, 200,441

BISMUTH GERMANATE Detectors
Ceramic Fiber Voltage Sensors for Broad Temperature Ranges, PB92-175702, 200,592

BISMUTH STRONTIUM LUTENS CUPRATES
Processing Bi-Pb-Sr-Ca-Cu-O Superconductors from Aromatized Slush, PB92-162625, 200,236
Limitations on a Combined Phonon Non-Phonon Mechanism of Inductivity in Bi2Sr2CaCu2Ox, PB92-175041, 200,294
Elastic Properties of Bi2Sr2CaCu2O8 and Bi2CaCu2O5+delta, PB92-175486, 200,302
Critical Currents in Silver-Sheathed Bi2Sr2CaCu2Ox0.1 + delta Fibers by Resistive Co-Sputtering from Elemental Targets with Pure Oxygen, PB92-129559, 200,340

BIT PATTERNS
Imaging Magnetic Bit Patterns Using a Scanning Tunneling Microscope with a Flexible Tip, PB92-175553, 200,476

BLODS
Phase Behavior of a Polymer Blend Solution during Steady Shear and Cessation of Shear Studied by Light Scattering, PB92-159797, 200,376

BLISTERING
Metallographic Model of Cathodic Delamination and Blistering Processes in Paint Films on Steel, PB92-175599, 200,592

BLOOD CHEMICAL ANALYSIS
Ascorbic and Dehydroascorbic Acid Measurement in Human Serum and Plasma, PB92-154442, 200,103
Determination of Retinol, alpha-Tocopherol, and beta-Carotene in Serum by Liquid Chromatography, PB92-125546, 200,102

BLOOD PLASMA
Ascorbic and Dehydroascorbic Acid Measurement in Human Serum and Plasma, PB92-154442, 200,103

BLOOD SERUM
Ascorbic and Dehydroascorbic Acid Measurement in Human Serum and Plasma, PB92-154442, 200,103
Compared Results for Cholesterol in Human Serum Obtained by the Reference Method and by the Definitive Method of the National Reference System for Cholesterol, PB92-165380, 200,104
Neutron Activation Analysis of Biological Samples with a Pre-Irradiation Chemical Separation, PB92-171321, 200,099

BLOWDOWNS
Analyzing Strategies for Eliminating Flame Blow-Down Occurring in the Navy's 19F4 Fire Fighting Trainer, PB92-165353, 200,423

BLOW FILMS
Structure/Processing/Property Relationships for High Molecular Weight High Density Polyethylene Blow Films, PB92-237692, 200,072

BLOWOUTS
Temperature and Radiation of Diffusion Flames with Suppression, PB92-144641, 200,157
## KEYWORD INDEX

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CARBONYL</td>
<td>Separation of Beta-Carotene Mixtures Precipitated from Liquid Solvent with High-Pressure CO2.</td>
</tr>
<tr>
<td>CAROTENES</td>
<td>Separation of Beta-Carotene Mixtures Precipitated from Liquid Solvent with High-Pressure CO2.</td>
</tr>
<tr>
<td>CAROTENOID</td>
<td>Determination of Retinol, alpha-Tocopherol, and beta-Carotene in Serum by Liquid Chromatography.</td>
</tr>
<tr>
<td>CARBONATES</td>
<td>Optimization of an Isocratic High-Performance Liquid Chromatographic Separation of Carotenoids.</td>
</tr>
<tr>
<td>CARRIER DENSITY</td>
<td>Optimization of an Isocratic High-Performance Liquid Chromatographic Separation of Carotenoids.</td>
</tr>
<tr>
<td>CARRIER MOBILITY</td>
<td>Experimental Validation of Lumillymβαr Carrier Mobilities in Heavy Doped Glasses and a Device Implement.</td>
</tr>
<tr>
<td>CARRIER PROTEINS</td>
<td>Crystallization of the Bacillus Subtilis Hisdine-Containing V.4-R Protein Hpr and Some of Its Bacillus Subtilis Directed Mutants.</td>
</tr>
<tr>
<td>CASCaded ELEMENTS</td>
<td>From Cascaded Surge Protective Devices: High-Low Versus Low-High.</td>
</tr>
<tr>
<td>CATALOGS (PUBLICATIONS)</td>
<td>Catalog of Widely Used Code Sets; Category: Data Standards and Guidelines, Subcategory: Representations and Codes.</td>
</tr>
<tr>
<td>CATIONS</td>
<td>Calculated Major- and Minority-Carrier Mobilities in Heavy Doped Silicon and Comparisons with Experiment.</td>
</tr>
<tr>
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<td>Experimental Validation of Lumillymβαr Carrier Mobilities in Heavy Doped Glasses and a Device Implement.</td>
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<td>CAVITY</td>
<td>From Cascaded Surge Protective Devices: High-Low Versus Low-High.</td>
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<td>Experimental Validation of Lumillymβαr Carrier Mobilities in Heavy Doped Glasses and a Device Implement.</td>
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</tr>
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<td>CAVITY</td>
<td>Calculated Major- and Minority-Carrier Mobilities in Heavy Doped Silicon and Comparisons with Experiment.</td>
</tr>
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<td>CAVITY</td>
<td>Experimental Validation of Lumillymβαr Carrier Mobilities in Heavy Doped Glasses and a Device Implement.</td>
</tr>
</tbody>
</table>
KEYWORD INDEX

GLYCERYTHRITE ACID
Determination of Glycercyclic Acid in Human Plasma by High-Performance Liquid Chromatography.
PB92-159060 200,164

GNMP (GOVERNMENT NETWORK MANAGEMENT PROFILE)
PB92-149871 200,509

GOLD
Volatility of Covalently Immobilized Cytochrome c on Self-Assembled Monolayer Electrodes.
PB92-132476 200,358
Static Secondary Ion Mass Spectrometry of Self-Assembled Monolayers on Gold.
PB92-129484 200,358

GOLD ALLOYS
Modeling of Crack Chemistry in Cu-Au Alloys.
PB92-144278 200,388

GOSS (GOVERNMENT OPEN SYSTEMS INTERCONNECTION PROFILE)
PB92-129669 200,517

GOVERNMENT/INDUSTRY RELATIONS
Standard Reference Materials; NBS-ASTM Cooperation.
PB92-166032 200,168
Moving Technology from Federal Laboratories to Industry.
PB92-166297 200,006
PB92-198100 200,006
Government Procurements Stress Applications Portability.
PB92-197353 200,514

GRADIOMETERS
Gradiometer Antennas for Tunnel Detection.
PB92-205400 200,159

GRAIN BOUNDARIES
Measurement and Analysis of Grain Boundary Grooving by Volume Diffusion.
PB92-166070 200,040

GRAPHITE FURNACE ATOMIC ABSORPTION SPECTROSCOPY
Automated Stirring Sample Introduction for Analysis of a River Sediment by Graphite Furnace Atomic Absorption Spectroscopy.
PB92-154236 200,160

GRAVIMETRIC ANALYSIS
Classical Analysis: A Look at the Past, Present, and Future.
PB92-141153 200,155
Intercomparison of a Range of Primary Gas Standards of Carbon Monoxide in Nitrogen and Carbon Dioxide in Nitrogen Prepared by the National Institute of Standards and Technology and the National Physical Laboratory.
PB92-197266 200,174

GRAVITATIONAL WAVES
PB92-165021 200,390

GRAVITONS
PB92-165021 200,390

GRAVITY
PB93-135531 200,188

GREENS FUNCTION
Green's Functions for Elastic Networks with Rigid Body Motions.
PB92-236604 200,352

GROUND STATE
Ground Torsional State of Acetaldhyde.
PB92-144799 200,218

GUIDELINES
PB92-149878 200,158

GUSSET PLATES
Experimental Study of Gusseted Connections.
PB92-197607 200,119

HANDBOOKS
Uniform Laws and Regulations in the Areas of Legal Metrole and Motor Fuel Quality, 1993 as Adopted by the 77th National Conference on Weights and Measures.
PB92-125086 200,864
Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices as Adopted by the 78th National Conference on Weights and Measures.
PB92-125086 1992

HEAT EXCHANGERS
Regenerator Performance with Sinusoidal Flow.
PB92-175172 200,358
Heat Transfer in a Compact Tubular Heat Exchanger with Application to the Engine Straits of the National Aerospace Plane.
PB92-175160 200,468
Materials Property Database Requirements for Gas-Fueled Ceramic Heat Exchangers.
PB92-125946 200,947

HEAT FLOW METERS
New Heater and Flux Gauge for the NBS Smoke Box.
PB93-113678 200,428

HEAT LOSS
PB92-238567 200,746

HEAT OF COMBUSTION
Bomb Calorimetric and NMR Studies on Crystalline Hexacyclin.
PB92-165216 200,276
Estimation Methods and Combustion Calorimetry on Organic Phosphorus Compounds.
PB92-165794 200,287
PB92-165802 200,267
Enthalpy of Combustion of 1,4-Dimethyl Dicarbomethoxyl.
PB92-130474 200,340

HEAT OF DISSOCIATION
PB92-166215 200,295

HEAT OF FORMATION
Bomb Calorimetric and NMR Studies on Crystalline Hexacycline.
PB92-165216 200,276
Estimation Methods and Combustion Calorimetry on Organic Phosphorus Compounds.
PB92-165794 200,287

HEAT OF FUSION
Measurement of the Heat of Fusion of Titanium and a Titanium Alum (90Tl-6AI-4V) by a Microsecond-Resolution Transient Technique.
PB92-171511 200,045

HEAT OF REACTION
Thermochromy of High Energy Reactions.
PB92-170844 200,302

HEAT PUMPS
Performance Evaluation of a Variable Speed, Mixed Refrigerant Pump.
PB92-143759 200,744
PB92-149814 200,021

HEAT TRANSFER
Transient Moisture and Heat Transfer in Multi-Layer Non-Isothermal Walls: Comparison of Predicted and Measured Results.
PB92-176760 200,083
Fuel Properties Effects on Burning Rate and Radiative Transfer from Liquid Fuel Flames.
PB92-176503 200,743

HEAT TRANSFER COEFFICIENTS
Heat Transfer in a Compact Tubular Heat Exchanger with Application to the Engine Straits of the National Aerospace Plane.
PB92-176603 200,468

HEAVY IONS
Proteic Spectroscopy in a Cooling Ring.
PB92-165331 200,388

HELIUM
Regenerative Performance with Noble Gas Mixtures.
PB92-175124 200,191
Absolute Ionization Energy of the 2 1S Level of Helium.
PB92-175769 200,419
PB92-236733 200,196

HELIUM NEON LASERS
Research on Laser Length Standards in the Precision Engineering Division, NIST.
PB93-129043 200,226

HENRY'S LAW
Correlation of Aqueous Henry's Constants from GC to the Critical Point.
PB92-236819 200,339

HEPTANE
Structure of a burning n-heptane spray generated from a pressure jet atomizer.
DE 92015581 200,729
Fuel property effects on the structure of spray flames.
DE 92015757 200,735

HETEROGENEITY INTERFEROMETER
Electronic Limitations in Phase Meters for Heterogeneity interferometer.
PB92-159813 200,586

HEXAGLYCINE
Bomb Calorimetric and NMR Studies on Crystalline Hexacyclin.
PB92-165216 200,276

HEXANE
Observation of Partial Discharge in Hexane Under High Magnification.
PB92-145135 200,696

HFB REACTOR
Existing Data Sources at U.S. Reactors.
PB92-159920 200,172

KW-31
KEYWORD INDEX

LOW TEMPERATURE SCIENCE & ENGINEERING

LIFE (DURABILITY)
- Computer Program POWNOR for Filling the Power-Normal and Lognormal Models to Life or Strength Data from Specimens of Various Sizes.
- PB92-199119
- 200,063

LIFELINE SYSTEMS
- PB92-171879
- 200,124

LIGHT SCATTERING
- Mobility Variance Determined from AC Electrophoretic Light Scattering.
- PB92-140509
- 200,097
- Optical Scattering from Rough Surfaces: Experiment and Theory.
- PB92-171178
- 200,207
- Light Scattered by Random Rough Surfaces and Roughness Determination.
- PB92-125722
- 200,207
- Stray-Light Suppression with High-Collection Efficiency in Laser Light-Shedding Experiments.
- PB92-129365
- 200,228
- Studies on Antibody-Reactions Using Light Scattering from Antigen-Coated Colloidal Particles.
- PB92-130043

LIGHT TRANSMISSION
- Approximate Solution to the Wave Equation - Revisited.
- PB92-144568
- 200,191

LIGHTING
- Calculating the Parameters of Full Lightning Impulses Using Model-Based Curve Fitting.
- PB92-148464
- 200,695

LIGHTING EQUIPMENT
- Effect of Building Envelopes on Cooling Loads Due to Lighting.
- PB92-150043
- 200,045

LIGHTING SYSTEMS
- PB92-187079
- 200,051

LIGHTWEIGHT CONCRETES
- Punching Shear Behavior of Lightweight Concrete Slabs and Shells.
- PB92-130443
- 200,109

LINE BROADENING
- Doppler Broadening of Raman Lines.
- PB92-237544
- 200,222

LINE SPECTRA
- Improved Wavelengths for Prominent Lines of Ni X to Ni XXV.
- PB92-175825
- 200,420

LINE WIDTH
- PB92-146787
- 200,109
- Office of Microelectronics Programs Opens at NIST.
- PB92-150243
- 200,639
- NIST Linewidth Measurement Program.
- PB92-157452
- 200,641
- Scanning Confocal Microscope for Precise Measurement of Optical Fiber Diameter.
- PB92-160343
- 200,300
- PB92-237227
- 200,120
- PB92-116434
- 200,693

LINEAR SYSTEMS
- Phase Characteristics and Time Responses of Unknown Linear Systems Determined from Measured CW Amplitude Data.
- PB92-183722
- 200,715

LINOLEIC ACID
- Chain-Propagating Length of Linoleic Acid Peroxidation in Aquous Monomeric and Micellar Systems.
- PB92-236223
- 200,207

LIPOSOMES
- Effect of Different Phospholipid-Cholesterol Membrane Compositions on Liposome-Mediated Formation of Calcium Phosphates.
- PB92-154665
- 200,103
- Effect of Membrane Cholesterol on Calcium Phosphate Formation in Aquous Suspensions of Amphiphilic Liposomes.
- PB92-154673
- 200,094

LIQUID CHROMATOGRAPHY
- Determination of Glycyrhetinic Acid in Human Plasma by High-Performance Liquid Chromatography.
- PB92-159060
- 200,164
- Optimization of an Isocratic High-Performance Liquid Chromatographic Separation of Carotenoids.
- PB92-153655
- 200,167
- Determination of Rare Earth Elements by Liquid Chromatographic Separation Using Inductively Coupled Plasma Mass Spectrometric Detection.
- PB92-153658
- 200,177

LITHIUM INORGANIC COMPOUNDS
- Vapor Pressure and Thermodynamics of Lithium Aluminates.
- PB93-135473
- 200,365

LITHIUM ISOTOPES
- PB92-166800
- 200,169

LITHIUM-LIKE IONS
- Multiconfiguration Dirac-Fock Calculations of Transition Energies with OED Corrections in Three-Electron Ions.
- PB92-156567
- 200,204

LITHOGRAPHY
- AD-P007 257/9
- 200,356
- Surface Figure Metrology for X-Ray Optics.
- AD-P007 258/7
- 200,357
- Nanolithography on III-V Semiconductor Surfaces Using a Scanning Tunneling Microscope Operating in Air.
- PB92-144452
- 200,626

LOAD CELLS
- Measurability Sensitivity Test for Load Cells.
- PB92-144914
- 200,779
- PB92-187087
- 200,788

LOADS (FORCES)
- Measurability Sensitivity Test for Load Cells.
- PB92-144914
- 200,779
- Fatigue Limits in Noncyclic Loading of Ceramics with Crack-Resistance Curves.
- PB92-187087
- 200,937

LOCAL AREA NETWORKS
- Overview of FDDI.
- PB92-226405
- 200,515
- Analysis of Transport Measurements Over a Local Area Network.
- PB92-226827
- 200,448

LOCALIZATION MODEL
- PB92-175215
- 200,990

LOGICAL CIRCUITS
- Margins and Yield in Single-Flux Quantum Logic.
- PB92-165554
- 200,562

LOGNORMAL DISTRIBUTION
- Estimators for Type-II Censored (Log) Normal Samples.
- PB92-143568
- 200,159

LOOMING
- Quantitative Approach to Looming.
- PB92-187079
- 200,041

LOW TEMPERATURE ALLOYS
- Review of Cryogenic Mechanical and Thermophysical Properties of Al-Li Alloys and Alloy 2219.
- PB92-143733
- 200,429

LOW TEMPERATURE SCIENCE & ENGINEERING
- Chargy Impact Tests Near Absolute Zero.
- PB92-143852
- 200,985
- Warm Precracking at 295 K and Its Effects on the 4-K Toughness of Austenitic Steels.
- PB92-143020
- 200,996
- Development of an SMA Electrode to Match Type II Consored (Log) Normal Samples.
- PB92-187087
- 200,996
- Effect of Cable and Strand Twist-Pitch Coincidence on the Critical Current of Flat, Coreless Superconductor Cables.
- PB92-175249
- 200,607
- Critical-Current Simulation and Data Acquisition.
- PB92-175248
- 200,600
- Progress in Cryocoolers.
- PB92-175645
- 200,094
- PB92-175652
- 200,416
- PB92-175678
- 200,025
- Trends in Superconductor Critical-Current Measurement Technology in the USA.
- PB92-175981
- 200,312

KW-37
Photocell Electrographic Study of the Interaction of Thin Fe Films with Mo/Si(0001) Surface.


Static Secondary Ion Mass Spectrometry of Self-Assembled Alkanethiol Monolayers on Gold.

Chemical Interaction of Mn with the Mo/C(0001) Surface Studied by High-Resolution Photoelectron Spectroscopy.

Antiferromagnetic Coupling in Fe/Cu/Fe and Co/Cu/Co Multilayers on Si(111).


Trilateral Characteristic of Synthesized Diamond Films on Silicon Carbide.

SURGES
Validating Surge Test Standards By Field Experience: High-Energy Tests and Varistor Performance.

Coordinating Cascaded Surge Protection Devices: High-Low versus Low-High.

Transients Are Here to Stay - Learn and Live with Them.

Cascading Surge-Protective Devices: Coordination versus the IEC 6241 Surge.

Standard for the 90s: IEEE C62.41 Surge Ahead.

SUSPENSIONS
Shearing Apparatus for Neutron Scattering Studies on Fluids: Preliminary Results for Colloid Suspensions.

SWELLING
Localization Model: Review and Extension to Swollen Rubber Elasticity.

Some Theoretical Results of Swelling in Fiber-Particle Filled Polymers.

Experience on the Elasticity of Dry and Swollen Networks: Implications for the Frenkel-Flory-Rehner Hypothesis.

Swelling in Crosslinked Natural Rubber: Experimental Evidence of the Crosslink Density Dependence of the.

SWITCHING CIRCUITS
Effects of Localized Hot-Carrier-Induced Charge in VLSI Switching Circuits.

SYNAPSES
Mark and Albucius Theories of the Cerebellum: Two Early Models of Associative Memory.

SYNCHROTRON RADIATION SOURCES
Self-Filtering Crystal Monochromators for Synchrotron X-Radiation.

SYNTHETIC MATERIALS
Laser-Induced Optical Emissions of CVD Diamond Studied in the Raman Microscope.

SYSTEM ENGINEERING
Integrating a Knowledge-Based Component into a Physical Database Design System.

TAGUCHI ARRAYS
Taguchi's Fixed-Element Arrays Are Fractional Factors.

TANKS (VEHICLES)

TANNING MATERIALS
Chromium(VI)-Resistant Yeast Isolated from a Sewage Treatment Plant Receiving Tannery Wastes.

TARGET ACQUISITION

TARTRAZINE
15M NMR Investigation of Azo-Hydrzone Acid-Base Equilibria of F2 and C Yellow No. 5 (Tartazine) and Two Analogs.

TEAR STRENGTH
Structure/Processing/Property Relationships for High Molecular Weight High Density Polyethylene Blown Films.

TECHNOLOGY ASSESSMENT
Welding Technology in Eastern Europe.

TECHNOLOGY INCENTIVES
Moving Technology from Federal Laboratories to Industry.

TECHNOLOGY TRANSFER
Manufacturing Technology Centres Program. A Sampling of Individual Case Histories.

TECHNOLOGY TRANSFER
Science and Technology: NIST in the 1990s.

TEETH
Deposition of Fluoride on Tooth Surfaces by a Two-Solution Moulhroinio in Vitro.

TELECOMMUNICATION
1,200 Bits Per Second Two-Wire Duplex Modems for Data Communications Use on Telephone-Type Circuits, Category: Telecommunications Standards, Subcategory: Modems.

TELECOMMUNICATIONS
2,400 Bits Per Second Two-Wire Duplex Modems for Data Communications Use on Telephone-Type Circuits, Category: Telecommunications Standards, Subcategory: Modems.

TELECOMMUNICATIONS
4,800 Bits Per Second Four-Wire Duplex Modems for Data Communications Use on Telephone-Type Circuits, Category: Telecommunications Standards, Subcategory: Modems.

TELECOMMUNICATIONS
8,000 Bits Per Second Four-Wire Duplex Modems for Data Communications Use on Telephone-Type Circuits, Category: Telecommunications Standards, Subcategory: Modems.

TELECOMMUNICATIONS
16,000 Bits Per Second Four-Wire Duplex Modems for Data Communications Use on Telephone-Type Circuits, Category: Telecommunications Standards, Subcategory: Modems.

TELEPHONE CIRCUITS
1200-Bit and 14,400-Bit Per Second Four-Wire Duplex Modems for Data Communications Use on Telephone-Type Circuits, Category: Telecommunications Standards, Subcategory: Modems.

TELEPHONE SYSTEMS
PBX Administrator's Security Standards Developed by the Federal Deposit Insurance Corporation.
Automated Compensation of Part Errors Determined by In-Process Gauging.

Title: Automated Compensation of Part Errors Determined by In-Process Gauging.

Abstract number: NTIS order number: PC A03/MF A01

Availability: Price Code

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4,800 and 9,600 Bits Per Second Two-Wire Duplex Modems for Data Communications Use on Telephone-Type Circuits: Category: Telecommunications Standard: Subcategory: Modems. FIPS PUB 165 200,435 PC$9.00

15N NMR Investigation of Azo-Hydrazine Acid-Base Equilibria of FD and C Yellow No. 5 (Tartrazine) and Two Analogues. PB92-236280 200,330 Not available NTIS

Ab Initio Calculations and Ideal Gas Thermodynamic Functions of Cyclopentadene and Cyclopentadene Derivatives. PB92-148089 200,224 Not available NTIS

Absolute Ionization Energy of the 2 (1)S Level of Helium. PB92-175769 201,419 Not available NTIS

Absolute Neutron Counting Based on B-10 Alpha-Gamma Coincidence Methods. PB92-171263 201,408 Not available NTIS

Absolute Optical Ranging Using Low Coherence Interferometry. PB92-165397 201,197 Not available NTIS

Absolute Wavelength Determinations in Molecular Tellurium: New Reference Lines for Precision Laser Spectroscopy. PB92-177248 201,203 Not available NTIS

Abstract and Index Collection in the Research Information Center of the National Institute of Standards and Technology. PB92-217587 200,808 PC A03/MF A01

AC Impedance Method for High-Resistance Measurements of Silicon. PB92-145184 200,629 Not available NTIS

Accelerated Aging Test Design for Coating Systems. PB93-129658 201,018 Not available NTIS

Accelerated Lambda Iteration Method for Multilevel Radiative Transfer. 1. Non-Overlapping Lines with Background Continuum. PB92-175744 201,418 Not available NTIS

Accumulated versus Natural Weathering of Coatings and Other Polymeric Materials: A State of the Art. PB92-129591 201,017 Not available NTIS

Accumulation of Creep Damage Under Varying Temperature Conditions. PB92-159771 201,349 Not available NTIS

Accuracy of the Charge Pumping Technique for Small Geometry MOSFETS. PB92-171115 200,654 Not available NTIS

Accurate Far-Infrared Rotational Frequencies of Carbon Monoxide. PB92-175892 200,316 Not available NTIS

Accurate Solutions to Schrödinger's Equation Using Modified Airy Functions. PB92-197573 201,435 Not available NTIS

Accurate Wavelengths for Resonance Lines of the Cu I and Zn I Isotopic Sequences for Pd to Dy. PB92-145150 201,366 Not available NTIS

Activation of Sodium and Potassium Pumping Modes of Sodium-Potassium ATPase by an Oscillating Electric Field. PB93-25591 201,101 Not available NTIS

Activities of the Intergency Committee on Seismic Safety in Construction. PB91-171834 200,070 Not available NTIS


Ada Compiler Validation Summary Report: Certificate Number: 91031851.11271, NEC Corporation, NEC Ada Compiler System for EWS-UX/V to V70/RX-UXS32, Version 1.0 EWS 480/60 = > NV4000 AD-A243 452/0 200,480 PC A05/MF A01

Adhesive Properties of Modified Glass-Ionomer Cements. PB93-130326 200,038 Not available NTIS
TITLE INDEX

PB92-17157 200,604 Not available NTIS

Excerpt

PB92-17517 200,612 Not available NTIS

PB92-17517 200,612 Not available NTIS

PB92-17517 200,612 Not available NTIS

PB92-17517 200,612 Not available NTIS

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PB92-17517 200,612 Not available NTIS

PB92-17517 200,612 Not available NTIS
Reduction of DX Centers in Superlattice Alloy-Like Material

High Electron Mobility Transistors

PB93-130000

200,691 Not available NTIS

Reference Model for Frameworks of Software Engineering Environment

(technical Report edma Tr/55, 2nd Edition)

PB92-158328

200,490 PC A06/MF A02

Reflection High-Energy Electron Diffraction (RFHED) Oscillations at 77 K

PB92-159425

201,269 Not available NTIS

Reflection X-ray Absorption Fine Structure Study of the Polycrystalline Alloys

PB92-175124

200,191 Not available NTIS

Regenerative Performance with Noble Gas Mixtures

PB92-175132

200,899 Not available NTIS

Rejection Mechanisms for Massively Parallel Neural Network Character Recognition Systems

PB92-213412

200,527 PC A03/MF A01

Relation of CO2 Concentration to Office Building Ventilation

PB92-135424

200,055 Not available NTIS

Relationship between Fractal Geometry and Fractography

PB93-135564

200,951 Not available NTIS

Relationships between Failure and Other Time Dependent Processes in Polymetric Materials

PB92-135566

201,072 Not available NTIS

Reliability of Oblique Drilling and Production Platforms

PB93-129278

201,178 Not available NTIS

Reliability of Offshore Operations: Proceedings of an International Workshop held in Gathersburg, Maryland

PB92-183748

201,175 PC A11/MF A03

Remote Time and Frequency Comparisons Now and in the Future

PB92-175017

200,455 Not available NTIS

Report of the National Conference on Weights and Measures (7th) held in Nashville, Tennessee on July 19-20, 1992

PB93-130046

200,145 PC A16/MF A03

Report on 1990 Actions by International Institute of Welding

PB92-159979

200,841 Not available NTIS

Report on 1991 Actions by International Institute of Welding

PB92-237379

200,847 Not available NTIS

Representations in Visual Motion

PB92-148287

200,040 PC A03/MF A01

Requirements and Recommendations for STEP Conformance Testing

PB92-159315

1991. PC A09/MF A01

Requirements and Recommendations for STEP Conformance Testing

PB92-158524

200,815 PC A03/MF A01

Requirements and Recommendations for STEP Conformance Testing

PB92-183793

200,142 PC A04/MF A01

Requirements for Global Programming Languages

PB92-165109

200,829 Not available NTIS

Research Considerations Regarding FIB/AIFS Tasks and Requirements

PB92-236609

200,005 PC A03/MF A01


PB93-118131

200,226 PC A05/MF A01

Research for Standards and Conformity Assessment

PB93-160050

200,089 Not available NTIS

Research on Laser Length Standards in the Precision Engineering Division, NIST

PB92-128043

201,226 Not available NTIS

Resistive Liquid-Vapor Surface Sensors for Liquid Nitrogen and Hydrogen

PB93-134115

200,364

(As per PB93-131381, PC A07)

Resistively-Tapered-Diode Electric-Field Probes up to 40 GHz

PB92-159970

200,701 Not available NTIS

Resonance Lines 4p(6)-4p(5)4d of the Kr I Isotopic Isotopes

PB92-145143

201,365 Not available NTIS

Resonant Circuit Model Evaluation Using Reflected S-Parameters

PB92-198126

200,570 Not available NTIS

Results of a CCRP Intercomparison of Spectral Irradiance Measurements by National Laboratories

PB92-149867

200,005 Not available NTIS

Sensitivity and Science and Technology: NIST in the 1990s.
TITLE INDEX

Superimposing Low-Phase-Noise, Low-Drift Instrumentation Techniques on RF Design. PB92-165414


Surface Analysis of Interfacial Properties for Thin Film and Bulk YBa2Cu3O7. PB92-171578

Surface Extended X-ray Absorption Fine Structure Studies of the Sio2/Si(100) Interface. PB92-154616

Surface Figure Metrology for X-Ray Optics. AD-P007 2567. PB92-13577 AP01/MF 991

Survey of Existing Multidimensional Quadrature Routines. PB92-129468

Swelling in Crosslinked Natural Rubber: Experimental Evidence. PB93-237469

Swolf's Not Available NTIS PB92-125771

Symmetric Level Index Antimetric in Simulation and Modelling. PB92-124621

Taguchi's Methods. PB92-234100

Taguchi's Fixed-Elementary Are Fractional Factorials. PB92-144176

Task Decomposition Module for Telerobot Trajectory Generation. PB92-237536

TCP/IP versus OSI, or How I Learned to Stop Translating and Love Protocols. PB93-135275

Technical Digest-Symposium on Optical Fiber Measurements. PB93-102229

Technical Program of the Factory Automation Systems Division 1992. PB92-265392


Technique for Tensile Creep Testing of Ceramics. PB93-159136

Technique and Workforce for Manufacturing and the Metals Industry in Post-Industrial America. PB92-234649

Technology Integration Workshop: Selected Papers. PB92-159276

Technology Transfer at NIST. PB92-170737

Temperature and Radiation of Diffuse Flames with Suppression. PB92-144611

Temperature Dependence of Magnetic Order in UP3Sn. PB92-171644

Temperature Dependence of the Quenching of l(+)(x)P3/2 by I2. PB92-165208

Temperature Dependence of the Verdet Constant in Several Diatomic Glasses. PB92-166289

Tensile, Fracture, and Fatigue Properties of Notched Aluminum Alloy Sheets at Liquid Nitrogen Temperatures. PB92-129457

Test Structures at NIST. PB92-125730


T1-16
Use of Magnetic Forces in the Alignment of a Radial Field Superconducting Magnet (Abstract).
PBE92-166172

PBE92-149780

Use of Resolution Ionization Mass Spectrometry for Measuring the Isotopic Compositions of Rhenium and Osmium Extracted from Silicate Rocks.
PBE92-237528

Use of Time-Domain Dielectric Spectroscopy to Evaluate the Lifetime of Nuclear Power Station Cables.
PBE92-187053

Use of Vision and Touch Sensors for Dimensional Inspection Tasks.
PBE92-191204

User Interface: A Hypertext Model Linking Art Objects and Related Information.
PBE92-171454

PBE92-158926

PBE92-222736

PBE92-126365

PBE92-236307

PBE92-172493

PBE92-213420

Using Diode Lasers for Atomic Physics.
PBE92-145283

PBE92-226330

Using Standards to Facilitate Access and Reuse of Museum Information.
PBE92-171552

PBE92-159607

UV Absorption Spectra and Kinetics of the Self Reactions of CH2CO2 and CH2F2 Radicals in the Gas Phase.
PBE92-219611

Validating STEP Application Models at the National POES Testbed Report Series.
PBE92-143726

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### NTIS ORDER/REPORT NUMBER INDEX

#### SAMPLE ENTRY

<table>
<thead>
<tr>
<th>Report or series number</th>
<th>Title</th>
<th>NTIS order number</th>
<th>Abstract number</th>
<th>Availability</th>
<th>Price Code</th>
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<tr>
<td>AD-A243 452/0</td>
<td>Ada Compiler Validation Summary Report: Certificate Number: 9109189111217, NEC Corporation, NEC Ada Compiler System for EWS-UX/V to V70/RX-UX832, Version 1.0 EWS 4900/60 &gt; &gt; MW4000. AD-A243 452/0</td>
<td>200,480 PC A05/MF A01</td>
<td></td>
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<tr>
<td>AD-A243 489/2</td>
<td>Spherical Near-Field Scanning: Experimental and Theoretical Studies. AD-A243 489/2</td>
<td>200,546 PC A07/MF A02</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AD-A244 496/6</td>
<td>Spectroscopy of Reaction Intermediates in Nitramine Decomposition and Combustion. AD-A244 496/6</td>
<td>200,407 PC A03/MF A01</td>
<td></td>
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<td>AD-A245 583/3</td>
<td>Effect of Green Density and the Role of Magnesium Oxide Aditive on the Densification of Alumina Measured by Small-Angle Neutron Scattering. AD-A245 583/3</td>
<td>200,904 Not available NTIS</td>
<td></td>
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</tr>
<tr>
<td>AD-A247 528/1</td>
<td>Diamond as an Optical Material. AD-A247 528/1</td>
<td>200,480 PC A03/MF A01</td>
<td></td>
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</tr>
<tr>
<td>AD-A245 178/5</td>
<td>Evolution of the Pore Size Distribution in Final-Stage Sintering of Alumina Measured by Small-Angle X-ray Scattering. AD-A245 178/5</td>
<td>200,905 Not available NTIS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AD-A249 179/3</td>
<td>Characterization of the Densification of Alumina by Multiple Small-Angle Neutron Scattering. AD-A249 179/3</td>
<td>200,906 Not available NTIS</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>AD-A249 510/9</td>
<td>Small-Angle Neutron Scattering Characterization of Processing/Microstructure Relationships in the Sintering of Crystalline and Glassy Ceramics. AD-A249 510/9</td>
<td>200,907 Not available NTIS</td>
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<tr>
<td>AD-A250 776/2</td>
<td>Methodology Investigation Nuclear Radiation Metrology Methods. Phase 1. AD-A250 776/2</td>
<td>201,160 PC A10/MF A03</td>
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<tr>
<td>AD-A253 551/6</td>
<td>Vibrational Spectra of Molar ions Isolated in Solid Neon: HCH + and HCD- AD-A253 551/6</td>
<td>200,210 Not available NTIS</td>
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<tr>
<td>AD-A253 618/3</td>
<td>Growth Defects in Diamond Films. AD-A253 618/3</td>
<td>201,234 PC A03/MF A01</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>AD-A255 729/8</td>
<td>Moire-Fringe Images of Twin Boundaries in Chemical Vapor Deposited Diamond. AD-A255 729/8</td>
<td>200,952 PC A03/MF A01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AD-A255 729/6</td>
<td>Fundamental Understanding of the Effects of Ceramic Processing on Product Microstructure. AD-A255 729/6</td>
<td>200,908 PC A04/MF A01</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>AD-A255 862/5</td>
<td>Twin Quintuplets in CVD Diamond. AD-A255 862/5</td>
<td>201,235 PC A03/MF A01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AD-P007 074/8</td>
<td>Integration of the Schrodinger Equation on a Massively Parallel Processor. AD-P007 074/8</td>
<td>201,235 PC A01/MF A01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AD-P007 158/3</td>
<td>Bootstrapping with Constraints: Analysis of Scattering Asymmetry for Polarized Beam Studies. AD-P007 158/3</td>
<td>201,086 PC A01/MF A01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AD-P007 257/9</td>
<td>National Institute of Standards and Technology Metrology for Soft-X-Ray Multilayer Optics. AD-P007 257/9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PB92-171466
Characterization of Ceramic Powders.
PB92-171467
Factors Affecting Interface Properties of Silicon Nitride Powders in Aqueous Environment.

PB92-171468
Computer-Generated Holography Using a Personal Computer.

PB92-171469
Mult-Line Calibration for MMIC Measurements.

PB92-171470
Effect of Contamination Level on Strength of Butyl-Adhered EPDM Joints in EPDM Single-Ply Roofing Membranes.

PB92-171511
Measurement of the Heat of Fusion of Titanium and a Titanium Alloy (BT4-646-A-4-V) by a Microsecond-Resolution Transient Technique.

PB92-171512
VLSI Chip Set for a Multiprocessor Performance Measurement System.

PB92-171537
Insulated Gate Bipolar Transistor (IGBT) Modeling Using ISE-SPICE.

PB92-171545
User Interface: A Hypertext Model Linking Art Objects and Related Information.

PB92-171550
Using Standards to Facilitate Access and Reuse of Museum Information.

PB92-171560
Erodibility and Activated Dynamics in Supercooled Liquids.

PB92-171578
Surface Analysis of Interfacial Properties for Thin Film and Bulk YBa2Cu3O7-

PB92-171586
Chemisorption Hydrogen and Hydrogenous Molecules.

PB92-171594
Electron Attachment to SF6 and SO2.

PB92-171602
Total Cross Sections for Electron Scattering and Attachment for SF6 and its Electrical-Discharge By-Products.

PB92-171610
Simple Noise Calibration Radiometer.

PB92-171628
MMIC Package Characterization with Active Loads.

PB92-171636
Linear Trap for High-Accuracy Spectroscopy of Stored Ions.

PB92-171644
Temperature Dependence of Magnetic Order in UPt3.

PB92-171669

PB92-171677
Characterized Materials Property Databases.

PB92-171685
Y-Branch Waveguide Glass Laser and Amplifier.

PB92-171719
Multiwatt Laser Calorimeter Design.

PB92-171727
Extending Electrical Measurements to the 0.5mm Regime.

PB92-171735
Influence of Phase-to-Phase Memory Propagation on the Stochastic Behavior of AC-Generated Partial Discharges.

PB92-171743
Influence of Memory on the Statistics of Pulses Corona.

PB92-171750
Anomalous Offset Quantized Hall Plateaus in High-Mobility Si-MOSFETs.

PB92-171766
Ignition of Lithium Vapor by CW Ozone/attention Laser Light.

PB92-171767
Methods for Characterizing Surface Topography.

PB92-171778
Optical Scattering from Rough Surfaces: Experiment and Theory.

PB92-171792
Metal-Mediated Hydroxide Shift Mechanism for Xylose Isomerization Based on the 1,8 A Symmetry Publigens Structures with Xyli+d and D-Xylose.

PB92-171807
Interpretation and Use of S-Parameters in Lossy Lines.

PB92-171818
Progress Toward MMIC On-Water Standards.

PB92-171826
Steady Cooling of a Boud Atom.

PB92-171828
Activities of the Interagency Committee on Seismic Safety in Construction.

PB92-171842
Competing for Construction in the World Arena.

PB92-171859
Fiber Cladding Diameter by Contact Micrometry.

PB92-171891
Staging Areas for Persons with Mobility Limitations.

PB92-171902

PB92-171912

PB92-171982
Training Feed Forward Neural Networks Using Conjugate Gradients.

PB92-171990
Feedback Diffusion-Controlled Reaction in a Vortex: A Report.

PB92-172006
Form Error Models of the NIST Algorithm Testing System.

PB92-172022

PB92-172030
Foundation of a Security Policy for Use of the National Research and Educational Network.

PB92-172048
Productivity Impacts in Building Life-Cycle Cost Analysis.

PB92-172055

PB92-172154
Science and Technology: NIST in the 1990s.

PB92-172169
Evaluation of the Visibility of Buried and Topmarks.

PB92-172174

PB92-172485
Development of Characterization Techniques for Polyurethanes I Characterization of SRM 1480, a Low Molecular Weight Polyurethane for SEC Calibration.

PB92-172700

PB92-172709

PB92-172725
Guide for Specifying and Building CITS with Data Management Standards.

PB92-172733
Noise-Induced Chaos and Phase Space Flux: A Sample-Theoretic Study.

PB92-172741

PB92-172758

PB92-172758
Use of Atmospheric Aerosols for Apportionment and Inverse Modeling.

PB92-172766
Properties of Copper and Copper Alloys at Cryogenic Temperatures.

PB92-172774
Shop of the 90’s: The Automation of Small Machine Shops Using Existing and Affordable Technology.

PB92-172777

PB92-172780
Analyzing and Exploiting Numerical Characteristics of Zone Fire Models.

PB92-172808

PB92-172816
Final Description of the SDDS Security Protocol at Layer 4 (SP4).

PB92-172824

PB92-173012
High-Level Functional Inspection and Testing Guide.

PB92-173012
PC A03/MF A01
Protein 200.455

Vacuum: 200.200

Sensitization 200.591

Plasmid 200.605

Carbonyl of PB92-175108

PB92-175116

PB92-175124

PB92-175132

PB92-175140

PB92-175157

PB92-175165

PB92-175173

PB92-175181

PB92-175199

PB92-175207

PB92-175215

PB92-175223

PB92-175231

PB92-175249

PB92-175256

PB92-175264

PB92-175272

PB92-175280

PB92-175286

PB92-175298

PB92-175306

PB92-175314

PB92-175320

PB92-175348

PB92-175355

PB92-175363

PB92-175371

PB92-175389

PB92-175397

PB92-175405

PB92-175413

PB92-175421

PB92-175439

PB92-175447

PB92-175454

PB92-175462

PB92-175470

PB92-175488

PB92-175504

PB92-175512

PB92-175512

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PB92-175528

PB92-175536

PB92-175546

PB92-175553

PB92-175561

PB92-175576

PB92-175587

PB92-175595

PB92-175603

PB92-175611

PB92-175655

PB92-175659

PB92-175660

PB92-175676

PB92-175686

PB92-175694

PB92-175702

PB92-175710

PB92-175726

PB92-175736

PB92-175744

PB92-175751

PB92-175759
PB92-197771
Optical Resonator for the NIST-NRL Free Electron Laser. 201,314 Not available NTIS
PB92-197779
Electronic Spectra of SF2 Radicals between 295 and 495 nm Observed with Resonance-Enhanced Multiphoton Ionization Spectroscopy. 200,320 Not available NTIS
PB92-197797
New Electronic State of SiH and SiD Radicals Observed by Resonance-Enhanced Multiphoton Ionization Spectroscopy. 200,327 Not available NTIS
PB92-197805
Eddy Current Sensing of Oxygen Content in High-Tc Superconductors. 201,313 Not available NTIS
PB92-197813
Study of Low Energetic Atomic Collisions in Solids Using High Resolution (gamma) Spectroscopy. 201,440 Not available NTIS
PB92-197821
Decentralized Control Architecture for Computer Integrated Manufacturing Systems. 200,821 Not available NTIS
PB92-197839
Multi-Level/Multi-Layer Architecture for Intelligent Shopfloor Control. 200,832 Not available NTIS
PB92-197847
Multi-Level/Multi-Layer Control Architecture for Computer Integrated Manufacturing Systems. 200,833 Not available NTIS
PB92-197854
Trace Experiments on Packed Beds with Forced and Mixed Convection Using Fiberoptic Fluorescence Probes. 200,105 Not available NTIS
PB92-197862
Theory of Ultrasonic Atomic Collisions in Optical Traps. 200,442 Not available NTIS
PB92-197870
Interaction Graphs: Graphical Aids for Planning Experiments. 200,792 Not available NTIS
PB92-197888
Crystalization of the ‘Bacillus Subtilis’ Milk-Ring-Containing Phosphocarrier Protein Hpr and of Some of Its Site-Directed Mutants. 200,119 Not available NTIS
PB92-197896
Gamma-Ray Dosimetry by Spectrophotometry of Phenylnicotinic Acid Solution. 200,442 Not available NTIS
PB92-197904
High Spatial Resolution Mapping of Resistivity Variations in Semiconductors. 200,677 Not available NTIS
PB92-197912
Critical-Temperature/Debye-Temperature Reduced Critical Magnetic Moment of LaCuO4 Superconductors. 201,314 Not available NTIS
PB92-197920
Solubility in Near- and Supercritical Water. 200,302 Not available NTIS
PB92-197938
Conformance Evaluation Methodology and Protocol Testing. 200,446 Not available NTIS
PB92-197946
Spatial Uniformity of Optical Detector Responsivity. 200,598 Not available NTIS
PB92-197953
Government Procurements Stress Applications Portability. 200,514 Not available NTIS
PB92-197961
Adsorption from Solution on Hydroxyapatite: Role of Hydrogen Bonding. 200,323 Not available NTIS
PB92-197979
Video Microscope with Submicrometer Resolution. 201,215 Not available NTIS
PB92-197987
Effect of Oxygen Concentration on CO and Smoke Produced by Flames. 200,424 Not available NTIS
PB92-197995
Analytic Correction for Probe-Position Errors in Spherical Near-Field Measurements. 200,561 Not available NTIS
PB92-198001
Experimental and Theoretical Probe Position Error Correction in Near-Field Antenna Measurements. 200,552 Not available NTIS
PB92-198019
Application of Parameter Estimation Theory in Low Frequency Accelerometer Calibration.
PB92-236579  201,071  Not available NTIS
PB92-236587  201,071  Not available NTIS
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PB92-237292  201,071  Not available NTIS
PB92-237300  201,071  Not available NTIS
PB92-237308  201,071  Not available NTIS
PB92-237316  201,071  Not available NTIS
PB92-237324  201,071  Not available NTIS
PB92-237332  201,071  Not available NTIS
PB92-237336  201,071  Not available NTIS
PB92-237344  201,071  Not available NTIS
PB92-237352  201,071  Not available NTIS
PB92-237360  201,071  Not available NTIS
PB92-237368  201,071  Not available NTIS
PB92-237376  201,071  Not available NTIS
PB92-237384  201,071  Not available NTIS
PB92-237392  201,071  Not available NTIS
PB92-237400  201,071  Not available NTIS
PB92-237408  201,071  Not available NTIS
PB93-135606 200.367 Not available NTIS
REPT-25 Weld and Heat Affected Zone Crack Arrest Fracture Toughness of AAR TC128 Grade B Steel PB92-164658 200.999 PC A03/MF A01

AD-A243 489/2 200.546 PC A07/MF A02

PB92-227107 200.402 PC A04/MF A01
TR-12 Diamond as an Optical Material AD-A247 628/1 201.189 PC A03/MF A01
UDR-TR-91-126 Modifications to Furniture Fire Model for HAZARD System PB92-148295 200.056 PC A07/MF A02
## APPENDIX A

**List of Depository Libraries in the United States**

### ALABAMA

**Auburn**
Auburn University Ralph Brown Draughon Library (1907)

**Birmingham**
Birmingham Public Library (1895)
Birmingham–Southern College Library (1932)
Samford University Library Harwell G. Davis Library (1884)

**Enterprise**
Enterprise State Junior College Learning Resources Center (1967)

**Fayette**
Bevill State Community College at Brewer Learning Resources Center (1979)

**Florence**
University of North Alabama Collier Library (1932)

**Gadsden**
Gadsden Public Library (1963)

**Huntsville**
University of Alabama in Huntsville Library (1964)

**Jacksonville**
Jacksonville State University Houston Cole Library (1929)

**Maxwell Air Base**
Air University Library (1963)

**Mobile**
Mobile Public Library (1963)
Spring Hill College Thomas Byrne Memorial Library (1937)
University of South Alabama Library (1968)

**Montgomery**
Alabama Public Library Service (1984)
Alabama Supreme Court and State Law Library (1884)
Auburn University at Montgomery Library (1971) REGIONAL

**Normal**
Alabama Agricultural and Mechanical University J. F. Drake Memorial Library Learning Resources Center (1963)

**Troy**
Troy State University Library (1963)

**Tuscaloosa**
University of Alabama Amelia Gayle Gorgas Library (1860) REGIONAL
University of Alabama School of Law Library (1967)

**Tuskegee**
Tuskegee University Hollis Burke Frissell Library (1907)

### ALASKA

**Anchorage**
Anchorage Law Library (1973)
Anchorage Municipal Libraries Z. J. Loussac Public Library (1978)
Department of the Interior Alaska Resources Library (1981)
University of Alaska at Anchorage Consortium Library (1961)
U.S. Court Law Library (1983)

**Fairbanks**
University of Alaska Elmer E. Rasmuson Library (1922)

**Juneau**
Alaska State Library (1900)
University of Alaska Southeast William A. Egan Library (1981)

**Ketchikan**
Ketchikan Community College Library (1970)

### AMERICAN SAMOA

**Pago Pago**
American Samoa Community College Pago Pago Learning Resources Center (1985)

### ARIZONA

**Apache Junction**
Apache Junction Public Library (1992)

**Coolidge**
Central Arizona College Learning Resources Center (1973)

**Flagstaff**
Northern Arizona University Cline Library (1937)
Glendale
Glendale Public Library (1986)

Mesa
Mesa Public Library (1983)

Phoenix
Arizona Department of Library Archives and Public Records (unknown)
REGIONAL
Grand Canyon University Fleming Library (1978)
Maricopa County Library District (1993)
Phoenix Public Library (1917)
U.S. Court of Appeals Ninth Circuit Library (1984)

Prescott
Yavapai College Library (1976)

Tempe
Arizona State University Hayden Library/Government Documents (1970)
Arizona State University Ross-Blakley Law Library (1977)

Tucson
Tucson-Pima Public Library (1970)
University of Arizona College of Law Library (1991)
University of Arizona Main Library (1907)

Winslow
Northland Pioneer College Winslow Center LRC (1985)

Yuma
Yuma County District Library (1963)

ARKANSAS

Arkadelphia
Ouachita Baptist University Riley Hickingbotham Library (1963)

Batesville
Lyons College Mabee Library (1963)

Clarksville
University 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 Robert A. Leffler (1978)

Jonesboro
Arkansas State University—Jonesboro Dean B. Ellis Library (1913)

Little Rock
Arkansas State Library (1978) REGIONAL
Arkansas Supreme Court Library (1962)
Central Arkansas Library System Main Library (1953)
University of Arkansas at Little Rock Library Ottenheimer Library (1973)
University of Arkansas at Little Rock Pulaski County 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 Technical University Tomlinson Library (1925)

Searcy
Harding University Brackett Library (1963)

Walnut Ridge
Williams 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 University Walter Stiern Library (1974)
Kern County, Beale Memorial Library (1943)
Berkeley
University of California General Library (1907)
University of California Boalt Hall Law Library (1963)

Carson
California State University Dominguez Hills Library (1973)
Carson Regional Library (1973)

Chico
California State University at Chico Merriam Library (1962)

Claremont
Claremont College Government Publications and Microforms Department Honnold/Mouth Library (1913)

Culver City
Culver City Library Los Angeles Public Library (1966)

Davis
University of California at Davis Shields Library (1953)
University of California at Davis Law Library (1972)

Downey
Downey City Library (1963)

Fresno
California State University at Fresno Henry Madden Library (1962)
Fresno County Free Library (1920)

Fullerton
California State University at Fullerton University Library (1963)

Garden Grove
Orange County Public Library (1963)

Hayward
California State University at Hayward Library (1963)

Inglewood
Inglewood Public Library (1963)

Irvine
University of California at Irvine Main Library (1963)

La Jolla
University of California at San Diego Central University Library (1963)

Lakewood
Angelo M. Iacoboni Public Library (1970)

Lancaster
Lancaster Public 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 Law School William M. Rains Law Library (1979)
Occidental College Mary Norton Clapp Library (1941)
Southwestern University School of Law Library (1975)
University of California at Los Angeles University Research Library (1932)
University of California at Los Angeles Hugh & Hazel Darling Law Library (1958)
University of Southern California Doheny Memorial Library (1933)
University of Southern California Law Library (1978)
U.S. Court of Appeals Ninth Circuit Library (1981)
Whittier College School of Law Library (1978)

Malibu
Pepperdine University Payson Library (1963)

Menlo Park
U.S. 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 Delmar T. Oviatt Library (1958)

Norwalk
Norwalk Regional Library (1973)

Oakland
Mills College Library (1966)
Oakland Public Library (1923)

Ontario
Ontario City Library (1974)
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<td>Public Library of Stockton and San Joaquin County (1884)</td>
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<td>California Lutheran University Pearson Library (1964)</td>
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<td><strong>Torrance</strong></td>
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Turlock
California State University, Stanislaus Library (1964)

Vallejo
Solano County Library System John F. Kennedy Library (1982)

Valencia
Valencia Library (1972)

Ventura
Ventura County Library E. P. Foster Library (1975)

Visalia
Tulare County Free Library (1967)

Walnut
Mount San Antonio College Learning Resources Library (1966)

West Covina
West Covina Regional Library (1966)

Whittier
Whittier College Wardman Library (1963)

COLORADO

Alamosa
Adams State College Library (1963)

Aurora
Aurora Public Library (1984)

Boulder
University of Colorado at Boulder Norlin Library (1879) REGIONAL
University of Colorado at Boulder School of Law Library (1988)

Broomfield
Mamie Doud Eisenhower Public Library

Colorado Springs
Colorado College Tutt Library (1880)
University of Colorado at Colorado Springs Library (1974)
U.S. Air Force Academy Library (1956)

Denver
Auraria Library (1978)
Colorado Supreme Court Library (1978)
Denver Public Library (1894) REGIONAL

Department of the Interior Bureau of Reclamation Library (1962)
Regis University Dayton Memorial Library (1915)
University of Denver College of Law Library Westminster Law Library (1978)
University of Denver Penrose Library (1909)
U.S. Courts Library (1973)

Fort Collins
Colorado State University Libraries (1907)

Golden
Colorado School of Mines Arthur Lakes Library (1939)

Grand Junction
Mesa County Public Library District (1975)
Mesa State College John Tomlinson Library (1985)

Greeley
University of Northern Colorado James A. Michener Library (1966)

Gunnison
Western State College of Colorado 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 McClelland Library (1893)
University of Southern Colorado Library (1965)

CONNECTICUT

Bridgeport
Bridgeport Public Library (1884)
Quinnipiac College School of Law Library Wahlstrom Library (1979)

Danbury
Western Connecticut State University Ruth A. Haas 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, Inc., 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 University 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
Silas Bronson Public Library (1869)
Teikyo Post University Traurig Library (1977)
West Haven
University of New Haven Marvin K. Peterson Library (1971)

DELAWARE

Dover
Delaware Division of Libraries (1992)
Delaware State University William C. Janson Library (1962)
Georgetown
Delaware Technical and Community College Southern Campus Library (1968)
Newark
University of Delaware Library (1907)
Wilmington
Widener University School of Law Library (1976)

DISTRICT OF COLUMBIA

Washington
Administrative Conference of the United States Library (1972)
Board of Governors of the Federal Reserve System Law Library (1976)
Board of Governors of the Federal Reserve System Research Library (1978)
American University Washington College of Law Library (1983)
Catholic University of America Robert J. White Law Library (1979)
Comptroller of the Currency Library (1986)
Department of Commerce Library (1955)
Department of Education Research Library (1988)
Department of Housing and Urban Development Library (1969)
Department of the Army Pentagon Library (1969)
Department of the Interior Natural Resources Library (1895)
Department of Justice Main Library (1895)
Department of Labor Library (1976)
Department of the Navy Library (1895)
Department of State Law Library (1966)
Department of State Library (1895)
Department of Transportation Main Library (1982)
Department of Transportation U.S. Coast Guard Law Library (1982)
Department of the Treasury Library (1895)
Department of Veterans’ Affairs Central Office Library (1967)
District of Columbia Court of Appeals Library (1981)
District of Columbia Public Library (1943)
Executive Office of the President Libraries (1965)
Federal Deposit Insurance Corporation Library (1972)
Federal Election Commission Law Library (1975)
Federal Mine Safety & Health Review Commission Library (1976)
General Accounting Office Information Services Center (1974)
General Services Administration Library (1975)
Georgetown University Law Center Edward Bennett Williams Law Library (1978)
Georgetown University Library (1969)
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)
Office of Personnel Management Library (1963)
U.S. Court of Appeals for the Federal Circuit Library (1986)
U.S. Court of Appeals Judges’ Library (1975)
U.S. Postal Service Library (1895)
U.S. Senate Library (1979)
U.S. Supreme Court Library (1978)

FLORIDA

Boca Raton
Florida Atlantic University S. E. Wimberly Library (1963)

Bradenton
Manatee County Public Library (1991)
Casselberry
Seminole County Public Library System (1989)

Clearwater
Clearwater Public Library System (1991)

Coral Gables
University of Miami Otto G. Richter Library (1939)

Daytona Beach
Volusia County Public Library Volusia County Library Center (1963)

Deland
Stetson University duPont-Ball Library (1887)

Fort Lauderdale
Broward County Main Library (1967)
Nova Southeastern University Law Library (1967)

Fort Pierce
Indian River Community College Library (1975)

Gainesville
University of Florida College of Law Library (1978)
University of Florida Libraries (1907) REGIONAL

Jacksonville
Jacksonville Public Libraries (1914)
Jacksonville University Carl S. Swisher Library (1962)
University of North Florida Thomas G. Carpenter Library (1972)

Key West
Florida Keys Community College Key West Campus Library (1989)

Lakeland
Lakeland Public Library (1928)

Leesburg
Lake-Sumter Community College Library (1963)

Melbourne
Florida Institute of Technology Evans Library (1963)

Miami
Florida International University University Park Campus Library (1970)
Miami-Dade Public Library (1952)
St. Thomas University Library (1966)

North Miami
Florida International University North Miami Campus 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 (1983)

Port Charlotte
Charlotte-Glades Library System (1973)

Saint Petersburg
Saint Petersburg Public Library (1965)
Stetson University College of Law Charles A. Dana Law 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 Meri Kelsey Library (1953)

Winter Park
Rollins College Olin Library (1909)

GEORGIA

Albany
Dougherty County Public Library (1964)

Americus
Georgia Southwestern College James Earl Carter Library (1966)

Athens
University of Georgia Libraries (1907) REGIONAL
University of Georgia School of Law Library (1979)
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Lewiston
Lewis-Clark State College The Library (1991)

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 David O. McKay Learning Resources Center (1946)

Twin Falls
College of Southern Idaho Library (1970)

ILLINOIS

Bloomington
Illinois Wesleyan University, Sheean Library (1964)

Bourbonnais
Olivet Nazarene University Benner Library and Resource Center (1946)

Carbondale
Southern Illinois University at Carbondale Morris Library (1932)
Southern Illinois University at Carbondale School of Law Library (1978)

Carlinville
Blackburn College Lumpkin Library (1954)

Carterville
John A. Logan College Learning Resources Center (1992)

Champaign
University of Illinois Law Library (1965)

Charleston
Eastern Illinois University Booth Library (1962)

Chicago
Chicago Public Library Harold Washington 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 Ronald Williams Library (1961)
Northwestern University School of Law Library (1978)
University of Chicago D'Angelo 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 College of Law Library (1978)
Northern Illinois University Founders' Memorial Library (1960)

Des Plaines
Oakton Community College Library (1976)

Edwardsville
Southern Illinois University at Edwardsville 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 (1990)

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 Library (1970)
Monmouth
Monmouth College Hewes Library (1860)

Mount Carmel
Wabash Valley College Bauer Media Center (1975)

Mount Prospect
Mount Prospect Public Library (1990)

Normal
Illinois State University Milner Library (1877)

Oak Park
Oak Park Public Library (1963)

Oglesby
Illinois Valley Community College Jacobs Memorial Library (1976)

Palos Hills
Moraine Valley Community College Robert E. Turner Learning Resources Center (1972)

Peoria
Bradley University Cullom-Davis Library (1963)
Peoria Public Library (1883)

River Forest
Rosary College Rebecca Crown Library (1966)

Rockford
Rockford Public Library (1895)

Romeoville
Lewis University Library (1952)

South Holland
South Suburban College Learning Resources Center

Springfield
Illinois State Library (unknown) REGIONAL

Streamwood
Poplar Creek Public Library (1980)

University Park
Governors' State University Library (1974)

Urbana
University of Illinois at Urbana-Champaign Documents Library (1907)

Wheaton
Wheaton College Buswell Memorial Library (1964)

Woodstock
Woodstock Public Library (1963)

Indiana

Anderson
Anderson Public Library (1983)
Anderson University Robert A. Nicholson Library (1959)

Bloomington
Indiana University Library (1881)
Indiana University School of Law Library (1978)

Crawfordsville
Wabash College Lilly Library (1906)

Evansville
Evansville-Vanderburgh County Public Library (1928)
University of Southern Indiana Library Services (1969)

Fort Wayne
Allen County Public Library (1896)
Indiana University-Purdue University at Fort Wayne (1965)

Franklin
Franklin College Library (1976)

Gary
Gary Public Library Main Library (1943)
Indiana University Northwest Library (1966)

Greencastle
DePauw University Roy O. West Library (1879)

Hammond
Hammond Public Library (1964)

Hanover
Hanover College Duggan Library (1892)

Huntington
Huntington College Richlyn Library (1964)

Indiana

Indianapolis
Butler University Irwin Library (1965)
Indiana State Library (unknown) REGIONAL
Indiana Supreme Court Law Library (1975)
Indiana University School of Law Library (1967)
Indiana University-Purdue University at Indianapolis University Library (1979)
Indianapolis-Marion County Public Library (1906)
Kokomo
Indiana University Kokomo Library (1969)
Muncie
Ball State University Alexander M. Bracken Library (1959)
Muncie Public Library (1906)
New Albany
Indiana University Southeast Library (1965)
Notre Dame
University of Notre Dame Kresge Law Library (1985)
University of Notre Dame Theodore M. Hesburgh Library (1883)
Rensselaer
Saint Joseph's College Robinson Memorial Library (1964)
Richmond
Earlham College Lilly Library (1964)
Morrison-Reeves Library (1906)
South Bend
Indiana University at South Bend Franklin D. Schurz Library (1965)
Terre Haute
Indiana State University Cunningham Memorial Library (1906)
Valparaiso
Valparaiso University Law Library (1978)
Valparaiso University Moellinger Memorial Library (1930)
West Lafayette
Purdue University Libraries (1907)

IOWA

Ames
Iowa State University Parks Library (1907)
Cedar Falls
University of Northern Iowa Donald O. Rod Library (1946)
Cedar Rapids
Cedar Rapids Public Library (1986)
Council Bluffs
Council Bluffs Public Library (1885)
Davenport
Davenport Public Library (1973)

Des Moines
Drake University Cowles Library (1966)
Drake University Law Library (1972)
Public Library of Des Moines (1888)
State Library of Iowa (unknown)

Dubuque
Carnegie-Stout Public Library (unknown)
Loras College Wahlert Memorial Library (1967)

Fayette
Upper Iowa University Henderson-Wilder Library (1972)

Grinnell
Grinnell College Burling Library (1874)

Iowa City
University of Iowa College of Law Library (1968)
University of Iowa Libraries (1884) REGIONAL

Lamoni
Graceland College F. M. 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)

Dodge City
Dodge City Community College Learning Resources Center (1991)
Emporia
Emporia State University William Allen White Library (1909)

Hays
Fort Hays State University Forsyth Library (1926)

Hutchinson
Hutchinson Public Library (1963)

Kansas City
Kansas City Kansas Community College Library (1992)

Lawrence
University of Kansas Government Documents and Maps Library (1869)
REGIONAL
University of Kansas Law School Library (1971)

Manhattan
Kansas State University Farrell Library (1907)

Pittsbug
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 (1975)
Kansas Supreme Court Law Library (1975)
Washburn University of Topeka Law Library (1971)

Wichita
Wichita State University Ablah Library (1901)

KENTUCKY

Ashland
Ashland Community College Library (1990)

Barbourville
Union College Abigail E. Weeks Memorial Library (1958)

Bowling Green
Western Kentucky University Helm-Cravens Library (1934)

Columbia
Lindsey Wilson College Katie Murrell Library (1987)

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 Paul G. Blazer Library (1972)

Hazard
Hazard Community College Library (1988)

Highland Heights
Northern Kentucky University W. Frank Steely Library (1973)

Lexington
University of Kentucky Law Library (1968)
University of Kentucky King Library South (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-Western College Library Learning Center (1966)

Richmond
Eastern Kentucky University John Grant Crabbe Library (1966)

Williamsburg

LOUISIANA

Baton Rouge
Louisiana State University Middleton Library (1907) REGIONAL
Louisiana State University Paul M. Herbert Law Center Library (1929)
### Southern University
- John B. Cade Library (1952)

### Louisiana State University Law Center
- Library (1979)

### State Library of Louisiana
- Library (1976)

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- John B. Cade Library (1952)

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### State Library of Louisiana
- Library (1976)

### Eunice
- Louisiana State University at Eunice Arnold LeDoux Library (1969)

### Hammond
- Southeastern Louisiana University Sims Memorial Library (1966)

### Lafayette
- University of Southwestern Louisiana Dupre Library (1938)

### Lake Charles
- McNeese State University Lether E. Frazar Memorial Library (1941)

### Leesville
- Vernon Parish Library (1991)

### Monroe
- Northeast Louisiana University Sandel Library (1963)

### Natchitoches
- Northwestern State University Watson Memorial Library (1887)

### New Orleans
- Law Library of Louisiana (unknown)
- Loyola University Library (1942)
- Loyola University Law Library (1978)
- New Orleans Public Library (1883)
- Our Lady of Holy Cross College Blaine S. Kern Library (1966)
- Southern University at New Orleans Leonard S. Washington Library (1962)
- Tulane University School of Law Library (1976)
- Tulane University Howard-Tilton Memorial Library (1942)
- U.S. Court of Appeals Fifth Circuit Library (1973)
- University of New Orleans Earl K. Long Library (1963)
- Xavier University Library (1991)

### Pineville
- Louisiana College Norton Memorial Library (1969)

### Ruston
- Louisiana Technical University Prescott Memorial Library (1896)
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### Shreveport
- Louisiana State University in Shreveport Noel Memorial Library (1967)
- Shreve Memorial Library (1923)

### Thibodaux
- Nicholls State University Ellender Memorial Library (1962)

### Maine

### Augusta
- Maine Law and Legislative Reference Library (1973)
- Maine State Library (unknown)

### Bangor
- Bangor Public Library (1884)

### Brunswick
- Bowdoin College Hawthorne-Longfellow Library (1884)

### Castine

### Lewiston
- Bates College George and Helen Ladd Library (1883)

### Orono
- University of Maine Raymond H. Fogler Library (1907) REGIONAL

### Portland
- Portland Public Library (1884)
- University of Maine School of Law Library Garbrecht Law Library (1964)

### Presque Isle
- University of Maine at Presque Isle Library (1979)

### Sanford

### Waterville
- Colby College Miller Library (1884)

### Maryland

### Annapolis
- Maryland State Law Library (unknown)
- U.S. Naval Academy Nimitz Library (1895)

### Baltimore
- Enoch Pratt Free Library (1887)
- Johns Hopkins University New Engineering Building Government/Publication/Maps Law Library (1882)
- Morgan State University Soper Library (1940)
- University of Baltimore Langsdale Library (1973)
- University of Baltimore Law Library (1880)
- University of Maryland School of Law Library Marshall Law Library (1969)
- U.S. Court of Appeals Fourth Circuit Library (1982)
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<td>Westminster</td>
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Wellesley
Wellesley College Margaret Clapp Library (1943)

Wenham
Gordon Jenks Learning Resource Center (1963)

Williamstown
Williams College Sawyer Library (unknown)

Worcester
American Antiquarian Society Library (1814)
University of Massachusetts Medical Center Lamar Soutter Library (1972)
Worcester Public Library (1859)

MIchigan

Albion
Albion College Stockwell-Mudd Library (1966)

Allendale
Grand Valley State University Zumberge Library (1963)

Alma
Alma College Library (1963)

Ann Arbor
University of Michigan Harlan Hatcher Graduate Library (1884)
University of Michigan Law Library (1978)

Benton Harbor
Benton Harbor Public Library (1907)

Clinton Township
Macomb County Library (1968)

Dearborn
Henry Ford Community College Eshleman Library (1957)

Detroit
Detroit College of Law Library (1979)
Detroit Public Library (1868) REGIONAL
Marygrove College Library (1965)
University of Detroit Kresge Law Library (1978)
University of Detroit-Mercy McNichols Campus Library (1884)
Wayne State University Purdy/Kresge Library (1937)
Wayne State University Arthur Neef Law Library (1971)

Dowagiac
Southwestern Michigan College Fred L. Mathews Library (1971)

East Lansing
Michigan State University Government Documents Library (1907)

Farmington Hills
Oakland Community College King Learning Resources Center (1968)

Flint
Flint Public Library (1967)
University of Michigan-Flint Library (1977)

Grand Rapids
Calvin College & Seminary Library (1967)
Grand Rapids Public Library (1876)

Houghton
Michigan Technological University J. Robert Van Pelt Library (1876)

Jackson
Jackson District Library (1965)

Kalamazoo
Kalamazoo Public Library (1907)
Western Michigan University Dwight B. Waldo Library (1963)

Lansing
Library of Michigan (1860) REGIONAL
Thomas M. Cooley Law School Library (1978)

Livonia
Livonia Public Library (1987)
Schoolcraft College Eric J. Bradner Library (1962)

Madison Heights
Madison Heights Public Library (1982)

Marquette
Northern Michigan University Lydia M. Olson Library (1963)

Monroe
Monroe County Library System (1974)

Mount Pleasant
Central Michigan University Charles V. Park Library (1958)

Muskegon
Hackley Public Library (1894)

Petoskey
North Central Michigan College Library (1962)

Pontiac
Oakland County Research Library 1992)
Port Huron
Saint Clair County Library (1876)

Rochester
Oakland University Kresge Library (1964)

Royal Oak
Royal Oak Public Library (1984)

Saginaw
Hoyt Library (1890)

Sault Ste. Marie
Lake Superior State University Kenneth Shouldice Library (1982)

Traverse City
Northwestern Michigan College Mark and Helen Osterlin Library (1964)

University Center
Delta College Library (1963)

Warren
Warren Public Library Arthur J. Miller Branch (1973)

Ypsilanti
Eastern Michigan University Library (1965)

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MICRONESIA

Pohnpei State

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MINNESOTA

Bemidji
Bemidji State University A. C. Clark Library (1963)

Blaine
Anoka County Library (1971)

Collegeville
Saint John's University Alcuin Library (1954)

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Duluth
Duluth Public Library (1909)
University of Minnesota-Duluth Library (1984)

Eagan
Dakota County Library—Westcott Branch (1983)

Edina
Hennepin County Library Southdale-Hennepin Area Library (1971)

Mankato
Mankato State University Memorial Library (1962)

Marshall
Southwest State University Library (1986)

Minneapolis
Minneapolis Public Library (1893)
University of Minnesota Law School Library (1978)
University of Minnesota Wilson Library (1907) REGIONAL

Moorhead
Moorhead State University Library (1956)

Morris
University of Minnesota, Morris, Rodney A. Briggs Library (1963)

Northfield
Carleton College The Library (1930)
Saint Olaf College Rolvaag Memorial Library (1930)

Saint Cloud
Saint Cloud State University, Learning Resources Center (1962)

Saint Paul
Hamline University School of Law Library (1978)
Minnesota State Law Library (unknown)
Saint Paul Public Library (1914)
University of Minnesota Saint Paul Campus Library (1974)
William Mitchell College of Law Library (1979)

Saint Peter
Gustavus Adolphus College Folke Bernadotte Memorial Library (1941)

Winona
Winona State University Maxwell Library (1969)
<table>
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<th>MISSISSIPPI</th>
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| **Cleveland**  
Delta State University W. B. Roberts Library (1975) |
| **Columbus**  
Mississippi University for Women John Clayton Fant Memorial Library (1929) |
| **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)  
Supreme Court of Mississippi State Law Library (unknown) |
| **Lorman**  
Alcorn State University J. D. Boyd Library (1970) |
| **Mississippi State**  
Mississippi State University Mitchell Memorial Library (1907) |
| **University**  
University of Mississippi J. D. Williams Library (1883) REGIONAL  
University of Mississippi James O. Eastland Law Library (1967) |

<table>
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<th>MISSOURI</th>
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| **Cape Girardeau**  
Southeast Missouri State University Kent Library (1916) |
| **Columbia**  
University of Missouri at Columbia Ellis Library (1862) REGIONAL  
University of Missouri-Columbia Law Library (1978) |
| **Fulton**  
Westminster College Reeves Library (1875) |
| **Hillsboro**  
Jefferson College Library (1984) |
| **Jefferson City**  
Lincoln University Inman E. Page Library (1944)  
Missouri State Library (1963)  
Missouri Supreme Court Library (unknown) |
| **Joplin**  
Missouri Southern State College George A. Spiva Library (1966) |
| **Kansas City**  
Kansas City Missouri Public Library (1881)  
Rockhurst College Greenlease Library (1917)  
University of Missouri at Kansas City Leon E. Bloch Law Library (1978)  
University of Missouri at Kansas City Miller Nichols Library (1938) |
| **Kirkville**  
Northeast Missouri State University Pickler Memorial Library (1966) |
| **Liberty**  
William Jewell College Charles F. Curry Library (1900) |
| **Maryville**  
Northwest Missouri State University B. D. Owens Library (1982) |
| **Rolla**  
University of Missouri at Rolla Curtis Laws Wilson Library (1907) |
| **Saint Charles**  
Lindenwood College Margaret Leggat Butler Library (1973)  
Saint Charles City/County Library District Kisker Road Branch Library (1990) |
| **Saint Joseph**  
River Bluffs Regional Library Central Library (1891) |
| **Saint Louis**  
Maryville University Library (1976)  
Saint Louis County Library (1970)  
Saint Louis Public Library (1866)  
Saint Louis University Law Library (1967)  
Saint Louis University Pius XII Memorial Library (1866)  
U.S. Court of Appeals Eighth Circuit Library (1972)  
University of Missouri at Saint Louis Thomas Jefferson Library (1966)  
Washington University John M. Olin Library (1906)  
Washington University Freund Law Library (1978) |
| **Springfield**  
Drury College F. W. Olin Library (1874)  
Southwest Missouri State University Duane G. Meyer Library (1963) |
| **Warrensburg**  
Central Missouri State University Ward Edwards Library (1914) |
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<td>1944</td>
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Scottsbluff Public Library (1925)
Wayne State College U.S. Conn Library (1970)
Nevada Supreme Court Library (1973)
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Las Vegas-Clark County Library District (1974)
University of Nevada at Las Vegas James Dickinson Library (1959)
Elko County Library (1991)
National Judicial College Law Library (1979)
New Hampshire Law Library (1994)
New Hampshire State Library (unknown)
University of New Hampshire Dimond Library (1907)
Dartmouth College Baker Library (1884)
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<td>Shrewsbury</td>
<td>Monmouth County Library (1968)</td>
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<tr>
<td>South Orange</td>
<td>Seton Hall University Walsh Library (1947)</td>
</tr>
<tr>
<td>Teaneck</td>
<td>Fairleigh Dickinson University Weiner Library (1963)</td>
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<td>Bloomfield</td>
<td>Bloomfield Public Library (1965)</td>
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<tr>
<td>Bridgeton</td>
<td>Cumberland County Library (1966)</td>
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<td>Camden</td>
<td>Rutgers University Law School Library (1979)</td>
</tr>
<tr>
<td>Glassboro</td>
<td>Rowan College of New Jersey Savitz Library (1963)</td>
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<tr>
<td>Hackensack</td>
<td>Johnson Free Public Library (1966)</td>
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<tr>
<td>Irvington</td>
<td>Irvington Public Library (1966)</td>
</tr>
<tr>
<td>Jersey City</td>
<td>Jersey City Public Library (1879)</td>
</tr>
<tr>
<td>Lawrenceville</td>
<td>Rider University Franklin F. Moore Library (1975)</td>
</tr>
<tr>
<td>Madison</td>
<td>Drew University Library (1939)</td>
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<tr>
<td>Bayonne</td>
<td>Bayonne Free Public Library (1909)</td>
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<tr>
<td>Bloomfield</td>
<td>Bloomfield Public Library (1965)</td>
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<td>Bridgeton</td>
<td>Cumberland County Library (1966)</td>
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<td>East Brunswick Public Library (1977)</td>
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<td>East Orange</td>
<td>East Orange Public Library (1966)</td>
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<tr>
<td>Elizabeth</td>
<td>Free Public Library of Elizabeth (1895)</td>
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<td>Glassboro</td>
<td>Rowan College of New Jersey Savitz Library (1963)</td>
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<td>Hackensack</td>
<td>Johnson Free Public Library (1966)</td>
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<td>Irvington Public Library (1966)</td>
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<td>Jersey City</td>
<td>Jersey City Public Library (1879)</td>
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<tr>
<td>Lawrenceville</td>
<td>Rider University Franklin F. Moore Library (1975)</td>
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<td>Madison</td>
<td>Drew University Library (1939)</td>
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Toms River
Ocean County College Library (1966)

Trenton
New Jersey State Library (unknown)
Trenton Public Library (1902)

Upper Montclair
Montclair State College Harry A. Sprague Library (1967)

Wayne
Wayne Public Library (1972)

West Long Branch
Monmouth College Guggenheim Memorial Library (1963)

Woodbridge
Free Public Library of Woodbridge (1965)

NEW MEXICO

Albuquerque
University of New Mexico Health Sciences Center Library (1973)
University of New Mexico School of Law Library (1973)
University of New Mexico General Library (1896) REGIONAL

Hobbs
New Mexico Junior College Pannell Library (1969)

Las Cruces
New Mexico State University Branson Library (1907)

Las Vegas
New Mexico Highlands University Donnelly Library (1913)

Portales
Eastern New Mexico University Golden Library (1962)

Santa Fe
New Mexico State Library (1960) REGIONAL
New Mexico Supreme Court Law Library (unknown)

Silver City
Western New Mexico University Miller Library (1972)

Socorro
New Mexico Institute of Mining & Technology New Mexico Tech Library (1984)

NEW YORK

Albany
Albany Law School Schaeffer Law Library (1979)
New York State Library (unknown) REGIONAL
State University of New York at Albany University Library (1964)

Binghamton
State University of New York at Binghamton Glenn G. Bartle Library (1962)

Brockport
State University of New York at Brockport Drake Memorial Library (1967)

Bronx
Fordham University Library (1937)
Herbert H. Lehman College Library (1967)
New York Public Library (1987)
State University of New York Maritime College Stephen B. Luce Library (1947)

Bronxville
Sarah Lawrence College Esther Raushenbush Library (1969)

Brooklyn
Brooklyn College Library (1936)
Brooklyn Law School Library (1974)
Brooklyn Public Library (1908)
Pratt Institute Library (1891)
State University of New York Medical Research Library (1958)

Buffalo
Buffalo and Erie County Public Library (1895)
State University of New York at Buffalo Charles B. Sears Law Library (1978)
State University of New York at Buffalo Lockwood Memorial Library (1963)

Canton
Saint Lawrence University Owen D. Young Library (1920)

Corning
Corning Community College Arthur A. Houghton Jr. Library (1963)

Cortland
State University College Cortland Memorial Library (1964)
Delhi
State University of New York College of Technology Resnick Library (1973)

East Islip
East Islip Public Library (1973)

Elmira
Elmira College Gannett Tripp Library (1956)

Farmingdale
State University of New York at Farmingdale Greenley Library (1917)

Flushing
Queens College Benjamin S. Rosenthal Library (1939)
Queens College of City University of New York Law School Library (1983)

Garden City
Adelphi University Swirbul Library (1966)

Geneseo
State University of New York at Geneseo Milne Library (1967)

Greenvale
Long Island University B. Davis Schwartz Memorial Library (1964)

Hamilton
Colgate University, Everett Needham Case Library (1902)

Hempstead
Hofstra University Axinn Library (1964)
Hofstra University School of Law Library (1979)

Huntington
Touro College School of Law Library (1985)

Ithaca
Cornell University Albert R. Mann Library (1943)
Cornell University Law School Library (1978)
Cornell University Olin Library (1907)

Jamaica
Queens Borough Public Library (1926)
Saint John's University Library (1956)
Saint John's University School of Law Library (1978)

Kings Point
U.S. Merchant Marine Academy Schuyler Otis Bland Library (1962)

Long Island City
Fiorello H. LaGuardia Community College Library (1981)

Middletown
Thrall Library (1986)

Mount Vernon
Mount Vernon Public Library (1962)

New Paltz
State University College at New Paltz Sojourner Truth Library (1965)

New York City
City College of City University of New York Cohen Library (1884)
College of Insurance Library (1965)
Columbia University Libraries (1882)
Columbia University School of Law Library (1981)
Cooper Union for the Advancement of Science and Arts Library (1930)
Fordham University Leo T. Kissam Memorial Law Library (1987)
Medical Library Center of New York (1976)
New York Law Institute Library (1909)
New York Law School Library (1979)
New York Public Library Astor Branch (1907)
New York Public Library Lenox Branch (1884)
New York University Elmer Holmes Bobst Library (1967)
New York University Law Library (1974)
U.S. Court of Appeals Second Circuit Library (1976)
Yeshiva University Chutick Law Library (1979)
Yeshiva University Pollack Library (1979)

Newburgh
Newburgh Free Library (1909)

Niagara Falls
Niagara Falls Public Library (1976)

Oakdale
Dowling College Library (1965)

Oneonta
State University College at Oneonta James M. Milne Library (1966)

Oswego
State University of New York at Oswego Penfield Library (1966)

Plattsburgh
State University College at Plattsburgh Benjamin F. Feinberg Library (1967)
**Potsdam**
Clarkson University Harriet Call Burnap Memorial Library (1938)
State University of New York-College at Potsdam Frederick W. Crumb Memorial Library (1964)

**Poughkeepsie**
Vassar College Library (1943)

**Purchase**
State University of New York at Purchase Library (1969)

**Rochester**
Rochester Public Library (1978)
University of Rochester Rush Rhees Library (1880)

**Saint Bonaventure**
Saint Bonaventure University Friedsam Memorial Library (1938)

**Saratoga Springs**
Skidmore College Library (1964)

**Schenectady**
Union College Schaffer Library (1901)

**Southampton**
Long Island University Southampton Campus Library (1973)

**Sparkill**
St. Thomas Aquinas College Lougheed Library (1984)

**Staten Island**
Wagner College Horrmann Library (1953)

**Stony Brook**
State University of New York at Stony Brook Frank Melville Jr. Memorial Library (1963)

**Syracuse**
Onondaga County Public Library (1978)
Syracuse University E. S. Byrd Library (1878)
Syracuse University College of Law Library H. Douglas Barclay Law Library (1978)

**Troy**
Troy Public Library (1869)

**Uniondale**
Nassau Library System (1965)

**Utica**
State University of New York Institute of Technology Library (1977)
Utica Public Library (1885)

**West Point**
U.S. Military Academy Library (unknown)

**White Plains**
Pace University School of Law Library (1978)

**Yonkers**
Yonkers Public Library Getty Square Branch (1910)

**Yorktown Heights**
Mercy College Library (1976)

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**NORTH CAROLINA**

**Asheville**
University of North Carolina at Asheville D. Hiden Ramsey Library (1965)

**Boiling Springs**

**Boone**
Appalachian State University Carol Grotnes Belk Library (1963)

**Buies Creek**
Campbell University Carrie Rich Memorial Library (1965)

**Burlington**
Elon College Iris Holt McEwen Library (1971)

**Chapel Hill**
University of North Carolina at Chapel Hill Law Library (1978)
University of North Carolina at Chapel Hill Walter Royal Davis Library (1884) REGIONAL

**Charlotte**
Public Library of Charlotte and Mecklenburg County (1964)
Queens College Everatt Library (1927)
University of North Carolina at Charlotte J. Murrey Atkins Library (1964)

**Cullowhee**
Western Carolina University Hunter Library (1953)
Davidson
Davidson College E. H. Little Library (1893)

Durham
Duke University School of Law Library (1978)
Duke University William R. Perkins Library (1890)
North Carolina Central University Law School Library (1979)
North Carolina Central University James E. Shepard Library (1973)

Fayetteville
Fayetteville State University Charles W. Chesnutt Library (1971)

Greensboro
North Carolina Agricultural and Technical State University F. D. Bluford Library (1937)
University of North Carolina at Greensboro Walter Clinton Jackson Library (1963)

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)

Pembroke
Pembroke State University Mary Livermore Library (1956)

Raleigh
Department of Cultural Resources Division of State Library (unknown)
North Carolina State University D. H. Hill Library (1923)
North Carolina Supreme Court Library (1972)

Rocky Mount
North Carolina Wesleyan College Pearsall Library (1969)

Salisbury
Catawba College Corriher-Linn-Black Library (1925)

Wilmington
University of North Carolina at Wilmington William M. Randall Library (1965)

Wilson
Barton College Hackney Library (1930)

Winston-Salem
Forsyth County Public Library Main Library (1954)
Wake Forest University Worrell Professional Center Library (1990)
Wake Forest University Z. Smith Reynolds Library (1902)

NORTH DAKOTA

Bismarck
Bismarck Veterans' Memorial Public Library (1967)
North Dakota State Library (1971)
North Dakota Supreme Court Law Library (unknown)
State Historical Society of North Dakota State Archives & Historical Research Library (1907)

Dickinson
Dickinson State University Stoxen Library (1968)

Fargo
North Dakota State University Library (1907) REGIONAL

Grand Forks
University of North Dakota Chester Fritz Library (1890) REGIONAL

Minot
Minot State University Gordon B. Olson Library (1925)

Valley City
Valley City State University Allen Memorial Library (1913)

NORTHERN MARIANA ISLANDS

Saipan
Northern Marianas College Olympio T. Borja Memorial Library (1988)

OHIO

Ada
Ohio Northern University Jay P. Taggart Law Library (1965)

Akron
Akron-Summit County Public Library (1952)
University of Akron Bierce Library (1963)
University of Akron School of Law Library (1978)
Alliance
Mount Union College Library (1888)

Ashland
Ashland University Library (1938)

Athens
Ohio University Alden Library (1886)

Bluffton
Bluffton College Musselman Library (1951)

Bowling Green
Bowling Green State University Jerome Library (1933)

Canton
Malone College Everett L. Cattel Library (1970)

Chardon
Chardon Public Library (1971)

Cincinnati
Public Library of Cincinnati and Hamilton County Main Library (1884)
University of Cincinnati College of Law Library (1978)
University of Cincinnati Langsam Library (1929)
U.S. Court of Appeals Sixth Circuit Library (1986)

Cleveland
Case Western Reserve University Freiberger Library (1913)
Case Western Reserve University School of Law Library (1979)
Cleveland Public Library (1886)
Cleveland State University Cleveland-Marshall College of Law Library
Joseph W. Bartunek III Law Library (1978)
Cleveland State University Library (1966)
Municipal Reference Library (1970)

Cleveland Heights
Cleveland Heights-University Heights Public Library (1970)

Columbus
Capital University Law and Graduate Center Documents Department
(1980)
Capital University Library (1968)
Columbus Metropolitan Main Library (1885)
Ohio State University College of Law Library (1984)
Ohio State University Libraries (1907)
Ohio Supreme Court Law Library (1973)
State Library of Ohio (unknown) REGIONAL

Dayton
Dayton and Montgomery County Public Library (1909)
University of Dayton Roesch Library (1969)
Wright State University Paul Laurence Dunbar Library (1965)

Delaware
Ohio Wesleyan University L. A. Beeghly Library (1845)

Elyria
Elyria Public Library (1966)

Findlay
University of Findlay Shafer Library (1969)

Gambier
Kenyon College Olin/Chalmers Libraries (1873)

Granville
Denison University Libraries (1884)

Hiram
Hiram College Teachout-Price Memorial Library (1874)

Kent
Kent State University Libraries (1962)

Marietta
Marietta College Dawes Memorial Library (1884)

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 King Library (1909)

Portsmouth
Shawnee State University Library (1987)

Rio Grande
University of Rio Grande Jeanette Albiez Davis Library (1966)

Springfield
Clark County Public Library (1884)
Steubenville
Franciscan University of Steubenville John Paul II Library (1971)
Public Library of Steubenville and Jefferson County (1950)

Tiffin
Heidelberg College Beeghly Library (1964)

Toledo
Toledo-Lucas County Public Library (1884)
University of Toledo College of Law Library (1981)
University of Toledo William S. Carlson Library (1963)

University Heights
John Carroll University Grasselli Library (1963)

Westerville
Otterbein College Courtright Memorial Library (1967)

Westlake
Porter Public Library (1991)

Wilmington
Wilmington College S. Arthur Watson Library (1986)

Wooster
College of Wooster Andrews Library (1966)

Worthington
Worthington Public Library (1984)

Youngstown
Public Library of Youngstown and Mahoning County (1923)
Youngstown State University William F. Maag Library (1971)

Edmond
University of Central Oklahoma Library (1934)

Enid
Public Library of Enid and Garfield County (1908)

Langston
Langston University G. Lamar Harrison Library (1941)

Lawton
Lawton Public Library (1987)

Norman
University of Oklahoma Bizzell Memorial Library (1893)
University of Oklahoma Law Library (1978)

Oklahoma City
Metropolitan Library System Downtown Library (1974)
Oklahoma City University Dulaney Browne Library (1963)
Oklahoma Department of Libraries (1893) REGIONAL

Shawnee
Oklahoma Baptist University Mabee Learning Center (1933)

Stillwater
Oklahoma State University Edmon Low Library (1907) REGIONAL

Tahlequah
Northeastern 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)

A-25
Corvallis
Oregon State University William Jasper Kerr Library (1907)

Eugene
University of Oregon Law Library (1979)
University of Oregon Library (1883)

Forest Grove
Pacific University Harvey W. Scott Memorial Library (1897)

Klamath Falls
Oregon Institute of Technology Library (1982)

La Grande
Eastern Oregon State College Walter M. Pierce Library (1954)

McMinnville
Linfield College Northup Library (1965)

Monmouth
Western Oregon State College Library (1967)

Pendleton
Blue Mountain Community College Library (1983)

Portland
Lewis and Clark College Aubrey R. Watzek Library (1967)
Multnomah County Library (1884)
Northwestern School of Law Paul L. Boley Law Library (1979)
Portland State University Branford P. Millar Library (1963) REGIONAL
Reed College Library Eric V. Houser Library (1912)
U.S. Department of Energy Bonneville Power Administration Library (1962)

Salem
Oregon State Library (unknown)
Oregon Supreme Court Law Library (1974)
Willamette University College of Law Library (1979)
Willamette University Mark O. Hatfield Library (1969)

PANAMA

Balboa Heights
Panama Canal Commission Technical Resources Center (1963)

Pennsylvania

Allentown
Muhlenberg College Trexler Library (1939)

Altoona
Altoona Area Public Library (1969)

Bethel Park
Bethel Park Public Library (1980)

Bethlehem
Lehigh University Library (1876)

Blue Bell
Montgomery County Community College Learning Resources Center (1975)

Bradford
University of Pittsburgh at Bradford Hanley Library (1979)

Broomall
Marple Public Library (1988)

California
California University of Pennsylvania Louis L. Manderino Library (1986)

Carlisle
Dickinson College Boyd Lee Spahr Library (1947)
Dickinson School of Law Sheeley-Lee Law Library (1978)

Cheyney
Cheyney University Leslie Pinckney Hill Library (1967)

Collegeville
Ursinus College Myrin Library (1963)

Coraopolis
Robert Morris College Library (1978)

Doylestown
Bucks County Free Library (1970)

East Stroudsburg
East Stroudsburg University Kemp Library (1966)

Erie
Erie County Library System (1897)

Greenville
Thiel College Langenheim Memorial Library (1963)
Harrisburg
State Library of Pennsylvania (unknown) REGIONAL
Widener University Harrisburg Campus School of Law Library (1989)

Haverford
Haverford College Magill Library (1897)

Indiana
Indiana University of Pennsylvania Stapleton Library (1962)

Johnstown
Cambria County Library System Glosser Memorial Library (1965)

Lancaster
Franklin and Marshall College Shadek-Fackenthal Library (1895)

Lewisburg
Bucknell University Ellen Clarke Bertrand Library (1963)

Mansfield
Mansfield University Library (1968)

Meadville
Allegheny College Lawrence Lee Pelletier Library (1907)

Millersville
Millersville University Helen A. Ganser Library (1966)

Monessen
Monessen Public Library (1969)

New Castle
New Castle Public Library (1963)

Newton
Bucks County Community College Library (1968)

Norristown
Montgomery County-Norristown Public Library (1969)

Philadelphia
Free Library of Philadelphia (1897)
Saint Joseph's University Francis A. Drexel Library (1974)
Temple University Paley Library (1947)
Temple University School of Law Library (1979)
U.S. Court of Appeals Third Circuit Library (1973)
University of Pennsylvania Biddle Law Library (1974)
University of Pennsylvania Library (1886)

Pittsburgh
Allegheny County Law Library (1977)
Carnegie Library of Pittsburgh Allegheny Regional Branch (1924)
Carnegie Library of Pittsburgh (1895)
Duquesne University School of Law Library (1978)
La Roche College John J. Wright Library (1974)
University of Pittsburgh Hillman Library (1910)
University of Pittsburgh School of Law Barco Law Library (1979)
U.S. Bureau of Mines Library (1962)

Pottsville
Pottsville Free Public Library (1967)

Reading
Reading Public Library (1901)

Scranton
Scranton Public Library (1895)

Shippensburg
Shippensburg University Ezra Lehman Memorial Library (1973)

Slippery Rock
Slippery Rock University Bailey Library (1965)

Swarthmore
Swarthmore College McCabe Library (1923)

University Park
Pennsylvania State University Pattee Library (1907)

Villanova
Villanova University Law School Library (1964)

Warren
Warren Library Association Warren Public Library (1885)

West Chester
West Chester University Francis Harvey Green Library (1967)

Wilkes-Barre
King's College D. Leonard Corgan Library (1949)

Williamsport
Lycoming College Snowden Memorial Library (1970)
### Youngwood
Westmoreland County Community College Learning Resources Center (1972)

### PUERTO RICO

#### Mayaguez
University of Puerto Rico Mayaguez Campus Library (1928)

#### Ponce
Pontifical Catholic University of Puerto Rico Encarnacion Valdes Library (1966)
Pontifical Catholic University of Puerto Rico School of Law Library (1978)

#### San Juan
University of Puerto Rico Jose M. Lazo Library (1928)
University of Puerto Rico Law Library (1991)

### RHODE ISLAND

#### Barrington
Barrington Public Library (1986)

#### Kingston
University of Rhode Island Library (1907)

#### Newport
U.S. Naval War College Library (1963)

#### Providence
Brown University John D. Rockefeller Jr. Library (unknown)
Providence College Phillips Memorial Library (1969)
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 (1977)

#### Woonsocket
Woonsocket Harris Public Library (1977)

### SOUTH CAROLINA

#### Aiken
University of South Carolina-Aiken Gregg-Graniteville Library (1989)

#### Charleston
Charleston Southern University L. Mendel Rivers Library (1967)
The Citadel Military College Daniel Library (1962)
College of Charleston Robert Scott Small Library (1869)

#### Clemson
Clemson University Robert Muldrow Cooper Library (1993) REGIONAL

#### Columbia
Benedict College Payton Learning Resources Center (1969)
South Carolina State Library (1895)
University of South Carolina Coleman Karesh Law Library (1983)
University of South Carolina Thomas Cooper Library (1884) REGIONAL

#### Conway
Coastal Carolina University Kimbel Library (1974)

#### Due West
Erskine College McCain Library (1968)

#### Florence
Florence County Library (1967)
Francis Marion University James A. Rogers Library (1970)

#### Greenville
Furman University James B. Duke Library (1962)
Greenville County Library (1966)

#### Greenwood
Lander University Jackson Library (1967)

#### Lancaster
University of South Carolina at Lancaster Medford Library (1990)

#### Orangeburg
South Carolina State University Miller F. Whittaker Library (1953)

#### Rock Hill
Winthrop University Dacus Library (1896)
Spartanburg
Spartanburg County Public Library (1967)

SOUTH DAKOTA

Aberdeen
Northern State University Williams Library (1963)

Brookings
South Dakota State University Hilton M. Briggs Library (1889)

Pierre
South Dakota State Library (1973)
South Dakota Supreme Court Library (1978)

Rapid City
Rapid City Public Library (1963)
South Dakota School of Mines and Technology Devereaux Library (1963)

Sioux Falls
Augustana College Mikkelsen Library (1969)
Sioux Falls Public Library (1903)

Spearfish
Black Hills State University E. Y. Berry Library (1942)

Vermillion
University of South Dakota I. D. Weeks Library (1889)

TENNESSEE

Bristol
King College E. W. King Library (1970)

Chattanooga
Chattanooga-Hamilton County Bicentennial Library (1908)
U.S. Tennessee Valley Authority Corporate Library (1976)

Clarksville
Austin Peay State University Felix G. Woodward Library (1945)

Cleveland
Cleveland State Community College Library (1973)

Columbia
Columbia State Community College John W. Finney Memorial Library (1973)

Cookeville
Tennessee Technological University Library (1969)

Jackson
Lambuth University Luther L. Gobbel Library (1967)

Jefferson City
Carson-Newman College Library (1964)

Johnson City
East Tennessee State University Sherrood Library (1942)

Knoxville
Knoxville County Public Library System Lawson-McGhee Library (1973)
University of Tennessee at Knoxville John C. Hodges Library (1907)
University of Tennessee Law Library (1971)

Martin
University of Tennessee at Martin Paul Meek Library (1957)

Memphis
Memphis-Shelby County Public Library (1896)
University of Memphis Cecil C. Humphreys School of Law Library (1979)
University of Memphis Libraries (1966)

Murfreesboro
Middle Tennessee State University Todd Library (1912)

Nashville
Fisk University Library (1965)
Public Library of Nashville and Davidson County Ben West Library (1884)
Tennessee State Library and Archives (unknown)
Tennessee State University Brown-Daniel Library (1972)
Vanderbilt University Alyne Queener Massey Law Library (1976)
Vanderbilt University Library (1884)

Sewanee
University of the South Jessie Ball duPont Library (1873)

TEXAS

Abilene
Abilene Christian University Margaret and Herman Brown Library (1911)
Hardin-Simmons University Rupert and Pauline Richardson Library (1940)

Arlington
Arlington Public Library (1970)
University of Texas at Arlington Library (1963)
Austin
Texas State Law Library (1972)
Texas State Library (unknown) REGIONAL
University of Texas at Austin Edie and Lew Wasserman Library (1966)
University of Texas at Austin General Libraries (1884)
University of Texas at Austin Tarleton Law Library (1965)

Baytown
Lee College Erma Wood Carlson Learning Resources Center (1970)

Beaumont
Lamar University Gray Library (1957)

Brownwood
Howard Payne University Walker Memorial Library (1964)

Canyon
West Texas A&M University Cornette Library (1928)

College Station
Texas A&M University-Sterling G. Evans Library (1907)

Commerce
East Texas State University James Gilliam Gee Library (1937)

Corpus Christi
Texas A&M University-Corpus Christi Library (1976)

Corsicana
Navarro College Learning Resources Center (1965)

Dallas
Dallas Baptist University Vance Memorial Library (1967)
Dallas Public Library (1900)
Southern Methodist University Fondren Library (1925)

Denton
University of North Texas Libraries (1948)

Edinburg
University of Texas-Pan American Library (1959)

El Paso
El Paso Public Library (1906)
University of Texas at El Paso Library (1966)

Fort Worth
Fort Worth Public Library (1905)
Texas Christian University Mary Couts Burnett Library (1916)

Galveston
Rosenberg Library (1909)

Garland

Houston
Houston Public Library (1884)
North Harris College Learning Resources Center (1974)
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 Library (1980)
University of Houston Law Center The O'Quinn Library (1979)
University of Houston M. D. Anderson Library (1957)

Huntsville
Sam Houston State University Newton Gresham Library (1949)

Irving
Irving Public Library System (1974)

Kingsville
Texas A&M University-Kingsville James C. Jernigan Library (1944)

Laredo
Laredo Junior College Harold R. Yeary Library (1970)

Longview
Longview Public Library (1961)

Lubbock
Texas Tech University Libraries (1935) REGIONAL
Texas Tech University School of Law Library (1978)

Nacogdoches
Stephen F. Austin State University Steen Library (1965)

Richardson
University of Texas at Dallas McDermott Library (1972)

San Angelo
Angelo State University Porter Henderson Library (1964)

San Antonio
Palo Alto College Learning Resources Center (1990)
Saint Mary's University Academic Library (1964)
Saint Mary's University Sarita Kenedy East Law Library (1982)
San Antonio College Library (1972)
San Antonio Public Library (1899)
Trinity University Elizabeth Coates Maddux Library (1964)
University of Texas at San Antonio Library (1973)
<table>
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<tr>
<th>Location</th>
<th>Library Name</th>
<th>Founded Date</th>
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<td>Castleton State College Calvin Coolidge Library</td>
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<td>Johnson</td>
<td>Johnson State College John Dewey Library</td>
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<td>Lyndonville</td>
<td>Lyndon State College Samuel Reed Hall Library</td>
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<td>Middlebury</td>
<td>Middlebury College Egbert Starr Library</td>
<td>1884</td>
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<td>Montpelier</td>
<td>Vermont Department of Libraries</td>
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<td>Northfield</td>
<td>Norwich University Kreitzberg Library</td>
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<td>South Royalton</td>
<td>Vermont Law School Library</td>
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<td>VIRGIN ISLANDS</td>
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<td>Saint Croix</td>
<td>Virgin Island Division of Libraries c/o Florence Williams Public Library</td>
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<td>Saint Thomas</td>
<td>University of the Virgin Islands Ralph M. Paiewonsky Library</td>
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<td>Alexandria</td>
<td>Dept. of the Navy Office of Judge Advocate General Law Library</td>
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<td>Arlington</td>
<td>George Mason University School of Law Library</td>
<td>1981</td>
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<td>U.S. Patent &amp; Trademark Office Scientific Technology Information Center</td>
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Virginia Polytechnic Institute and State University Libraries (1907)

Bridgewater
Bridgewater College Alexander Mack Memorial Library (1902)

Charlottesville
University of Virginia Alderman Library (1910) REGIONAL
University of Virginia Arthur J. Morris Law Library (1964)

Chesapeake
Chesapeake Public Library System (1970)

Danville
Danville Community College Learning Resources Center (1969)

Emory
Emory and Henry College Kelly Library (1884)

Fairfax
George Mason University Fenwick Library (1960)

Fredericksburg
Mary Washington College Simpson Library (1940)

Hampden-Sydney
Hampden-Sydney College Eggleston Library (1891)

Hampton
Hampton University William R. and Norma B. Harvey Library (1977)

Harrisonburg
James Madison University Carrier Library (1973)

Lexington
Virginia Military Institute Preston Library (1874)
Washington and Lee University James B. Leyburn Library (1910)
Washington and Lee University Wilbur C. Hall Law Library (1978)

Martinsville
Patrick Henry Community College Learning Resources Center (1971)

Norfolk
Norfolk Public Library System (1895)
Old Dominion University Library (1963)
U.S. Armed Forces Staff College Library (1963)

Petersburg
Virginia State University Johnston Memorial Library (1907)

Quantico
Federal Bureau of Investigation FBI Academy Library (1970)
Marine Corps Research Center C40RC James Carson Breckinridge Library (1967)

Reston
Department of the Interior Geological Survey Library (1963)

Richmond
Library of Virginia (unknown)
University of Richmond Boatwright Memorial Library (1900)
University of Richmond Law School Library (1982)
U.S. Court of Appeals Fourth Circuit Library (1973)
Virginia Commonwealth University James Branch Cabell Library (1971)
Virginia State Law Library (1973)

Roanoke
Hollins College Fishburn Library (1957)

Salem
Roanoke College Fintel Library (1886)

Williamsburg
College of William and Mary Earl Gregg Swem Library (1936)
College of William and Mary Marshall-Wythe Law Library (1978)

Wise
Clinch Valley College John Cook Wyllie Library (1971)

WASHINGTON

Bellevue
Bellevue Regional Library (1990)

Bellingham
Western Washington University Mable Zoe Wilson Library (1963)

Cheney
Eastern Washington University John F. Kennedy Library (1966)

Des Moines
Highline Community College Library (1983)

Ellensburg
Central Washington University Library (1962)

Petersburg
Virginia State University Johnston Memorial Library (1907)

Everett
Everett Public Library (1914)
### 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 TSD (1907)

### Seattle
- Seattle Public Library (1908)
- University of Washington Marian Gould Gallagher Law Library (1969)
- University of Washington Suzzallo Library (1890)

### Spokane
- Gonzaga University School of Law Library (1979)
- Spokane Public Library (1910)

### Tacoma
- Tacoma Public Library (1894)
- University of Puget Sound Collins Memorial Library (1938)
- 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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#### Appleton
- Lawrence University Seeley G. Mudd Library (1869)

#### Beloit
- Beloit College Col. Robert H. Morse Library (1888)

#### Eau Claire
- University of Wisconsin-Eau Claire William D. McIntyre Library (1951)

#### Fond du Lac
- Fond du Lac Public Library (1966)

#### Green Bay
- University of Wisconsin-Green Bay Cofrin Library (1968)

#### La Crosse
- La Crosse Public Library (1883)
- University of Wisconsin-La Crosse Murphy Library (1965)

#### Madison
- Madison Public Library (1965)
- State Historical Society of Wisconsin Library (1870) REGIONAL
- University of Wisconsin-Madison Law Library (1981)
- University of Wisconsin-Madison Memorial Library (1939)
- Wisconsin State Law Library (unknown)
Milwaukee
Alverno College Library/Media Center (1971)
Marquette University Law Library (1987)
Medical College of Wisconsin Libraries Todd Wehr Library (1980)
Milwaukee County Law and Reference Library (1934)
Milwaukee Public Library (1861) REGIONAL
Mount Mary College Haggerty Library (1964)
University of Wisconsin-Milwaukee Golda Meir Library (1960)

Oshkosh
University of Wisconsin-Oshkosh Forrest R. Polk Memorial Library (1956)

Platteville
University of Wisconsin-Platteville Karrmann Library (1964)

Racine
Racine Public Library (1898)

Ripon
Ripon College Library (1982)

River Falls
University of Wisconsin-River Falls Chalmer Davee Library (1962)

Sheboygan
Mead Public Library (1983)

Stevens Point
University of Wisconsin-Stevens Point University Library (1951)

Superior
Superior Public Library (1908)
University of Wisconsin-Superior Jim Dan Hill Library (1935)

Waukesha
Waukesha Public Library (1966)

Wausau
Marathon County Public Library (1971)

Whitewater
University of Wisconsin-Whitewater Library and Learning Resources (1963)

Wyoming
Casper
Natrona County Public Library (1929)

Cheyenne
Wyoming State Law Library (1977)
Wyoming State Library (unknown)

Gillette
Campbell County Public Library (1980)

Laramie
University of Wyoming Coe Library (1907)
University of Wyoming Law Library (1978)

Powell
Northwest College John Taggart Hinckley Library (1967)

Riverton
Central Wyoming College Library (1969)

Rock Springs
Western Wyoming Community College Library (1969)

Sheridan
Sheridan College Griffith Memorial Library (1963)
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San Diego—6363 Greenwhich Drive, Suite 230, 92122, Area Code 619 Tel 557-5395, FAX 619-557-6176
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<td>(Boston District Office)–187 State Street, 04333, Area Code 207 Tel 622-8249, FAX 207-626-9156</td>
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<td>Gaithersburg</td>
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<td>Oklahoma</td>
<td>Oklahoma City</td>
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<td>–440 S. Houston Steet, 74127, Area Code 918 Tel 581–7650, FAX 918-581-2844</td>
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<td>–One World Trade Center, 121 SW Salmon, Suite 242, 97204, Area Code 503 Tel 326–3001, FAX 503-326-8351</td>
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<td>Pennsylvania</td>
<td>Philadelphia</td>
<td>–660 American Avenue, Suite 201, King of Prussia, PA, 19406, Area Code 610 Tel 962–4980, FAX 610-962-4989</td>
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<td>Pittsburgh</td>
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<td>–2002 Federal Building, 1000 Liberty Avenue, 15222, Area Code 412 Tel 644–2850, FAX 412-644-4875</td>
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<td>Puerto Rico</td>
<td>San Juan (Hato Rey)</td>
<td>–Room G–55, Federal Building, Chardon Avenue, 00918, Area Code 809 Tel 766–5555, FAX 809-766-5692</td>
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<td>Rhode Island</td>
<td>Providence</td>
<td>(Hartford District Office)–7 Jackson Walkway, 02903, Area Code 401 Tel 528–5104, FAX 401-528-5067</td>
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<td>South Carolina</td>
<td>Charleston</td>
<td>–c/o Charleston Trident Chamber of Commerce, P.O. Box 975, 81 Mary Street, 29402, Area Code 803 Tel 727–4051, FAX 803-727-4052</td>
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• • Sioux Falls (Des Moines District Office)—200 N. Phillips Avenue, Commerce Center, Suite 302, 57102, Area Code 605 Tel 330-4264, FAX 605-330-4266

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• • Knoxville—301 E. Church Avenue, 37915, Area Code 615 Tel 545-4637, FAX 615-523-2071

• • Memphis—22 N. Front Street, Suite 200, 38103, Area Code 901 Tel 544-4137, FAX 901-575-3510

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1NTIS will label each item with up to eight characters of your organization's routing code.

Prices are subject to change. The NTIS Sales Desk (703) 487-4650 can provide pricing verification.

SUBTOTAL from other side

Handling Fee per order (see chart at left)

Payment not included. Please bill me, add $7.50 (Available for U.S., Canada, and Mexico only)

GRAND TOTAL

☐ OVER—Order continued on reverse

Value of Order Handling Fee

| $10.00 or less | $2.00 |
| $10.01 – $50.00 | $4.00 |
| $50.01 – $100.00 | $6.00 |
| Over $100.00 | $8.00 |

Add $2.00 to above for orders sent outside of the U.S., Canada, and Mexico.

F-3
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<th>Customer Routing</th>
<th>Quantity</th>
<th>Specify density for tape orders</th>
<th>Unit Price</th>
<th>Paper Copy</th>
<th>Microfiche</th>
<th>Other</th>
<th>Internat'l Air Mail</th>
<th>TOTAL PRICE</th>
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<td>optional (up to 8 digits)</td>
<td>1600 bpi</td>
<td>6250 bpi</td>
<td>3480 cartridge</td>
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Call (703) 487-4650 and ask for any of the following free titles or check the appropriate box below.

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