NAT'L INST. OF STAND & TECH R.I.C.
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NIST
PUBLICATIONS

NIST Special Publication 305—Supplement 24

Publications of the National Institute of Standards and Technology 1992 Catalog

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SUP.24
1995

U.S. Department of Commerce
Technology Administration
National Institute of Standards and Technology

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.

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- Advanced Systems

Computing and Applied Mathematics Laboratory

- Applied and Computational Mathematics[2]
- Statistical Engineering[2]
- Scientific Computing Environments[2]
- Computer Services
- Computer Systems and Communications[2]
- Information Systems

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[1] At Boulder, CO 80303.

[2] Some elements at Boulder, CO 80303.

NIST Special Publication 305—Supplement 24

Publications of the National Institute of Standards and Technology 1992 Catalog

Debby King, Editor

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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.

NIST PUBLICATIONS ANNOUNCEMENTS

SAMPLE ENTRY

MANUFACTURING TECHNOLOGY	**NTIS Subject Category**
Computer Aided Design (CAD)	**NTIS Subcategory**
200,822	*Abstract Number*
PB92-205434 PC **A03**/MF **A01**	**NTIS order number** Availability **Price Codes**
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Automated Production Technology Div.	Corporate or performing organization
Automated Compensation of Part Errors Determined by In-Process Gauging.	**Report Title**
K. W. Yee, H. T. Bandy, J. Boudreaux, and N. D. Wilkin. Jun 92, 22p	Personal authors Report date Page count
NISTIR-4854	Report Number Contract or grant number
Keywords: *Computer aided design, *Components, *Error correcting devices, Machine tools, Real time, Controllers, Automation, Quality control, Cutting.	Keywords: * indicates keyword index entry
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 down loaded 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 to less than the correction resolution which for the machine used is 4 micrometers.	Abstract

ADMINISTRATION & MANAGEMENT

Management Information Systems

200,001
PB92-144922 Not available NTIS
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Systems and Software Technology Div.
Designing Multimedia Systems for Museum Objects and Their Documentation.
Final rept.
J. Moline. 1991, 18p
Pub. in Microcomputers for Information Management 8, n2 p69-86 Jun 91.

Keywords: *Museums, *Management information systems, Records management, Humanities, Research projects, Data processing, On line systems, *Multimedia, Hypertext, OSE(Open Systems Environment).

The paper illustrates how hypertext and multimedia can be applied in museums to facilitate humanities research. It presents a model of a museum professional's informational needs and shows how these needs could be met. The solution is based on the Open-System Environment (OSE) and the necessary data interchange standards.

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.
NBS/NIST: A Historical Perspective. A Symposium in Celebration of NIST's Ninetieth Anniversary, March 4, 1991.
Special pub. (Final).
K. A. Beal. Apr 92, 80p NIST/SP-825
Also available from Supt. of Docs. as SN003-003-03152-6.

Keywords: *US NBS, *Meetings, Historical aspects, *National Bureau of Standards, *National Institute of Standards and Technology, *US NIST, Automotive Safety Laboratory, Boulder Laboratories, Central Radio Propagation Laboratory, Diamond Ordnance Fuze Laboratory, Gaithersburg(Maryland).

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 Technology. 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 new and interesting insights on significant historical events and personalities that shaped and influenced NBS/NIST. Papers include: 'Current View,' John W. Lyons; 'Historical Perspective: 1901-1970,' Elio Passaglia; 'Historical Perspective: 1969-1973,' Lewis M. Branscomb; 'Historical Perspective: 1973-1988,' Ernest Ambler; 'History of the Boulder Laboratories,' Robert A. Kamper; 'The Gaithersburg Site,' Robert S. Walleigh; 'Diamond Ordnance Fuze Laboratory and National Inventors Council,' Jacob Rabinow; 'Automotive Safety Laboratory,' Paul J. Brown; and 'Central Radio Propagation Laboratory,' C. Gordon Little.

200,004
PB92-222249 PC **A06**/MF **A02**
National Inst. of Standards and Technology (TS), Gaithersburg, MD. Metric Program.
Metric Transition Plans and Activities of Federal Government Agencies.
G. P. Carver, R. A. O'Brien, and B. Nupp. Aug 92, 113p NISTIR-4911
Prepared in cooperation with Internal Revenue Service, Washington, DC. Sponsored by Department of Transportation, Washington, DC.

Keywords: *Metric system, *Metrication, Unit of measurement, Government policies, Planning, *Federal agencies.

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, 'aggregate,' appraisal 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.
Final rept.
R. McCabe, C. Wilson, and D. Grubb. Aug 92, 24p NISTIR-4892
Contract FBI-AZ11 00-FBI-0001
Sponsored by Federal Bureau of Investigation, Washington, DC.

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

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 its 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
National Bureau of Standards, Gaithersburg, MD. Office of Research and Technology Applications.
Moving Technology from Federal Laboratories to Industry.
Final rept.
J. M. Wyckoff. 1988, 11p
See also PB87-152039.
Pub. in Proceedings of International Symposium on Advanced Technology in Natural Resource Management, Fort Collins, CO., June 20-23, 1988, p198-208.

Keywords: *Technology transfer, *Government/industry relations, Legislation, US NBS, Reprints, National Bureau of Standards, Federal Laboratory Consortium, Federal agencies, US NIST.

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 person-to-person interactions 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 effective mechanisms. 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. In recent years, the Federal Laboratory Consortium for Technology Transfer, (FLC), has become the forum for sharing such systems experience among Federal laboratories, as well as a network for linking users to appropriate laboratory resources.

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 NIST/SP-828
Color illustrations reproduced in black and white.

Keywords: *Research and development, *Technology transfer, Laboratories, Measurement, Technology innovation, Industries, Competition, United States, Government/industry relations, Materials, Manufacturing, Quality assurance, Health Care, Environmental research, *NIST(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-superconductors, lightwave electronics, high-speed digital communications, biosensors, and artificial intelligence.

200,008
PB92-198100 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
National Institute of Standards and Technology and Its Advanced Technology Program: A New Model for Government/Industry Innovation.
Final rept.
J. Tesk. 1991, 2p
Pub. in Proceedings of Symposium on Industry/University/Government Biomedical Research Alliances in the Public Interest, Models for the Future, Boston, MA., March 21-22, 1991, p3-13-3-14.

Keywords: *Research and development, *Government/industry relations, *Technology innovation, United States, Technology transfer, Research projects, Reprints, National Institute of Standards and Technology.

The federal government has provided unique opportunities 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.

200,009
PB92-199108 PC **A04**/MF **A01**
Federal Coordinating Council for Science, Engineering and Technology, Washington, DC. Committee on Industry and Technology.
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 technology transfer from basic research to application. Continuing input from all parties will be sought and collaboration will be fostered through mechanisms such as consortia and cooperative research and development agreements. The President's FY 1993 budget includes $1821.4 million for materials R&D representing an increase of 10 percent over the FY 1992 base. Special emphasis is placed on synthesis and processing, those areas critical to the development of new materials and to the improvement of reliability, cost, and quality of all 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.
Publications of the National Institute of Standards and Technology 1991 Catalog.
Special pub. Jan-Dec 91.
E. T. Gladden. Jun 92, 443p NIST/SP-305/23
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) collection. (Also included are NBS/NIST papers published prior to 1991, but not reported in previous supplements of the annual catalog.) 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.
G. P. Carver. Jun 92, 14p NISTIR-4858
See also COM-71-50329.

Keywords: *Metric system, *Metrication, 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 metric units. 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.

AERONAUTICS & AERODYNAMICS

Test Facilities & Equipment

200,012
PB92-165935 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Process Measurements Div.
Air Speed Calibrations at the National Institute of Standards and Technology.
Final rept.
N. E. Mease, W. G. Cleveland, G. E. Mattingly, and J. M. Hall. 1992, 12p
Pub. in Proceedings of Measurement Science Conference, Anaheim, CA., January 30-31, 1992, 12p.

Keywords: *Wind tunnels, *Calibration, *Air flow, *Velocity measurement, Pitot tubes, Laser doppler velocimeters, Errors, Measuring instruments, Airspeed indicators, Flow measurement, Reprints.

The wind tunnel facilities and equipment used for air speed calibrations at the National Institute of Standards and Technology (NIST) are described with details of the tunnels' construction and their performance characteristics. The mathematical relationships for air speed computations are shown and error budgets for both the Pitot-static tube and Laser Doppler anemometer (LDA) measuring systems are discussed. The performance relationships for these two systems and the advantages of each are presented. Examples are given to show the method for accounting for changes in fluid density by including the effects of pressure, temperature, and humidity. A relationship is given for computing air speed from Pitot-static tube measurements, including the effects of compressibility. Random uncertainty analysis for the air speed relationships is discussed and quantified using the NIST conditions. The associated systematic error estimates are discussed in terms of round-robin assessment methods.

AGRICULTURE & FOOD

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. R. Karam, and M. G. Simic. 1988, 3p
Pub. in Analytical Chemistry 60, n19 p1117-1119 1988.

Keywords: *Biological indicators, *Hydroxyl radicals, *Irradiated food, Chemical reactions, Water, Gas chromatography, Mass spectroscopy, 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-Tyrosine (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.

ASTRONOMY & ASTROPHYSICS

Astronomy & Celestial Mechanics

200,014
PB92-144526 Not available NTIS
National Inst. of Standards and Technology (CAML), Gaithersburg, MD.
Lissajous Transformation. 1. Basics.
Final rept.
A. Deprit. 1991, 25p
See also Part 2, PB92-144534 and Part 4, PB92-144542. Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Celestial Mechanics and Dynamical Astronomy 51, p201-225 1991.

Keywords: Partial differential equations, Canonical transformations, Hamiltonian functions, Harmonic oscillators, Perturbation theory, Dynamics, Isotopy, 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 elements 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
PB92-144534 Not available NTIS
National Inst. of Standards and Technology (CAML), Gaithersburg, MD.
Lissajous Transformation. 2. Normalization.
Final rept.
A. Deprit, and A. Elipe. 1991, 24p
See also Part 1, PB92-144526 and Part 4, PB92-144542.
Pub. in Celestial Mechanics and Dynamical Astronomy 51, p227-250 1991.

Keywords: Hamiltonian functions, Perturbation theory, Dynamics, Isotopy, 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 pole-like 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.

200,016
PB92-144542 Not available NTIS
National Inst. of Standards and Technology (CAML), Gaithersburg, MD.
Lissajous Transformation. 4. Delaunay and Lissajous Variables.
Final rept.
A. Deprit, and C. A. Williams. 1991, 10p
See also Part 1, PB92-144526 and Part 2, PB92-144534. Sponsored by Defense Advanced Research Projects Agency, Arlington, VA., and Naval Observatory, Washington, DC.
Pub. in Celestial Mechanics and Dynamical Astronomy 51, p271-280 1991.

Keywords: Celestial mechanics, Canonical transformations, Four dimensional, Kepler laws, Reprints, *Lissajous transformation, Delaunay transformations, Elliptic oscillators.

Relations are established between the Delaunay variables defined over a phase space E in four dimensions and the Lissajous variables defined over a four-dimensional phase space F when the latter is mapped onto E by a parabolic canonical transformation.

200,017
PB92-144880 Not available NTIS
National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Applied and Computational Mathematics Div.
Lissajous Transformation. 3. Parametric Bifurcations.
Final rept.
B. R. Miller. 1991, 20p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Celestial Mechanics and Dynamical Astronomy 51, p251-270 1991.

Keywords: Bifurcation(Mathematics), Perturbation theory, Harmonic oscillators, Reprints, *Lissajous transformation, Elliptic oscillators.

A parametric family of cubic perturbed 1-1 resonant harmonic oscillators is examined with an aim to understanding the phase flows of the reduced system. Variation of the parameters leads the system through five bifurcations of different types. Some bifurcations are due to passage through cases of discrete symmetry or integrability. A conjecture correlating degenerate equilibria in reduced systems with integrability is modified and reinforced.

200,018
PB92-236678 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Simplify or Perish.
Final rept.
A. Deprit, and B. Miller. 1989, 12p
Pub. in Applications of Computer Technology to Dynamical Astronomy, p189-200 1989.

Keywords: *Celestial mechanics, Canonical transformations, Object-oriented programming, Parallel processing, Hamiltonian functions, Lunar trajectories, Computation, Reprints, Poisson series.

Three suggestions are made for breaking the gridlock which paralyses progress in automating massive symbolic calculations in celestial mechanics: (1) simplifications by canonical transformations; (2) object oriented programming to endow the algebra of Poisson series with various structures, and (3) massively parallel processing.

Astrophysics

200,019
PB92-165059 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.
Shock-Drift Particle Acceleration in Superluminal Shocks: A Model for Hotspots in Extragalactic Radio Sources.
Final rept.
M. C. Begelman, and J. G. Kirk. 1990, 15p
Contract NASA-NAGW-766, Grant NSF-AST83-51997
Sponsored by National Aeronautics and Space Administration, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Astrophysical Jnl. 353, n1 p66-80 1990.

Keywords: *Extragalactic radio sources, *Particle acceleration, Relativistic particles, Shock fronts, Synchrotron radiation, Reprints, Superluminal motion.

Efficient acceleration of relativistic particles must occur in the hotspots of extragalactic radio sources. Recent evidence that jets in Fanaroff-Riley Type II radio sources are relativistic even on kiloparsec scales suggests that the hotspots in these sources are the downstream regions of relativistic shocks. Additional evidence that 'compact' hotspots exhibit relativistic beaming suggests that the shocks responsible for these hotspots are often highly oblique. The authors discuss the morphology, polarization and spectra of compact hotspots in the context of the oblique relativistic shock model, focusing particularly on the spectral cutoffs which have recently been observed.

200,020
PB92-165117 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Quantum Physics Div.
X-ray Emission from Hybrid-Chromosphere Stars.
Final rept.
A. Brown, S. A. Drake, M. E. Van Steenberg, and J. L. Linsky. 1991, 6p
Contracts NASA-NAG5-82, NASA-NAG5-985
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 373, p614-619, 1 Jun 91.

Keywords: *Stars, High temperature plasmas, X-ray sources, Stellar winds, Stellar coronal, Hybrid structures, EXOSAT satellite, Reprints, X ray emission.

The current evidence for the existence of hot (= or > one million K) plasma around hybrid-chromosphere stars is examined. EXOSAT observations of the hybrid star alpha TrA provide the first X-ray detection of such a star. An X-ray differential emission measure locus is derived and used to demonstrate that the temperature of the X-ray-emitting plasma is unlikely to be lower than one million K. Estimates are made of the interstellar hydrogen column densities toward hybrid stars using a variety of methods in order to allow interpretation of X-ray observations. The X-ray luminosity of alpha TrA is calculated. X-ray nondetections 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 TrA. It now seems that the conceptual model of Linsky, in which the higher temperature plasma is magnetically confined and separated from the outflowing stellar wind, is most likely to correctly represent the physical structuring of hybrid star outer atmospheres.

200,021
PB92-165125 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.
Formation of Carbon Stars.
Final rept.
G. L. Bryan, K. Volk, and S. Kwok. 1990, 11p
Sponsored by Natural Sciences and Engineering Research Council of Canada, Ottawa (Ontario).
Pub. in Astrophysical Jnl. 365, p301-311, 19 Dec 90.

Keywords: *Carbon stars, *Stellar evolution, Stellar envelopes, Stellar mass ejection, Reprints, Mass loss.

The authors present an integrated model of asymptotic giant branch (AGB) evolution, using empirical formulae to allow for nuclear shell burning in the core, the 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, the oxygen-rich-to-carbon-rich star ratio, 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 eta. 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 'superwind' 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 descended from a low-mass (< 3 solar masses) population, and high-mass (3-8 solar masses) stars remain oxygen-rich for most of their AGB lifetime.

200,022
PB92-165661 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Quantum Physics Div.
Possible Bipolar Nature of 21 Micron IRAS Sources.
Final rept.
B. J. Hrivnak, and S. Kwok. 1991, 6p
Pub. in Astrophysical Jnl. 368, p564-569, 20 Feb 91.

Keywords: Intermediate infrared radiation, Infrared Astronomy Satellite, Stellar mass ejection, Stellar envelopes, Nebulae, Stars, Reprints, *Infrared sources(Astronomy).

We report the discovery of another IRAS source (22574 + 6609) showing the unidentified 21 micrometer emission feature. Its overall energy distribution is similar to the well-known edge-on bipolar nebulae AFGL 2688 and AFGL 618. Ground-based optical and infrared observations of this object and two other 21 micrometer sources show that while all three have very similar infrared properties, they differ greatly in the visual region. We suggest that all three of these 21 micrometer sources are intrinsically similar bipolar nebulae viewed at different orientations.

200,023
PB92-166107 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.
Bars within Bars: A Mechanism for Fueling Active Galactic Nuclei.
Final rept.
I. Shlosman, J. Frank, and M. C. Begelman. 1989, 3p
Contract NAGW-766, Grant NSF-AST83-51997
Sponsored by National Aeronautics and Space Administration, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Nature 338, n6210 p45-47 1989.

Keywords: *Starburst galaxies, Accretion disks, Black holes, Instability, Reprints, *Active galactic nuclei.

We propose a mechanism for gas supply in active galactic nuclei and nuclear starburst galaxies which brings in gaseous materials from galactic scales via successive dynamical instabilities. The first stage is a large-scale stellar bar which sweeps the interstellar medium into a gaseous disc of a few hundred pc radius. This gaseous disc may, under certain conditions discussed below, become dynamically unstable again and its material flow inwards until turbulent viscous processes become the dominant mechanism for angular momentum transport. The large-scale flow described here may feed viscosity-driven accretion flows around a black hole, or may lead to the formation of a black hole if none was present initially.

200,024
PB92-170984 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
Laboratory Investigation of the Production and Properties of Molecular and Radical Species Pertinent to Planetary Atmospheres.
Final rept.
A. Fahr, J. T. Herron, and A. H. Laufer. 1989, 5p
Pub. in Proceedings of International Conference on Laboratory Research for Planetary Atmospheres (1st), Bowie, MD., October 25-27, 1989, p227-231.

Keywords: *Vinylidene radicals, *Chemical properties, *Planetary atmospheres, Ethylene, Acetylene, Reaction kinetics, Photolysis, Reprints.

Vinylidene(H2C=C) is shown to be the largest photodecomposition channel in the direct photolysis of both C2H2 and C2H4. The chemistry of H2C=C as it relates to planetary atmospheres is discussed. The vinyl radical (C2H3), important in the acetylene chemistry cycle, has been directly observed spectroscopically and the kinetics of several key reactions of this species measured.

200,025
PB92-175256 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Quantum Physics Div.
Optically Thin Thermal Emission as the Origin of the Big Bump in the Spectra of Active Galactic Nuclei.
Final rept.
G. J. Ferland, K. T. Korista, and B. M. Peterson. 1990, 5p
Pub. in Astrophysical Jnl. 363, pL21-L25, 10 Nov 90.

Keywords: *Seyfert galaxies, Emission spectra, Line spectra, X rays, Reprints, *Active galactic nuclei.

The nature of the 'big bump,' the excess of ultraviolet emission seen in many active nuclei, is a clue to the source of the energy generation in the central regions of quasars. The authors report observations of the Seyfert galaxy Mrk 590, which show dramatic changes in both the continuum and hydrogen lines, thus offering a clue to the origin of the 'big bump'.

200,026
PB93-125318 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Quantum Physics Div.
Solution of Radiative Transfer Problems in Molecular Bands without the LTE Assumption by Accelerated Lambda Iteration Methods.
Final rept.
A. A. Kutepov, D. Kunze, D. G. Hummer, and G. B. Rybicki. 1991, 19p
Grants NASA-NAGW-766, NSF-AST88-02937
Sponsored by National Aeronautics and Space Administration, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Jnl. Quant. Spectrosc. Radiat. Transfer 46, n5 p347-365 1991.

Keywords: *Planetary atmospheres, *Radiative transfer, Earth atmosphere, Venus atmosphere, Molecular spectra, Carbon monoxide, Carbon dioxide, Intermediate infrared radiation, Iteration, Reprints.

An iterative method based on the use of approximate transfer (or Lambda) operators, which was designed initially to solve multilevel NLTE line formation problems in stellar atmospheres, is adapted and applied to the solution of the NLTE molecular band radiative transfer in planetary atmospheres. A test application of this new technique to the solution of NLTE radiative transfer problems for optically-thick and thin new technique to the solution of NLTE radiative transfer problems for optically-thick and thin bands (the 4.3 micrometer CO2 band in the Venusian atmosphere and the 4.7 and 2.3 micrometer CO bands in the Earth's atmosphere) is described. The necessity for careful treatment of rotational NLTE in weak lines of the 4.3 micrometer CO2 fundamental band is shown. The possible influence of neglecting or treating approximately the CO2 10 micrometer laser transitions and also effects of the overlap of the 4.3 micrometer CO2 with the continuum are investigated. The rotational NLTE effects in the 4.7 micrometer CO band in the upper Earth's atmosphere are estimated.

200,027
PB93-125383 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Quantum Physics Div.
GHRS Far-Ultraviolet Spectra of Coronal and Noncoronal Stars: Capella and gamma Draconis.
Final rept.
J. L. Linsky, A. Brown, and K. G. Carpenter. 1991, 13p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of the First Year of HST Observations Conference, Baltimore, MD., May 1991, p70-82.

Keywords: *Giant stars, Far ultraviolet radiation, Ultraviolet spectra, Stellar spectra, Stellar winds, Stellar coronae, Binary stars, Late stars, Reprints, *Capella star, *Gamma Draconis star.

We report on the first GHRS spectra of two very different late-type giant stars - Capella and gamma Dra. Capella is a 104 day period binary system consisting of two stars (G9 III and G0 III) each of which shows bright emission lines formed in solar-like transition regions and coronae. By contrast, gamma Dra is a hybrid-chromosphere star with very weak emission lines from high-temperature plasma. Low-dispersion spectra of these stars covering the 1160 to 1717 A spectral range show unresolved emission lines from neutral species through N V. The very different surface fluxes detected in the spectra of these stars suggest different types of heating mechanisms.

200,028
PB93-135226 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Electron and Optical Physics Div.
Sounding Rocket Measurement of the Absolute Solar EUV Flux Utilizing a Silicon Photodiode.
Final rept.
H. S. Ogawa, D. McMullin, D. L. Judge, and L. R. Canfield. 1990, 5p
Pub. in Jnl. of Geophys. Res. Space Physics 95, n4 p4291-4295 1990.

Keywords: *Solar ultraviolet radiation, *Solar flux density, *Extreme ultraviolet radiation, Sounding rockets, Silicon diodes, Radiometry, Reprints.

A newly developed stable and high quantum efficiency silicon photodiode was used to obtain an accurate measurement of the absolute magnitude of the solar extreme ultraviolet photon flux in the spectral region between 50 and 800A. The detector was flown aboard a solar pointing sounding rocket launched from White Sands Missile Range in New Mexico on October 24, 1988. The adjusted daily 10.7 cm solar radio flux and sunspot number were 168.4 and 121 respectively. The unattended absolute value of the solar EUV flux in the specified wavelength region was 6.88 X 10(sup 10) photons/sq cm/sec. Based on a nominal probable error of 10% for NIST outgoing efficiency measurements in the 50 - 500A region (8% on longer wavelength measurements between 500-1216A), and based on experimental errors associated with our rocket instrumentation and analysis, a conservative total error estimate of - 16% is assigned to the absolute integral solar flux obtained.

200,029
PB93-135267 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Quantum Physics Div.
What Can Solar and Stellar Ultraviolet Observations Tell About Chromospheric and Coronal Heating Mechanisms.
Final rept.
J. L. Linsky. 1991, 13p
Grants NAG5-82, NAG5-1145
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of Conference on Mechanisms of Chromospheric and Coronal Heating, Heidelberg, Germany, June 5-8, 1990, p166-178 1991.

Keywords: *Stellar chromospheres, *Stellar coronae, *Solar corona, *Chromosphere, *Plasma heating, Atmospheric heating, Solar ultraviolet radiation, Stellar radiation, Late stars, Emission spectra, Scaling laws, Magnesium ions, Iron ions, Carbon ions, Reprints.

The determination of which heating mechanisms are responsible for the observed emission line fluxes is a difficult, nonunique process. The author discusses some of the spectral diagnostic problems encountered in deriving differential emission measures and methods for including all major emitters, especially FeII, in determining the total power radiated from a plasma. The author proposes two scaling laws by which one may simply determine the total power radiated in the chromosphere (from the MgII h and k lines) and the higher temperature layers (from the CIV 1594 A feature). These scaling laws lead to estimates of the total power radiated and thus the mechanical heating rates for basal and saturated atmospheres. The heating rates for plages in RS CVn systems are consistent with saturated heating.

ATMOSPHERIC SCIENCES

Meteorological Data Collection, Analysis, & Weather Forecasting

200,030
PB92-221308 PC **A06**/MF **A02**
National Inst. of Standards and Technology, Gaithersburg, MD. Office of Quality Programs.
Benefit-Cost Analysis for the Modernization and Associated Restructuring of the National Weather Service.
R. E. Chapman. Jul 92, 119p NISTIR-4867
Sponsored by National Weather Service, Silver Spring, MD.

Keywords: *Weather forecasting, Benefit cost analysis, Sensitivity analysis, Economic analysis, Information dissemination, *National Weather Service, Modernization.

The report focuses on a critical evaluation of two alternatives configurations for the National Weather Service (NWS). The first configuration represents a continuation of the status quo; it is referred to as the Current System. The second configuration represents a full deployment of the proposed modernization and restructuring of NWS; it is referred to as the Proposed System. The Current System is rapidly becoming obsolete and will require significant commitments if it is to continue service into the next century. The Proposed System represents deployment of a suite of technologies focused on improving the accuracy, timeliness, and capabilities of the NWS. The economic evaluation was carried out in two stages; (1) baseline analysis; and (2) structured sensitivity analysis. The baseline analysis produced results which strongly favor the Proposed System. Two key economic measures, the benefit-cost ratio and net present value, were significantly higher for the Proposed System. The structured sensitivity analysis produced results which were similar to the baseline analysis. The report concludes that the Proposed System is the most economical solution to the NWS' needs and responsibilities.

Meteorological Instruments & Instrument Platforms

200,031
PB93-130334 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Process Measurements Div.
Humidity Sensing, Measurements, and Calibration Standards.
Final rept.
P. H. Huang. 1990, 10p
Pub. in Proceedings of Sensors Expo 1989, p12-21 Feb 90.

Keywords: *Humidity measurement, *Calibration standards, Surface acoustic wave devices, Vapor pressure, Delay lines, Sensors, Water, Reprints, Halogenated polymers, SAW devices.

The paper summarizes the present activities in humidity calibration standards and sensing technology at the National Institute of Standards and Technology. The most common units in humidity calibration for the two-pressure humidity generator are discussed. Recent results in the areas of saturated salt solutions for humidity generation, halogenated polymeric humidity sensors and surface acoustic wave microsensors for humidity measurements are presented.

Physical Meteorology

200,032
PB92-170679 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
Towards a Quantitative Understanding of Atmospheric Ozone.
Final rept.
R. Atkinson, D. L. Baulch, R. A. Cox, R. F. Hampson, J. A. Kerr, and J. Troe. 1989, 16p
Pub. in Planetary and Space Science 37, n12 p1605-1620 Dec 89.

Keywords: *Ozone layer, Atmospheric chemistry, Atmospheric composition, Photochemical reactions, Historical aspects, Reaction kinetics, Databases, Stratosphere, Troposphere, Reviews, Reprints, Ozone depletion.

The review deals with the historical development of a chemical kinetics and photochemical database for use in atmospheric modeling. Initiated by the suggestion that the release of nitric oxide into the stratosphere from the exhaust gases of supersonic aircraft could seriously deplete stratospheric ozone, the quest for such a database began in 1971. The present article traces the development of the detailed chemistry of the homogeneous gas-phase reactions which control the levels of ozone in the stratosphere. It also includes coverage of the more recent heterogeneous chemistry which is believed to be involved in the Antarctic 'ozone hole,' as well as the background to the on-going establishment of a reaction rate database for application to tropospheric chemistry and modeling.

BEHAVIOR & SOCIETY

Education, Law, & Humanities

200,033
PB92-171545 Not available NTIS
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Systems and Software Technology Div.
User Interface: A Hypertext Model Linking Art Objects and Related Information.
Final rept.
J. Moline. 1991, 16p
Pub. in Interfaces for Information Retrieval and Online Systems: The State of the Art, Chapter 10, p133-148 1991.

Keywords: *Information retrieval, *Models, Expert systems, Museums, Databases, Data sources, Prototypes, Knowledge bases(Artificial intelligence), *Numismatrics, *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 numismatics. Numismatists 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

200,034
PB92-144443 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Development of Self-Setting Calcium Phosphate Cements.
Final rept.
L. C. Chow. 1991, 11p
See also PB91-202879. Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of the Ceramic Society of Japan 99, n10 p954-964 1991.

Keywords: *Dental materials, *Calcium phosphates, *Cements, *Medical supplies, In vivo analysis, Biocompatibility, Physical properties, Hardness, Mixtures, Performance evaluation, Reprints, Self-setting, Apatite/hydroxy.

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 several different mixtures data in the literature at present indicate that mixtures of tetracalcium phosphate and dicalcium phosphate (or dicalcium phosphate dihydrate) may be most desirable because they produce cements that have greater strengths and contain nearly pure hydroxyapatite. The combination of self-setting capability and high biocompatibility makes 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.

200,035
PB92-144906 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Adsorption of Low Molecular Weight Poly(acrylic acid) on Hydroxyapatite: Role of Molecular Association and Apatite Dissolution.
Final rept.
D. N. Misra. 1991, 3p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Langmuir 7, n11 p2422-2424 1991.

Keywords: *Dental materials, *Surface chemistry, *Polyacrylates, *Hydrogen bonds, Polymer chemistry, Adsorption, Isotherms, Phosphorus, Calcium, Dissolving, Langmuir frequency, Reprints, *Apatite/hydroxy.

Adsorption of low molecular weight poly(acrylic acid) from aqueous solution on hydroxyapatite shows that the isotherm first rises, reaches a maximum, then decreases, and is irreversible. This is qualitatively explained on the basis of the increasing self-association 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 DiMarzio on the basis of theoretical considerations.

200,036
PB92-165455 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Corrosive Response of the Interface Tissue to Dental Implants.
Final rept.
A. C. Fraker, P. Sung, A. C. Van Orden, and H. Hahn. 1990, 12p
See also PB91-194787.
Pub. in Techniques for Dental Implants, Implant Prosthodontics: Surgical and Prosthetic, Chapter 21, p293-304 1990.

Keywords: *Dental implants, *Corrosion, Tissues(Biology), Surface tension, Metals, Cations, Reprints.

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.

200,037
PB93-129450 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Gazing into the Future of Esthetic Restorative Materials.
Final rept.
R. L. Bowen, F. C. Eichmiller, and W. A. Marjenhoff. 1992, 7p
Sponsored by American Dental Association, Chicago, IL.
Pub. in Jnl. of the American Dental Association 123, p33-39 May 92.

Keywords: *Dental materials, Composite materials, Dental cements, Sealants, Resins, Reprints, Glass ionomer cements.

The article outlines the authors' perceptions of the future of esthetic dental restorative materials such as composites, glass ionomer cements, pit and fissure sealants and laboratory fabricated resin.

200,038
PB93-130326 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Adhesive Properties of Modified Glass-Ionomer Cements.
Final rept.
J. E. Rusz, J. M. Antonucci, F. C. Eichmiller, and M. H. Anderson. 1992, 6p
See also PB88-198072. Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Dental Materials 8, p31-36 Jan 92.

Keywords: *Dental materials, *Adhesives, *Acid bonded reaction cements, Composite materials, Chemical bonds, Resin cements, Dental cements, Reprints, Glass ionomer cements.

The incorporation of water-soluble polymers and/or vinyl monomers into glass-ionomer cements can yield toughened 'hybrid cement-composites'. This study compared a commercial water-hardening glass-ionomer cement and seven experimental hybrids in their bonding to both dentin and Silar composite. The cements were sanded and phosphoric-acid-etched or left with an unaltered matrix-formed surface when adhesion to composite was tested. Resin-modified cements may promote better bonding by improved interaction and compatibility with the resin component of the composite.

Bionics & Artificial Intelligence

200,039
N92-14696/8
(Order as N92-14694/3, PC **A03**/MF **A01**)
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Marr and Albus Theories of the Cerebellum: Two Early Models of Associative Memory.
J. S. Albus. Mar 89, 6p
In Research Inst. For Advanced Computer Science, Cerebellar Models of Associative Memory: Three Papers from IEEE Compcon Spring 1989 p 8-13.

Keywords: *Biological models (Mathematics), *Cerebellum, *Cerebral cortex, *Efferent nervous systems, *Learning theory, *Neural nets, *Neurons, *Synapses, Associative processing (Computers), Axons.

The Marr and Albus theories of the cerebellum are compared and contrasted. They are shown to be similar in their analysis of the function of the mossy fibers, granule cells, Golgi cells, and Purkinje cells. They both predict motor learning in the parallel fiber synapses on the Purkinje dendrites mediated by concurrent climbing fiber input. This prediction has been confirmed by experimental evidence. In contrast, Marr predicts these synapses would be facilitated by learning, while Albus predicts they would be weakened. Experimental evidence confirms synaptic weakening.

200,040
PB92-148287 PC **A03**/MF **A01**
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Representations in Visual Motion.
D. Raviv, and J. S. Albus. Jan 92, 28p NISTIR-4747
See also PB90-254863, PB91-157156 and PB92-133016. Prepared in cooperation with Florida Atlantic Univ., Boca Raton.

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 rectilinear 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 radial distance of a point in 3-D space from the camera translational path is kept constant at any instant of time. The second observation is that the relative depth 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 simple. All measurements for these representations are taking place in camera coordinates, only one camera is necessary, and the magnitude of the camera velocity vector needs not be known. The mathematics involved is simple, and thus it may be suitable for real time applications.

200,041
PB92-183656 PC **A05**/MF **A01**
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Robot Systems Div.
Quantitative Approach to Looming.
D. Raviv. Apr 92, 76p NISTIR-4808
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.

The visual looming effect has been shown to be very important when action is taking place. 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 Circles (EFCs).

Human Factors Engineering

200,042
PB92-171024 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Gas Mask Fit Testing 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.
Pub. in Proceedings of U.S. Army Testing Technology and Calibration Concept 2000 Symposium, Redstone Arsenal, AL., June 15, 1989, p113-117.

Keywords: *Protective masks, *Chemical warfare, Aerosols, Reprints, *Fit testing.

A summary of and projected needs for future work in gas mask fit testing and fit monitoring is presented.

BUILDING INDUSTRY TECHNOLOGY

Architectural Design & Environmental Engineering

200,043
PB92-154533 Not available NTIS

National Inst. of Standards and Technology (CAML), Gaithersburg, MD.
ZIP 2.0: The Enhanced Zip-Code Insulation Program.
Final rept.
S. R. Petersen. 1991, 12p
See also PB91-167155. Sponsored by Department of Energy, Washington, DC. Building Systems and Materials Div.
Pub. in Insulation Materials: Testing and Applications, ASTM STP 116, p109-120 1991.

Keywords: *Residential buildings, *Thermal insulation, *Economic analysis, Engineering costs, Climate, Prices, Energy conservation, Life cycle costs, Heating, Cooling, Reprints, Zip codes, ZIP computer program.

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 crawlspaces), 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 insulation costs, 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 (NEL), 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
Pub. in ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) Transactions, v96 pt2 p361-366 1990.

Keywords: *Air conditioning, *Buildings, *Turbulent flow, *Mathematical models, Ventilation, Air flow, Numerical analysis, Reprints.

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 of the 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 generally are found 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.

200,045
PB92-160043 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Environment Div.
Effect of Building Envelopes on Cooling Loads Due to Lighting.
Final rept.
S. J. Treado. 1989, 9p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of Thermal Performance of the Exterior Envelopes of Buildings IV Conference, Orlando, FL., December 4-7, 1989, p3-11.

Keywords: *HVAC systems, *Buildings, *Lighting equipment, Illuminating, Heating load, Walls, Heat storage, Cooling load, Reprints.

The interaction between the building envelope and lighting and HVAC systems is examined based on full-scale measurements and computer modeling of a lighting interaction test facility. Cooling loads due to lighting, in particular peak cooling loads during transient operation of the lighting system, are influenced by the building thermal 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 (BFRL), Gaithersburg, MD. Building Environment Div.
Thermophysical Property Measurements Using an Encapsulated Bead Thermistor: Applications to Liquids and Insulation Materials.
Final rept.
B. P. Dougherty, and W. C. Thomas. 1992, 9p
Pub. in Jnl. of Solar Energy Engineering 114, p23-31 Feb 92.

Keywords: *Thermophysical properties, *Thermistors, *Environmental engineering, Thermal conductivity, Thermal diffusivity, Thermal insulation, Liquids, Measuring instruments, Thermodynamic properties, Transient response, Thermal measurements, Reprints.

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 (NEL), Gaithersburg, MD. Building Environment Div.
Application of Mathematical Modeling to the Evaluation of Building Ventilation Systems.
Final rept.
J. B. Fang, R. A. Grot, and T. Kurabuchi. 1988, 15p
Pub. in Proceedings of AIVC Conference (9th), Gent, Belgium, September 12-15, 1988, p327-341.

Keywords: *Ventilation, *Mathematical models, *Turbulent flow, Diffusers, Air flow, Three dimensional flow, Temperature distribution, Numerical analysis, Environmental engineering, Air circulation, 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 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
PB92-172048 PC **A03**/MF **A01**
National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Office of Applied Economics.
Productivity Impacts in Building Life-Cycle Cost Analysis.
B. C. Lippiatt, and S. F. Weber. Feb 92, 30p NISTIR-4762
See also PB91-506568, PB91-507194, and PB91-167288. 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-priced office designs that enhance productivity may make economic sense. A method for including productivity benefits in building economic analysis could account for productivity differences among design alternatives. Two suitable economic methods 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 with respect to a set of evaluation criteria, including compatibility with life-cycle cost analysis, ease of use, data requirements, and form of results. Based on the evaluation, the net benefits method is recommended as most appropriate for including employee productivity in building economic analysis.

200,049
PB92-172055 PC **A13**/MF **A03**
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Computing and Applied Mathematics.
Life-Cycle Costing for Energy Conservation in Buildings: Student's Manual. February 1992.
Final rept.
R. T. Ruegg, and S. R. Petersen. Feb 92, 284p NISTIR-4778
See also PB90-199068. Sponsored by Department of Energy, Washington, DC. Federal Energy Management Program Staff.

Keywords: *Federal buildings, *Energy conservation, *Retrofitting, *Life cycle costs, Design standards, Manuals, Instructions, Handbooks, Energy economics, Cost analysis, Fuel consumption, Public buildings, Program evaluation.

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 and encouraging building professionals to take into account long-run economic consequences of their decisions. The course has three main goals: (1) to instruct Federal engineers, architects, and managers in using life-cycle cost analysis for making decisions affecting energy consumption in Federal buildings; (2) to instrct contractors and consultants who work on Federal projects in evaluating projects according to Federal requirements; and (3) to provide members of the building community at large the methods, 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 (BFRL), Gaithersburg, MD. Building Environment Div.
Formal Analysis of the BACnet MS/TP Medium Access Control Protocol.
S. T. Bushby. Apr 92, 26p NISTIR-4777
See also PB91-187286. Sponsored by Department of Energy, Washington, DC. Federal Energy Management Program Staff.

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

BACnet, a draft standard communication protocol for building automation and control systems, contains options for physical and data link layer protocols. One option is to use an EIA-485 physical layer combined with a Master-Slave/Token Passing (MS/TP) media 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 deadlock 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 (BFRL), Gaithersburg, MD.
Interaction of Lighting, Heating and Cooling Systems in Buildings.
S. J. Treado, and J. W. Bean. Mar 92, 117p NISTIR-4701
See also PB88-170006 and PB89-136295.

Keywords: *Lighting systems, *Buildings, *Cooling load, *Energy efficiency, Test facilities, Fluorescent lamps, Heat transmission, Illuminating, Space HVAC systems, Energy conservation, Design criteria.

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.

Architectural Design & Environmental Engineering

200,052
PB92-213321 PC **A03**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Prototype Simplified Daylighting Design Tool.
S. J. Treado, and P. J. Goodin. Jul 92, 23p NISTIR-4842
See also PB83-240481 and PB90-149253.

Keywords: *Daylighting, *Energy conservation, *Cooling load, Energy consumption, Interior lighting, Mathematical models, Window glazing, Cost analysis, Architecture, Thermal analysis, Buildings.

The report describes a prototype simplified design tool which has been developed to provide information for developing effective building fenestration systems. A computer software system 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 (BFRL), Gaithersburg, MD. Building Environment Div.
Thermal Performance of Residential Electric Water Heaters Subjected to Various Off-Peak Schedules.
Final rept.
A. H. Fanney, and B. P. Dougherty. 1992, 10p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of ASME/JSES/KSES International Solar Energy Conference Solar Engineering, Maui, HI., April 5-9, 1992, p1221-1230.

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

A number of electric utilities 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 period and hot 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-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 meet the 1991 minimum efficiency standards as specified within the National Appliance Energy Conservation Act. The energy factor, as measured using 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 (BFRL), Gaithersburg, MD.
Study of Ventilation Measurement in an Office Building.
W. S. Dols, and A. K. Persily. Oct 92, 43p NISTIR-4905
Sponsored by Bonneville Power Administration, Portland, OR.

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

The major findings of the study are as follows. Airflow rates were measured in the air handling system ductwork using pitot tube, hot-wire anemometer, and vane anemometer traverses, and good agreement was obtained between the different techniques. While accurate determinations of percent outdoor air intake were achieved using tracer gas techniques, the use of CO2 detector tubes yielded unreliable results. Reliable determinations of ventilation rates per person were made based on SF6 decay and direct airflow rate measurements 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 ASHRAE Standard 62-1981, the standard on which the design was based, but the minimum rates 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 under minimum outdoor air 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 (BFRL), Gaithersburg, MD. Building Environment Div.
Relation of CO2 Concentration to Office Building Ventilation.
Final rept.
A. K. Persily, and W. S. Dols. 1990, 16p
Sponsored by Department of Energy, Washington, DC., General Services Administration, Washington, DC., and Geological Survey, Reston, VA.
Pub. in ASTM STP 1067, 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 mechanically ventilated office buildings for many years. The analysis of the concentration of carbon dioxide generated by building occupants has been suggested 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 concentrations have also been suggested as specific assumptions and unique conditions in order to yield reliable information on building air exchange characteristics, and these requirements may not always be met in office buildings. This paper discusses the relationship between CO2 concentration data and building air exchange.

Building Equipment, Furnishings, & Maintenance

200,056
PB92-148295 PC **A07**/MF **A02**
Dayton Univ., OH.
Modifications to Furniture Fire Model for HAZARD System.
Final rept. 1990-91.
M. A. Dietenberger. Oct 91, 127p UDR-TR-91-126, NIST/GCR-92/601
Grant NIST-NANB OD1051
See also PB89-218366 and PB91-206664. Sponsored by National Inst. of Standards and Technology (BFRL), 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 60NANBOD1051 for the National Institute of Standards and Technology. Modifications to the furniture fire model (FFM) for inclusion in the HAZARD system required three major tasks: (1) comparison of the FAST/FFM predictions with several full-scale burns measured in the furniture calorimeter, (2) development of an algorithm for personal computers to calibrate ignition and flame 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 CFAST. The application problems are compartmentation, structural fire resistance, ignitibility of a secondary combustible item, and room flashover studies.

200,057
PB92-164771 PC **A04**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Routine for Analysis of the People Movement Time for Elevator Evacuation.
J. H. Klote, and D. M. Alvord. Feb 92, 68p NISTIR-4730
See also PB84-118397 and PB87-233771. Sponsored by Public Buildings Service, Washington, DC.

Keywords: *Fires, *Buildings, *Elevators(Lifts), *Escape systems, Computerized simulation, Evacuating(Transportation), Safety engineering, Human factors engineering, Computer applications.

The paper is 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 Div.
Stopping Cigarette-Initiated Fires: Can It Be Done.
Final rept.
R. G. Gann, and M. D. McGibeny. 1988, 5p
See also PB90-241480.
Pub. in International Connections 2, n5 p17-21 Sep/Oct 88.

Keywords: *Ignition, *Furniture, *Flammability, *Cigarette smoking, 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 it 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 (BFRL), Gaithersburg, MD.
Influence of Ignition Source on the Flaming Fire Hazard of Upholstered Furniture.
T. G. Cleary, T. J. Ohlemiller, and K. M. Villa. 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 matchlike flame, an incandescent lamp, a space heater, and a large flame source (CTB 133 equivalent gas burner). The tests were performed in a furniture calorimeter where heat release rate and species production rates were obtained. For any chair type, the time to the peak heat release rate depended on the ignition sequence, but the magnitude of the peak did not, within the scatter of the data for any given chair. HAZARD I, the fire hazard assessment method developed at NIST, was used to quantify the hazard posed by the different ignition scenarios. No deaths were predicted when a working smoke detector was present. When a detector was not present, the results from the limited number of 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.

200,060
PB92-237023 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Fire Science and Engineering Div.
Design of Elevator Smoke Control Systems for Fire Evaluation.
Final rept.
J. H. Klote, and G. T. Tamura. 1991, 9p
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions, v97 pt2 p634-642 1991.

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 feasibility of using elevators for the evacuation of the handicapped during a fire. This 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 method 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, building leakage areas, elevator car velocity, 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 for design analysis is presented with example analyses of two different elevator smoke control systems. Results indicate that many types of elevator smoke control systems 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.
N. E. Groner, and B. M. Levin. Sep 92, 62p NIST/GCR-92/615
Contract SBNB166527
See also PB83-139345 and PB92-187129. Sponsored by National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.

Keywords: *Human factors, *Evacuation, *Fire safety, *Elevators(Lifts), Handicapped persons, Fire protection, Office buildings, Emergencies, Decision making, Planning, Escape systems.

If elevators could be used in fire emergencies, the safety of building occupants with mobility limitations could be greatly enhanced and the time for all occupants to evacuate might be reduced. The report covers a study of human factors considerations related to the possible use of elevators for evacuations in fire emergencies. 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, manning and training 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.
Evaluation of Precision for the ASTM E648-91A Standard Test Method for Critical Radiant Flux of Floor-Covering Systems.
J. R. Lawson. Aug 92, 35p NISTIR-4799
See also PB90-154626. Sponsored by Carpet and Rug Inst., Dalton, GA.

Keywords: *Carpets, *Test methods, *Flammability testing, Heat flux, Ignition, Floor coverings, Flame propagation, Fire tests, Standards, Precision, *ASTM E658-91A.

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 control over air flow through the test chamber and an extended chamber equilibration time before the apparatus is calibrated. An interlaboratory test program was conducted to develop the precision data. In 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 interlaboratory study was designed and carried out using procedures recommended in ASTM E 691 standard on interlaboratory studies. Results from the program show that precision for the revised ASTM E 648 method is generally well within the range expected for standard fire test procedures. Coefficients of variation for repeatability ranged from 2.2 to 19.7 percent, and coefficients of variation for reproducibility ranged from 3.6 to 25.2 percent. In addition to these findings, a carpet variability problem appears to 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.
Technical Review of the Furniture Fire Model. Version 3.
C. L. Beyler. 17 Jul 91, 24p NIST/GCR-92-618
Contract NANB114423
Sponsored by National Inst. of Standards and Technology, Gaithersburg, MD. Technology Administration.

Keywords: *Furniture, *Fires, *Mathematical models, Computer programs, Heat transfer, Calorimeters, Ventilation, Flame propagation, Combustion, Ignition, Burning rate.

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 hazard evaluations. These include extensive validation of submodels, evaluations of the adequacy of the overall program including experimental and numerical experimentation, and definition of methods for developing the inputs required.

200,064
PB93-125060 PC **A06**/MF **A02**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Computer Model of the Smoldering Ignition of Furniture.
H. E. Mitler, and G. Walton. Sep 92, 103p NISTIR-4973

Keywords: *Furniture, *Ignition, *Flammability, *Mathematical models, Fabrics, Flammability tests, Heat transfer, Pyrolysis, Reaction kinetics, Combustion, Boundary conditions, Heat flux, Algorithms, Computer programs, TMPSUB2 Computer program.

The paper describes a user-friendly computer model, TMPSUB2. The model calculates the temperature field throughout a solid (but porous) substrate which can undergo exothermic pyrolysis, when it is exposed to an arbitrary (localized) heat flux which can move uniformly, such as that of a smoldering cigarette. TMPSUB2 has successfully simulated the thermal runaway signifying smoldering ignition of the substrate when it is exposed to a set of external heating fluxes. The processes 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. TMPSUB2 also 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. TMPSUB2 solves the 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 padding, behaves as a thermally thin layer. Use of TMPSUB2 shows that smoldering ignition would result from a stationary hot spot of intensity and dimension simulating a quietly smoldering cigarette. A users' guide is included.

200,065
PB93-125979 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 rept.
T. Ohlemiller, and K. Villa. 1992, 30p
Pub. in Fire Safety Jnl. 18, p325-354 1992.

Keywords: *Chairs, *Flammability testing, *Ignition, Burning rate, Fire tests, Flammability, Calorimeters, Gas burners, Standards, Test methods, Fabrics, Furniture, Test facilities, Reprints.

The California Bulletin (CB) 133 upholstery ignition source is based on the use of crumpled newsprint. The present work examined the reproducibility of several aspects of this source when placed 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 fluxes, the peak flux there and the flux 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 is the CB 133 igniter.

200,066
PB93-125987 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 rept.
W. J. Parker, K. M. Tu, S. Nurbakhsh, and G. H. Damant. 1991, 10p
Pub. in Proceedings of International Symposium on Fire Safety Science (3rd), Edinburgh, Scotland, July 8-12, 1991, p699-708.

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 this set of chairs was obtained. Calculations were made of the upper layer temperature 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 Standards & Codes

United States Standards and Building Regulations: Problems and Opportunities for International Trade.
Final rept.
J. G. Gross. 1991, 12p
Pub. in Proceedings of International Workshop: The Change the Single European Market Shall Introduce into the Building Sector, Venice, Italy, December 5, 1990, p61-72 1991.

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 participants in enforcement of building regulations will be reviewed. Actions which the United States should take to accommodate international commerce will be shared.

200,068
PB92-160050 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Building and Fire Research Lab. Office.
Research for Standards and Conformity Assessment.
Final rept.
R. N. Wright, and J. G. Gross. 1991, 20p
Pub. in Proceedings of RILEM International Seminar on Direct Transfer of Research Results to Industry, Buenos Aires, Argentina, November 4-6, 1991, p1-20.

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 the principal 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.

200,069
PB92-165539 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Center for Building Technology.
Codes, Standards, and Institutions: Pressures for Change.
Final rept.
J. G. Gross. 1991, 13p
Pub. in Jnl. of Professional Issues in Engineering Education and Practice 117, n2 p75-87 Apr 91.

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 and to the improvement of the building regulatory system. U.S. practices for development and enforcement of building standards and codes are described for the guidance of those who seek to develop or apply improved building 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 systems that are supported by laboratory accreditation and certification. The European EC 92 programs, the development and use of international standards, and the related certification and testing programs are reviewed.

200,070
PB92-171834 Not available NTIS
National Inst. of Standards and Technology (BFRL), 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, DC.
Pub. in Proceedings of Federal Construction Council Symposium 'Retrofitting Buildings for Seismic Safety', Washington, DC., November 20, 1990, p26-32 1991.

Keywords: *Building codes, *Earthquake engineering, Seismic waves, Design standards, Earthquakes, Standards, Buildings, Earthquake resistant structures, Earthquake resistance, Reprints.

The Interagency 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 voluntary standards suitable for federal use in the assessment of the seismic resistance of existing buildings and the strengthening of those inadequately resistant.

200,071
PB92-173012 PC **A19**/MF **A04**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
HVAC Functional Inspection and Testing Guide.
J. Y. Kao. Mar 92, 427p NISTIR-4758
See also PB91-216697. Sponsored by General Services Administration, Washington, DC.

Keywords: *Specifications, *Federal buildings, *Space HVAC systems, *Inspection, Energy management systems, Fire protection, Quality assurance, Warning systems, Public buildings, Testing, Manuals, Guidelines.

The document addresses general criteria and procedures for the functional inspection and testing of heating, ventilating, and air conditioning (HVAC) equipment and systems prior to their acceptance. Functional inspection and testing as 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 Commissioning of HVAC Systems' as the overall process which includes procedures and methods for documenting and verifying the performance of HVAC systems so that the systems operate 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.

200,072
PB92-196062 PC **A16**/MF **A03**
National Conference of States on 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 SBNBOC6267
Errata sheet inserted. Sponsored by National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Structures Div., and Federal Emergency Management Agency, Washington, DC.

Keywords: *Building codes, *Earthquake resistant structures, *Seismic design, State government, Regulations, Local government, Surveys, Earthquake engineering, Construction management, Enforcement.

The report provides technical and administrative information on the status of seismic design and construction provisions adopted by state and local jurisdictions and of 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 code adoption 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 on the basis of population and seismic risk. All states had a minimum of five contact points; each of the three U.S. territories constitute one contact; and the 186 largest cities were each contacted. 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 low populations had areas located no 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.

200,073
PB92-205343 PC **A03**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Guidelines and Procedures for Implementation of the Executive Order on Seismic Safety of New Building Construction.
D. Todd, and A. Bieniawski. Jun 92, 24p NISTIR-4852
Also pub. as Interagency Committee on Seismic Safety in Construction rept. no. ICSSC/RP-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 effects, *Executive Order on Seismic Safety.

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 and endorsed by consensus of the Interagency Committee on Seismic Safety in Construction. The Executive Order applies only to new construction. All buildings owned, leased constructed, assisted (through such methods as loans, grants, or guarantees of loans), or regulated by the Federal government must conform to the requirements of the Order. Each Federal agency is independently 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.

200,074
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 SBN1C6532
See also PB92-196062. Sponsored by National Inst. of Standards and Technology (BFRL), Gaithersburg, MD., and Federal Emergency Management Agency, Washington, DC.

Keywords: *Building codes, *Earthquake resistant structures, Structural design, Seismic waves, Design standards, Earthquake engineering, Standards, Design criteria, Tables(Data), Regulations, Specifications, Executive Order 12699.

The seismic provisions of four major model building codes are compared to the 1988 edition of the NEHRP Recommended Provisions for the Development of Seismic Regulations for New Buildings. The 1992 BOCA National, 1992 SBCCI 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) and Federal agencies in identifying codes appropriate for use in implementing Executive Order 12699, 'Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction'. The ICSSC recommends the use of codes and standards that are substantially equivalent to the NEHRP Recommended Provisions.

200,075
PB93-120814 PC **A21**/MF **A04**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Standards Referenced in Model, State, and City Building Codes.
J. N. Brewer. Sep 92, 492p NISTIR-4952

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

The publication provides a listing 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 referencing it, the date of the code, the locations within the code where the standard is referenced, and the date of the standard referenced in the code. The publication 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.
Toward the Goal of a Performance Fire Code.
Final rept.
R. W. Bukowski, and T. Tanaka. 1991, 6p
Pub. in Fire and Materials 15, p175-180 1991.

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 Management & Techniques

200,077
PB92-137546 PC **A06**/MF **A02**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Toxic Potency Measurement for Fire Hazard Analysis.
Special pub. (Final).
V. Babrauskas, B. C. Levin, R. G. Gann, M. Paabo, and R. H. Harris. Dec 91, 122p NIST/SP-827
Also available from Supt. of Docs. as SN003-003-03129-1. See also PB90-261231 and PB91-167270.

Keywords: *Smoke, *Fire hazards, *Toxicity, *Buildings, Carbon monoxide, Humans, Rats, Exposure, Combustion, Test methods, Construction materials, Polyvinyl chloride, Polyurethane resins, Douglas fir wood.

A comprehensive methodology has been developed for obtaining and using smoke toxicity data for fire hazard analysis. 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.

200,078
PB92-171842 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Building and Fire Research Lab. Office.
Competing for Construction in the World Arena.
Final rept.
R. N. Wright. 1991, 4p
Pub. in Construction Business Review 1, n3 p36-39 May/Jun 91.

Keywords: *Construction industry, *Competition, *United States, *Global, Buildings, Quality, Employment, Reprints.

Buildings and other facilities shelter and support most human activities. The quality of those facilities affects the competitiveness of the country's industry, and the safety and welfare of its people. Moreover, construction quality strongly affects national wealth. Over five-eighths of the fixed, reproducible wealth is invested in constructed facilities, not including land or mineral deposits. And the industry itself is one of the nation's largest. In 1991, alone, new construction put in place amounted to $445 billion - 8.1 percent of the GNP - and provided employment for 6.7 million workers.

Construction Materials, Components, & Equipment

200,079
PB92-132984 PC **A06**/MF **A02**
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.
FPETOOL: Fire Protection Engineering Tools for Hazard Estimation.
H. E. Nelson. Oct 90, 121p NISTIR-4380
Contract GSA/PBS-87-03
See also PB86-203049 and PB92-108919. Sponsored by Public Buildings Service, Washington, DC.

Keywords: *Fire protection, *Buildings, *Fire hazards, Fire safety, Computer programs, Mathematical models, Fire tests, Ignition, Combustion, Heat transfer, Fire detection systems, Smoke, Fires, Computerized simulation, FPETOOL computer program.

FPETOOL 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 use established engineering relationships. 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.
Effect of Contaminants and Cure Time on EPDM Single-Ply Joint Strength.
Final rept.
J. W. Martin, and E. Embree. 1989, 16p
Pub. in Jnl. of Materials in Civil Engineering 1, n3 p151-166 Aug 89.

Keywords: *Curing, *Contamination, *Adhesive strength, *Seams(Joints), *Roofing, Failure, Bonding strength, Adhesion, Construction materials, Roofs, Joints(Junctions), Reprints.

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 field-formed seams. Talc-like particulates introduced during manufacture may be one of the causes of seam failure, since these particulates 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. It is found that the Gompertz model fits the data quite well and that at high contamination levels, the Gompertz model predicts that the maximum strength of a joint could be as little as one-half that of a clean joint and the joints failed adhesively. The maximum achievable strength is in well-cleaned joints that always failed cohesively. These results emphasize the importance of surface cleanness and the need for standards and guidelines to assure the performance of joints.

200,081
PB92-165828 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Science and Engineering Div.
Model for Upward Flame Spread on Vertical Wall.
Final rept.
A. K. Kulkarni, and S. J. Fischer. 1988, 4p
See also PB89-214787.
Pub. in Proceedings of Fall Technical Meeting Chemical and Physical Processes in Combustion, Clearwater Beach, FL., December 5-7, 1988, p72-1-72-4.

Keywords: *Walls, *Fires, *Models, Flames, Combustible flow, Burning rate, Combustion, Flame propagation, Combustion physics, Pyrolysis, Reprints.

Concepts introduced in the upward flame spread models of Saito et al. (1985) and Quintiere et al. (1986) have been developed further to formulate a model that accepts certain measurable 'fire properties' obtained from small scale experiments in order to predict the upward propagation of fire on a vertical wall made of a combustible material. The present formulation differs from the previous models in primarily two respects: (a) the present model accepts an arbitrarily specified local mass loss rate as a function of time, unlike the previous models which assumed the mass loss rate to be either a square-wave or an exponentially decaying function, and (b) the present model allows as input a flame height correlation in the form of an exponential function.

200,082
PB92-165984 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Science and Engineering Div.
Room Fires as a Design Determinate, Revisited.
Final rept.
H. E. Nelson. 1990, 7p
Pub. in Fire Technology 26, n2 p99-105 May 90.

Keywords: *Fire tests, *Flashover, Safety engineering, Buildings, Fire hazards, Reprints.

In 1965 the author proposed two basic elements in determining the impact of a fire in a room, the first of these being the intensity of the fire. The intensity of the fire was divided into three categories as a function of the fuel, geometry, ventilation, and fire-resisting strength of the room construction. The three categories are listed below: (1) Fires that do not go to flashover. These were essentially considered to present hazard only in the room of fire involvement; (2) Fires that flashover. These fires were capable of projecting hazard and extending the fire beyond the room of origin. In the 1965 version, this was visualized as primarily an impact of radiant energy emitted from the source fire; (3) Fires that both flashover and have enough total fuel to sustain a flashed-over environment long enough to cause fire transmission beyond the boundaries of the room even if the doors were closed. This was envisioned as occurring through 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-Layer Non-Isothermal Walls: Comparison of Predicted and Measured Results.
Final rept.
D. M. Burch, W. C. Thomas, L. R. Mathena, B. A. Licitra, and D. B. Ward. 1989, 19p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of ASHRAE/DOE/BTECC/CIBSE Conference on Thermal Performance of the Exterior Envelopes of Buildings IV, Orlando, FL., December 4-7, 1989, p513-531.

Keywords: *Walls, *Moisture content, *Transport properties, *Heat transfer, Transient response, Finite difference method, Construction materials, Thermal resistance, Thermal insulation, Diffusion, Reprints.

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 was insulated with glass-fiber insulation, the other with cellulose insulation. Moisture was permitted to accumulate within the walls during a 34-day period. The model predicted with good agreement 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 rept.
G. Frohnsdorff. 1988, 6p
Sponsored by Oak Ridge National Lab., TN.
Pub. in Proceedings of International Symposium on Mathematical Modeling of Roof Systems, Oak Ridge, TN., September 15-16, 1988, p163-168 1988.

Keywords: *Roofing, *Knowledge bases(Artificial intelligence), *Expert systems, Mathematical models, 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 an integrated knowledge 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 (NEL), Gaithersburg, MD. Building Materials Div.
Comment on 'Fluid Flow in a Random Porous Medium: A Network Model Effective Medium Approximation'.
Final rept.
E. J. Garboczi. 1990, 2p
Pub. in Jnl. of Applied Physics 67, n10 p6567-6568, 15 May 90.

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 analyzed via an effective medium approximation. The effective-medium theory developed for this model gave a prediction for the critical fraction of cracks at which a connected pathway of cracks first appeared in the lattice. This paper computes the critical fraction of cracks numerically and finds that its value is 0.194 + or - 0.01, which is 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.
Analytical and Numerical Models of Transport in Porous Cementitious Materials.
Final rept.
E. J. Garboczi, and D. P. Bentz. 1990, 7p
Sponsored by Northwestern Univ., Evanston, IL.
Pub. in Materials Research Society Symposium Proceedings 176, p675-681 1990.

Keywords: *Cements, *Transport properties, *Fluid flow, Diffusivity, Porous materials, Permeability, Pressure gradients, Mathematical models, 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, (2) new computational methods 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 Contamination Level on Strength of Butyl-Adhered EPDM Joints in EPDM Single-Ply Roofing Membranes.
Final rept.
J. W. Martin, E. Embree, and W. J. Rossiter. 1989, 9p
See also PB92-144831.
Pub. in Proceedings of Conference on Roofing Technology (9th) 'Putting Roofing Technology to Work', Gaithersburg, MD., May 4-5, 1989, p64-72.

Keywords: *Roofing, *Adhesive bonding, *Seams(Joints), *Failure, Adhesion tests, Membranes, Construction materials, Adhesives, Contamination, Quality assurance, Reprints, Ethylene propylene diene terpolymer, Single ply roofing membranes.

The most frequently cited failure mode for EPDM (ethylene propylene diene terpolymer) single-ply roofing systems is the failure of the field-formed seams. The cause of these failures has not, as yet, been isolated. The presence of talc-like particles, introduced during the manufacturing process, may be a primary factor, since the presence of these particles may act to block adhesive bond formation. To test the hypothesis, the strength of butyl-adhered EPDM T-peel joints was determined as a function of cure time and contamination level. It was concluded that the strength of an EPDM T-peel joint exponentially decreases with an increase in contamination. These results reinforce the need for strict adherence to proper seam cleaning techniques prior to the application of the butyl adhesive and the need for quality assurance techniques for assuring satisfactory seam formation.

200,088
PB92-171669 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Building Materials Div.
Creep-Rupture Tests of Joints Fabricated from Aged EPDM Rubber Membrane Material.
Final rept.
W. J. Rossiter, T. Nguyen, J. W. Martin, W. E. Byrd, and J. F. Seiler. 1991, 18p
Sponsored by Construction Engineering Research Lab. (Army), Cincinnati, OH.
Pub. in Proceedings of ACS (American Chemical Society) Rubber Division Symposium on Rubber in Construction, Detroit, MI., October 8, 1991, 18p.

Keywords: *Seams(Joints), *Adhesives, *Roofing, *Creep rupture strength, Creep rupture tests, Creep properties, Rubber, Joints(Junctions), Membranes, Creep tests, Mechanical tests, Reprints.

An experiment was conducted to assess the creep-rupture performance of joints fabricated from aged EPDM rubber membrane material. The rubber, sampled from a 10-year old roof, was abrasively cleaned with heptane prior to joint formation. Two sets of joints were prepared using a butyl-based pre-formed tape: one designated as 'patch' specimens (one strip of cleaned aged rubber adhered to one strip of cleaned new rubber), and the second designated as 'new seam' specimens (two strips of cleaned new rubber bonded together). Both sets were stressed in peel under creep conditions to determine their times-to-failure. The mean time-to-failure of the new seam joints was significantly longer than that of the patch joints. The locus of failure of the patch joints (and also new seam joints) was at the interface between the surfaces of the new rubber and the tape.

200,089
PB92-175140 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Fire Science and Engineering Div.
Computer Model for Estimating the Response of Sprinkler Links to Compartment Fires with Draft Curtains and Fusible Link-Actuated Ceiling Vents.
Final rept.
W. D. Davis, and L. Y. Cooper. 1991, 15p
Sponsored by American Architectural Mfrs. Association, Des Plaines, IL.
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 fusible links due to the presence of a ceiling jet imbedded in an upper layer. An important new feature in the program 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 venting the upper layer on the ceiling jet 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 geometry modeled by the program is that of a large compartment enclosed by 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 rept.
E. J. Garboczi. 1991, 5p
Pub. in Powder Technology 67, p121-125 1991.

Keywords: *Porous materials, *Porosity, Hydraulic conductivity, Porosimeters, Permeability, Pore pressure, Percolation, Low density materials, Permeameters, Construction materials, Reprints, Mercury porosimetry.

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 cyclindrical 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.

Automated Low-Temperature Guarded Hot Plate for Measuring Apparent Conductivity.
Final rept.
D. R. Smith, W. P. Dube, and B. J. Filla. 1991, 23p
Sponsored by National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
Pub. in Insulation Materials: Testing and Applications, ASTM STP 116, v2 p479-501 1991.

Keywords: *Thermal insulation, *Thermal conductivity, *Low temperature tests, Temperature measurement, Test facilities, Heaters, Thermodynamic properties, Test methods, Heat transfer, Flat plates, Reprints.

A guarded-hot-plate apparatus has been developed for measuring the apparent thermal conductivity of flat-slab 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 temperatures, 100 to 400 K; temperature differences, 3 to 150 K; temperature gradients, 0.1 to 10 K/mm; 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, giving insight into the heat-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 (BFRL), Gaithersburg, MD.
Building and Fire Research Project Summaries, 1992.
N. J. Raufaste. Mar 92, 133p NISTIR-4796
See also report for 1991, PB91-216788.

Keywords: *Research projects, *Fires, *Buildings, *Abstracts, Flammability, Construction materials, Structural engineering, Earthquake engineering, Concretes, Refrigerating machinery, Fire safety, Construction industry.

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 unwanted fires exceeded $100 billion annually. The quality of 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. The report summarizes BFRL's research for 1992. The report is arranged by its research programs: structural engineering, materials science and engineering, mechanical and environmental systems, fire science and engineering, and fire measurement and research. Each summary lists the project title, the BFRL point of contact, sponsor, research, and recent results.

200,093
PB92-213313 PC **A03**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Modeling Smoke Movement through Compartmented Structures.
W. W. Jones, and G. P. Forney. 8 Jul 92, 35p NISTIR-4872
See also PB86-138625 and PB91-144436.

Keywords: *Smoke, *Buildings, *Mathematical models, *Fires, Ventilation, Transport properties, Pyrolysis, Air flow, Combustion products, Flux(rate), Combustion.

The paper describes a model of fire growth and smoke transport for compartmented structures, with emphasis on those aspects which are important to making correct predictions of smoke movement in multicompartment structures. In particular, the authors are interested in the ability to model the movement of toxic gases from the room of origin of a fire to a distant 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
PB92-213347 PC **A03**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
CORRIDOR: A Routine for Estimating the Initial Wave Front Resulting from High Temperature Fire Exposure to a Corridor.
H. E. Nelson, and S. Deal. Jul 92, 40p NISTIR-4869
See also PB89-189260 and PB92-156769. Sponsored by Public Buildings Service, Washington, DC. Office of Real Property Management and Safety.

Keywords: *Buildings, *Fire tests, Computerized simulation, Mathematical models, Smoke, Flashover, Algorithms, Graphs(Charts), CORRIDOR computer program, FPETOOL system.

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 FPETOOL and adjustments made to accommodated 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 users' guide is included.

200,095
PB92-213362 PC **A03**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Semi-Quantitative Model for the Burning Rate of Solid Materials.
J. G. Quintiere. Jun 92, 43p NISTIR-4840
See also PB85-159945.

Keywords: *Burning rate, *Construction materials, *Fires, Heat transfer, Combustion, Mathematical models, Flux(Rate), Combustion products, Pyrolysis, Gasification.

An analytical model was developed to describe the processes involved in the burning and extinction of solid materials and is described in the report. Included are flame heat transfer, charring, transient conduction, and water application. The model qualitatively describes the burning rate of both charring and thermoplastic-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, in conjunction with a critical flame temperature, is used to describe suppression and extinction by water.

200,096
PB92-213388 PC **A06**/MF **A02**
Rutgers - The State Univ., New Brunswick, NJ.
Flow Through Horizontal Vents as Related to Compartment Fire Environments.
Rept. for 29 Sep 90-30 Sep 91.
Q. Tan, and Y. Jaluria. Jun 92, 106p NIST/GCR-92/607
Grant NANB7D0743
Sponsored by National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.

Keywords: *Vents, *Fires, *Buildings, Pressure gradients, Air flow, Fire tests, Mathematical models, Flow rate, Ventilation, Test facilities, Buoyancy, Natural convection, Pressure measurement.

A detailed investigation has been carried out on the flow exchange through a horizontal vent in a compartment containing a fire. A plexiglass tank with a vented horizontal partition in the middle was constructed to simulate the warmer interior environment due to a fire and the cooler ambient environment by filling the upper and lower compartment with brine and pure water, respectively. Experiments have been carried out on the combined natural and forced convection flow by imposing a pressure difference across the vent. The flow rates through the vent were determined over wide ranges of the governing variables, such as the pressure difference across the opening, density difference across the opening and the opening length to diameter ratio. The basic characteristics of the flow, particularly whether it is unidirectional or bidirectional, was also studied. Volume flow rates were obtained as functions of the governing parameters in terms of correlating 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 (BFRL), Gaithersburg, MD.
Implicitly Coupling Heat Conduction into a Zone Fire Model.
W. F. Moss, and G. P. Forney. Jul 92, 35p NISTIR-4886
Prepared in cooperation with Clemson Univ., SC.

Keywords: *Fires, *Buildings, *Mathematical models, Conduction, Heat transfer, Differential equations, Computerized simulation.

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 modeling solution 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 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Science and Engineering Div.
Framework for Utilizing Fire Property Tests.
Final rept.
T. G. Cleary, and J. G. Quintiere. 1991, 10p
See also PB91-240788.
Pub. in Proceedings of International Symposium (3rd) Fire Safety Science, Edinburgh, Scotland, July 8-12, 1991, p647-656.

Keywords: *Buildings, *Fire tests, *Flame propagation, Fires, Walls, Floors, Predictions, Ceilings(Architecture), Mathematical models, Test methods, Reprints.

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 needed model data are couched in terms of available test method results, e.g., Cone Calorimeter and LIFT apparatuses. 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 lining experiments.

200,099
PB92-236488 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Materials Div.
Expert Systems for Roofing Construction.
Final rept.
J. R. Clifton, W. J. Rossiter, and L. J. Kaetzel. 1990, 4p
Pub. in International Jnl. of Roofing Technology 2, p57-60 1990.

Keywords: *Expert systems, *Roofing, *Construction, Construction materials, Membranes, Artificial intelligence, Computer programs, Buildings, Sheathing, Roofs, Reprints.

The paper describes expert technology, including the principles, 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 slippage problems in built-up bituminous membranes.

200,100
PB92-236736 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Building Environment Div.
Measurements of Moisture Diffusion in Building Materials.
Final rept.
A. H. Fanney, W. C. Thomas, D. M. Burch, and L. R. Mathena. 1991, 15p
Sponsored by Department of Energy, Washington, DC.
Pub. in ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) Transactions, v97 pt2 p99-113 1991.

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 temperatures of 76 F and 44 F. Moisture transfer rates were measured using a modified ASTM (American Society for Testing and Materials) permeance cup procedure. The modifications were implemented to investigate the dependence of moisture diffusivity on moisture content and take into account the effects of external transfer resistance. Diffusivities were correlated with moisture content using an exponential relationship. The measured diffusivities for both materials depended strongly on moisture content and temperature. 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.

200,101
PB92-237437 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Fire Science and Engineering Div.
Analytical Model for Transient Gasification of Noncharring Thermoplastic Materials.
Final rept.
K. D. Steckler, T. Kashiwagi, H. R. Baum, and K. Kanemaru. 1991, 10p
Pub. in Proceedings of International Symposuium on Fire Safety Science (3rd), Edinburgh, Scotland, July 8-12, 1991, p895-904.

Keywords: *Gasification, *Thermoplastics, *Pyrolysis, *Fire models, Heat flux, Heat loss, Construction materials, Sublimation, Combustion products, Vaporizing, Burning rate, Reprints, Polymethylmethacrylate.

An analytical model is presented for the one-dimensional transient gasification of a noncharring thermoplastic material subjected to a specified, time-dependent external radiant heat flux. The model provides for temperature-dependent thermal properties and time-dependent radiative and convective heat losses 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, sub-surface absorption and degradation processes play a significant role but are not represented in the current model. Variable thermal properties, however, are shown to be non-crucial provided an appropriate effective temperature is chosen for their evaluation.

200,102
PB92-238617 PC **A03**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Note on the Pressure Equations Used in Zone Fire Modeling.
R. G. Rehm, and G. P. Forney. Aug 92, 35p NISTIR-4906

Keywords: *Pressure dependence, *Mathematical models, *Fires, Boundary layer, Conservation equations, Reaction kinetics, Pressure gradients, Ordinary differential equations, Computer programs, Buildings, *Fire models, Zone fires.

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 equilibrates much more rapidly than other dynamical variables. Since the models are very simple, analytical techniques can be applied and some insight gained regarding the nature of these problems. The models consist of ordinary 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 stiff 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.

200,103
PB92-238690 PC **A04**/MF **A01**
Worcester Polytechnic Inst., MA.
Characterization of the Confined Ceiling Jet in the Presence of an Upper Layer in Transient and Steady-State Conditions. Final Report, August 1990-July 1991.
V. Motevalli, and C. Ricciuti. Aug 92, 51p NIST/GCR-92/613
Grant NANBOD1049
See also PB90-109661 and PB90-227976. Sponsored by National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.

Keywords: *Fires, *Jet flow, *Boundary layer, Velocity distribution, Buildings, Fire tests, Heat transfer, Test facilities, Mathematical models, Temperature distribution, Computer programs, Ceiling jets, Enclosure fires.

The report examines data from a study of small-scale fire induced ceiling jet in a confined situation for a smooth horizontal ceiling. These results were obtained from experiments conducted at the National Institute of Standards and Technology, Center for Fire Research using 2.0 and 0.75 kW fires at r/H locations of 0.26 and 0.75. The data gathered from these experiments represent a collection of transient and steady-state temperature and velocity measurements of a confined ceiling jet and upper layer. The results from this data were compared to similar experimental data collected in a previous study for unconfined ceiling jet using the same apparatus. Comparison of the confined and unconfined ceiling jet data, quantification of the developing upper layer and analysis of heat transfer to the ceiling, are presented in this report. Despite the limited data, it is concluded that the unconfined ceiling jet correlations may only be valid at the very early time, prior to development of the upper layer and that steady-state unconfined correlations are certainly invalid for confined conditions. The velocity of the confined ceiling jet within the upper layer is 20-25% less than the unconfined case affecting the heat transfer coefficient.

200,104
PB92-500420 CP **D05**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
HAZARD 1 Fire Hazard Assessment Method (Version 1.1) (for Microcomputers).
Software (Final rept).
R. D. Peacock, W. W. Jones, R. W. Bukowski, and C. L. Forney. Jun 91, 9 diskettes NIST/SW/DK-92/001, NIST/HB-146-VOLS-I/II
Library of Congress catalog card no. 89-600740. System: IBM PC XT/AT/PS2 or compatible; MS DOS 3.0+ operating system, 640K. Language: FORTRAN/BASIC Assemb. A math coprocessor 8087,80287 or 80387 and a 2Mb hard disk drive are required. Supersedes PB89-215404.
Availability: six 5 1/4 inch and three 3 1/2 inch diskettes, 360K and 720K double density. Technical Reference Guide and Software User's Guide are included.

Keywords: *Software, *Fire hazards, *Buildings, Fires, Fire damage, Models, Evacuation, Fire losses, Injuries, Casualties, Diskettes.

HAZARD I describes a method for predicting the hazards to occupants involved in a building fire. The software consists of modules which can predict the time varying environment within a building resulting from a specified group of occupants as they interact with the building, the fire, and each other; and the impact of the exposure of each of the occupants to the fire products in terms of whether the occupants successfully escape, are incapacitated, or killed.

200,105
PB93-116465 PC **A07**/MF **A02**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Building and Fire Research Laboratory Publications, 1991.
N. H. Jason. Apr 92, 137p NISTIR-4827
Also available from Supt. of Docs. See also PB91-216788.

Keywords: *Research projects, *Fires, *Buildings, *Bibliographies, Burning rate, Cements, Fire hazards, Fire detection systems.

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 combined to form BFRL. The publication is a supplement to Building and Fire Research Laboratory Publications, 1990 and previous editions of Fire Research Publications and the Building Technology Publications. Contact the author if you would like information about earlier editions. Only publications prepared by the members of the BFRL staff, by other National Institute of Standards and Technology (NIST) personnel for BFRL, or by external laboratories under contract or grant from BFRL are cited.

200,106
PB93-124964 PC **A03**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
International Conference on Fire Suppression Research (1st): Summary. Held in Stockholm and Boras, Sweden on May 5-8, 1992.
V. Sjolin, D. D. Evans, and N. H. Jason. Oct 92, 45p NISTIR-4946
Prepared in cooperation with Swedish Fire Research Board, Stockholm.

Keywords: *Fire extinguishers, *Research, *Fire fighting, *Meetings, Fire protection, Fire extinguishing agents, Sprinklers, Fire tests, Abstracts, Technology assessment.

The report contains the Research Priorities, Recommendations and Summaries of papers presented at the Stockholm conference. The conference was organized to bring together a cross-section of the researchers, users, and sponsors of fire suppression research worldwide. BRANDFORSK (Swedish 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.

200,107
PB93-125961 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Science and Engineering Div.
Smoldering Combustion Propagation on Solid Wood.
Final rept.
T. J. Ohlemiller. 1991, 10p
Pub. in Proceedings of International Symposium on Fire Safety Science (3rd), Edinburgh, Scotland, July 8-12, 1991, p565-574.

Keywords: *Wood, *Flammability tests, Fire tests, Ignition, Flammability, Air flow, Heat transmission, Fire hazards, Flame propagation, Combustion, Reprints, *Smoldering combustion.

Factors controlling the spread of smoldering combustion on solid wood (red oak, white pine) were examined in a configuration designed to enable self-sustained 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 either of the upstream end of this channel (yielding forward smolder propagation), the downstream end (reverse smolder) or mid-length (coupled forward/reverse smolder). In separate tests the air flow velocity (referred to the initial cross section of the channel) was varied from about 9 to 22 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 into flaming combustion. A simple energy balance model indicates a central role of radiative transfer in sustaining the smolder process.

200,108
PB93-126035 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Building and Fire Research Lab. Office.
International Fire Research.
Final rept.
J. E. Snell. 1991, 15p
See also PB91-149302.
Pub. in Proceedings of International Symposium on Fire Safety Science (3rd), Edinburgh, Scotland, July 8-12, 1991, p149-163.

Keywords: *Fire safety, *Research, Cooperation, Buildings, Fire tests, International relations, Meetings, Fire prevention, Reprints, Forum for International Cooperation on Fire Research.

The paper makes the case for international fire research, discusses the development and activities of the Forum for International Cooperation on Fire Research (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 (NEL), Gaithersburg, MD. Structures Div.
Punching Shear Behavior of Lightweight Concrete Slabs and Shells.
Final rept.
D. I. McLean, L. T. Phan, H. S. Lew, and R. N. White. 1990, 7p
See also NUREG/CR-2920.
Pub. in ACI Structural Jnl. 87, n4 p386-392 Jul/Aug 90.

Keywords: *Reinforced concrete, *Shear properties, *Lightweight concretes, *Concrete slabs, *Shells(Structural forms), *Nuclear reactor containment, Presstressed concrete, Reinforcement(Structures), Loads(Forces), Concrete structures, Shear strength, Concrete construction, Offshore structures, Reprints, Punching shear loads.

Results of an experimental investigation of the punching shear strength of reinforced and prestressed lightweight concrete slabs and shells representative of the exterior walls of offshore structures are summarized. Eight continuous slabs, one single-span slab, and six single-span shells were tested. The main variables investigated were amount of shear reinforcement, shell curvature, prestressing, span continuity condition, and size of loaded area. The punching shear strengths observed were much higher than those predicted by the 1983 ACI Building Code (ACI 318-83), particularly in the specimens with shear reinforcement and curvature. The higher strengths were a result of the following: the relatively small span-to-thickness ratios of the specimens, superior performance of the headed shear reinforcing bars used in the study when compared to conventional stirrups, and the presence of arch action produced by shell curvature.

200,110
PB93-129500 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Fire Measurement and Research Div.
Cone Calorimeter for Controlled-Atmosphere Studies.
Final rept.
V. Babrauskas, W. H. Twilley, M. Janssens, and S. Yusa. 1992, 7p
Pub. in Fire and Materials, v16 p37-43 1992.

Keywords: *Fire tests, *Calorimeters, *Buildings, Thermal measurements, Combustion, Heat transfer, Burning rate, Test facilities, Thermal measuring instruments, Fires, Reprints, *Cone calorimeters.

Many fires occur in ambient atmospheric conditions. To investigate certain types of fires, however, it is necessary to consider combustion where the oxidizer is not 21% oxygen/79% nitrogen. The Cone Calorimeter (ASTM 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 burning specimens with room air being drawn in for combustion. To facilitate studying fires involving different atmospheres, a special version of the Cone Calorimeter was designed. This unit allows controlled combustion 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. This paper describes the background 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 (BFRL), Gaithersburg, MD. Building and Fire Research Lab. Office.
Smoke Toxicity Hazard: A Status Report.
Final rept.
J. E. Snell. 1989, 6p
Pub. in LAB DATA, v19 n2 p4-9 1989.

Keywords: *Toxicity, *Smoke, *Fire hazards, Fire tests, Combustion, Construction materials, Combustion products, Fire safety, Buildings, Reprints.

The status of ongoing efforts in the United States to address the technical concerns relating to the smoke toxicity hazards from accidental fires is discussed with particular emphasis on the work of the Center for Fire Research at the National Bureau of Standards to develop the methods to predict fire and smoke hazard.

200,112
PB93-135143 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Building Materials Div.
Construction Materials Reference Laboratory at NIST Promoting Quality in Laboratory Testing.
Final rept.
J. H. Pielert. 1989, 5p
Sponsored by American Society for Testing and Materials, Philadelphia, PA., and American Association of State Highway and Transportation Officials, Washington, DC.
Pub. in ASTM (American Society for Testing and Materials) Standardization News, v17 n12 p40-44 Dec 89.

Keywords: *Construction materials, *Laboratories, Samples, Cements, Standards, Test methods, Sampling, Test facilities, Reprints, *Construction Materials Reference Laboratory.

The Construction Materials Reference Laboratories (CMRL) located at NIST have the goal of improving the quality of testing of construction materials. CMRL is made up of the Cement and Concrete Reference Laboratory (CCRL) and AASHTO Materials Reference Laboratory (AMRL). The four major functions of CCRL and AMRL are the inspection of construction materials testing laboratories, distribution of proficiency samples, participation in the work of technical committees, and study of testing problems. The current scope and participation levels of these activities will be discussed.

200,113
PB93-135309 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Fire Measurement and Research Div.
Analysis of Large-Scale Fire Test Data.
Final rept.
R. D. Peacock. 1991, 28p
Pub. in Fire Safety Jnl. 17, p387-414 1991.

Keywords: *Fire tests, *Data analysis, Experimental data, Fires, Burning rate, Pressure, Algorithms, Gas analysis, Calorimetry, Mass transfer, Temperature, Reprints.

Large-scale room fire testing has evolved from simple fire performance measurements such as intensity and duration of 'room fires' to sophisticated measurements to understand the properties which cause the fire. This paper provides a overview of typical calculations, based upon published research results, that are used at the Center for Fire Research and elsewhere for the analysis of a large-scale room fire test. Analysis of large-scale fire test data requires the development of a series of algorithms that combine individual measurements to produce the desired physical quantity. A set of algorithms for the analysis of fire test data based upon published research results is described. Included are fire-specific calculations such as smoke and gas analysis, layer temperature and interface position, mass loss and flows, and rate of heat release. Examples of the application of the calculations are provided.

Structural Analyses

200,114
PB92-154103 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Structures Div.
Simple Approach to Precast Beam-Column Connection Assemblies.
Final rept.
G. S. Cheok, and H. S. Lew. 1992, 21p
Pub. in Proceedings of ACI (American Concrete Institute) International Conference on Evaluation and Rehabilitation of Concrete Structures and Innovations in Design, Hong Kong, December 3-6, 1991, p1363-1383 1992.

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

An experimental study of precast concrete beam-column connection assemblies is presented. The 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 connection that is economical and easily constructed. All test specimens were 1/3-scale models of the prototype. The monolithic concrete specimens were designed to 1985 Uniform Building Code (UBC) Seismic Zone 2 and 4 criteria. The designs of the precast specimens were similar to those for the monolithic specimens designed to UBC seismic Zones 2 and 4. Results from the monolithic specimens provide a benchmark for comparison with results from the precast tests. Comparisons 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 (BFRL), Gaithersburg, MD. Structures Div.
Periodic and Chaotic Oscillations of Modified Stoker Column.
Final rept.
G. R. Cook, and E. Simiu. 1991, 16p
See also PB90-215849. Sponsored by Department of the Interior, Washington, DC.
Pub. in Jnl. of Engineering Mechanics 117, n9 p2049-2064 Sep 91.

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

Records are presented of typical measured motions of a modified forced Stoker column, including periodic motion around a stable fixed point of the unforced column; periodic snap-through motion around the unstable fixed point; and chaotic motion. Characterizations of the recorded chaotic motion include the autocorrelation function; the spectral density plot; capacity dimensions; and the Lyapounov exponent. Numerical simulations were performed in which spring stiffnesses measured under static conditions and dissipative forces 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 springs. The simulations yielded chaotic motions comparable qualitatively to, though different quantitatively from, those recorded in the laboratory. As evidenced by the estimated fractal dimension, the influence of the spring mass distribution was not sufficiently strong to affect the dimension of the embedding phase space for the attractor of the chaotic motion.

200,116
PB92-171974 PC **A03**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Measurement of Structural Response Characteristics of Full-Scale Buildings: Analytical Modeling of the San Bruno Commercial Office Building.
L. T. Phan, E. M. Hendrickson, and R. D. Marshall. Mar 92, 50p NISTIR-4782
See also PB91-167239.

Keywords: *Dynamic response, *Structural vibration, *Buildings, Dynamic structural analysis, Measurement, Soil-structure interactions, Earthquake engineering, Frequencies, Seismic waves, Vibration damping, Earthquakes, Loma Prieta Earthquake.

A 6-story commercial office building in San Bruno, California, which experienced the Loma Prieta earthquake of October 17, 1989 and sustained no visible damage, was subjected to ambient vibration tests in September 1990. Ambient vibration data were recorded from the 13 accelerometers installed prior to the Loma Prieta earthquake. Comparison of dynamic characteristics revealed that the first-mode response frequency deduced from the Loma Prieta records is significantly lower than that deduced from ambient vibration tests, and the damping ratio for strong motion is subtantially higher than that obtained from ambient vibration. A computer model of the building was developed and applied using two different boundary conditions; fixed-based and spring-supported conditions. The fixed-base conditions was used to simulate the building response to ambient vibration, and the spring-supported condition was used to incorporate soil-structure interaction and thus simulate realistic building response to the Loma Prieta earthquake. Results of analyses showed that the first-mode response frequencies for the two cases differ by essentially the same factor observed from measurements. The suggests that the difference in first-mode response frequencies between ambient vibration and strong motion in the building was due largely to soil-structure interaction.

200,117
PB92-189562 PC **A08**/MF **A02**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Earthquake Resistant Construction Using Base Isolation: Earthquake Protection in Buildings through Base Isolation. Volume 1.
Special pub. (Final).
N. J. Raufaste. Apr 92, 162p NIST/SP-832-VOL-1
Also available from Supt. of Docs. as SN003-003-03155-1. See also Volume 2, PB92-189570.

Keywords: *Earthquake resistant structures, *Vibration isolators, Structural vibration, Vibration damping, Earthquake engineering, Foundations, Japan, Seismic waves, Shock resistance, Buildings, Dynamic response, Case histories, Performance evaluation, Effectiveness, Guidelines, Structural members, Design criteria, *Foreign technology, Translations.

The report is Volume 1 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 the 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.

200,118
PB92-189570 PC **A24**/MF **A04**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Earthquake Resistant Construction Using Base Isolation: Survey Report on Framing of the Guidelines for Technological Development of Base-Isolation Systems for Buildings. Volume 2.
Special pub. (Final).
N. J. Raufaste. Apr 92, 575p NIST/SP-832-VOL-2
Also available from Supt. of Docs. as SN003-003-03154-2. 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 Two of a two volume series on passive energy dissipating systems for buildings and other structures. The volume, Survey Report on Framing of the Guidelines in Technological Development of Base Isolation Systems for Buildings, addresses the performance of these systems and provides examples of buildings installed with the systems. The documents provide guidelines for evaluating these systems and a directory of these 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 provided 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.

200,119
PB92-197607 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Structures Div.
Experimental Study of Gusseted Connections.
Final rept.
J. L. Gross. 1989, 491p
See also PB89-127278.
Pub. in Proceedings of National Steel Construction Conference Fabricators and Engineers Working Together, Nashville, TN., June 22-24, 1989, 491p.

Keywords: *Steel structures, *Gusset plates, *Buckling, Framed structures, Deformation, Columns(Supports), Loads(Forces), Structural members, Model tests, 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 subassemblages 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 failure mode for the two strong-axis column connections was gusset buckling. The weak-axis column connection failed by tearing of the gusset plate. The moment introduced by the eccentricity in the bracing was distributed to the beam and column in the strong-axis column connection. This moment was carried almost entirely 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.

200,120
PB92-198068 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Hurricane Climatology.
Final rept.
E. Simiu. 1987, 7p
Pub. in Proceedings of WERC/NSF Wind Engineering Symposium High Winds and Building Codes, Kansas City, MO., November 2-4, 1987, p317-323.

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 now standard approach developed by Russell for estimating hurricane (cyclone) wind speeds corresponding to various mean recurrence intervals. It is suggested that recent developments in extreme value theory might enable hurricane wind speed distribution tails to be estimated more realistically than has sofar 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.

200,121
PB92-201102 PC **A05**/MF **A02**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
List of Publications 1969-1991. Panel on Wind and Seismic Effects.
Special pub. (Final).
N. J. Raufaste. Apr 92, 97p NIST/SP-835
Also available from Supt. of Docs. as SN003-003-03159-3.

Keywords: *Seismic effects, *Wind(Meteorology), *Disasters, *Structural design, Highways, Damage, Listings, Soil-structure interactions, Wind loads, Tsunamis, Wind tides, Air water interactions, Floods, 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, storm surge, and tsunamis. This work is 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 design and construction of civil engineering lifelines, buildings, and water front structures, and to exchange high wind and seismic measurement records. Annual meetings alternate 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.

200,122
PB93-113579 PC **A05**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Measurement of Structural Response Characteristics of Full-Scale Buildings: Comparison of Results from Strong-Motion and Ambient Vibration Records.
Final rept.
R. D. Marshall, L. T. Phan, and M. Celebi. Oct 92, 86p NISTIR-4884
Sponsored by Geological Survey, Menlo Park, CA. Branch of Engineering Seismology and Geology.

Keywords: *Dynamic response, *Structural vibration, *Seismic effects, *Earthquake damage, Vibration damping, Soil-structure interactions, Earthquakes, Data acquisition, Earthquake engineering, Buildings, Displacement, Signal processing, 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. The buildings represent a range of construction materials, structural systems, foundation systems and building dimensions. Results of the analyses are compared with 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 higher than the corresponding frequencies derived from strong-motion response records. When soil-structure interaction is involved, the strong-motion modal frequencies may 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 forced vibration tests. The lower bound of damping estimates obtained from strong-motion response records in the study is consistent with published data. Where soil-structure interaction is a significant factor, the overall damping for strong-motion response may be 3 to 4 times the indicated lower bound.

200,123
PB93-113652 PC **A09**/MF **A02**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Office Workspace for Tomorrow DOT Workshop (November 13-14, 1991). Contributed Papers.
A. I. Rubin. Mar 92, 191p NISTIR-4801
Sponsored by Department of Transportation, Washington, DC. Office of the Secretary.

Keywords: *Workstations, *Office buildings, *Workplace layout, *Meetings, Design standards, Man 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 November 13 and 14, 1991. The 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. A followon report (NISTIR 4802), will describe the workshop proceedings. Workshop presentations covered the following topics: workstation design process, programming tradeoffs, workstation standards and criteria, ergonomics, human resource issues, leading edge workstation design, impact of new technologies on office and workstation design, lighting, environmental technologies, information and data systems, building design, facility management, forecasts of the office-of-the-future. These issues were discussed by panel members, and with representatives from the Department of Transportation and other federal agencies.

200,124

PB93-118115 PC **A20**/MF **A04**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Proceedings of the U.S.-Japan Workshop on Earthquake Disaster Prevention for Lifeline Systems (4th). Held in Los Angeles, California on August 19-21, 1991.
Special pub. (Final).
R. T. Equchi. Aug 92, 469p NIST/SP-840
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 Inst., 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 (BFRL), Gaithersburg, MD.
Wind and Seismic Effects. Proceedings of the Joint Meeting of the U.S.-Japan Cooperative Program in Natural Resources Panel on Wind and Seismic Effects (24th).
Special pub. (Final).
N. J. Raufaste. Sep 92, 600p NIST/SP-843
Also available from Supt. of Docs. as SN003-003-03180-1. See also PB92-116425.

Keywords: *Seismic effects, *Wind pressure, *Meetings, *Earthquake resistant structures, Dynamic structural analysis, Buildings, International cooperation, Earthquakes, Structural vibration, Wind loads, Dynamic loads, Storms, Tsunamis, Hazards, Vibration damping, Earthquake engineering, Highway bridges, Mathematical models.

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).

General

200,126

PB92-132992 PC **A03**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Preliminary Study of the 1991 Oakland Hills Fire and Its Relevance to Wood-Frame, Multi-Family Building Construction.
K. D. Steckler, D. D. Evans, and J. E. Snell. Nov 91, 38p NISTIR-4724
See also PB83-242289. Portions of this document are not fully legible. Color illustrations reproduced in black and white.

Keywords: *Wooden structures, *Residential buildings, *Fires, Urban areas, Building codes, Apartment buildings, Investigations, Construction materials, Oakland(California).

The purpose of the study was to establish the relevance, if any, of the Oakland hills wildland and suburban fire that occurred on October 20, 1991, to the design of multi-family wood-frame housing in the United States (U.S.) and Japan. A group of fire scientists and experts in building practices from both countries studied the fire through inspections of the site and meetings with local fire and building officials. The high wind speed, proximity of flammable vegetation to structures, and the flammability of exterior construction materials were factors in the spread of the fire. The use of wood framing members in the construction of multi-family housing did not influence significantly the rate of spread or extent of the fire. The severity and duration of the exposure, from fires ignited both outside and inside of buildings, resulted in total destruction of most structures within the fire area, regardless of the type of construction.

200,127

PB92-141563 PC **A07**/MF **A02**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Fire Performance of Wire and Cable: Reaction-to-Fire Tests. A Critical Review of the Existing Methods and of New Concepts.
Technical note (Final).
V. Babrauskas, R. D. Peacock, E. Braun, R. W. Bukowski, and W. W. Jones. Dec 91, 133p NIST/TN-1291
Also available from Supt. of Docs. as SN003-003-03139-9. See also NUREG/CR-4570 and PB92-109164. Sponsored by National Electrical Mfrs. Association, Washington, DC.

Keywords: *Fire tests, *Power lines, Wire, Standards, Buildings, Combustion.

U.S. and Canadian reaction-to-fire tests for wire and cable are examined. The technical basis for their development is analyzed. The data requirements for engineering computations of fire hazard are examined. It is found that the current methods are primarily based on determining ignitability, speed of flame travel, or distance of flame propagation. The fire hazard to building occupants, however, is associated with the heat release rate of the fire, instead. Newer testing methods, which are not yet standards but which do measure the heat release rate of cables, are already under development. A limited comparison is made to British and international standards. Recommendations are made for improved testing strategies. The document includes about 300 references.

200,128

PB92-156744 PC **A03**/MF **A01**
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Mechanical Engineering.
Compartment Fire Combustion Dynamics.
Annual rept. 1 Aug 89-1 Aug 90.
R. J. Roby, and C. L. Beyler. May 91, 40p NIST/GCR-91/588
Grant NANB8D02829
See also PB86-110004. Prepared in cooperation with Hughes Associates, Inc., Wheaton, MD. Sponsored by National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.

Keywords: *Fires, *Combustion products, *Buildings, *Toxicity, Carbon monoxide, Gases, Tests.

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 realistic compartment fires. As most fire 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 materials 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 (BFRL), Gaithersburg, MD.
Field Modeling of Room Fires.
W. D. Davis, G. P. Forney, and J. H. Klote. Nov 91, 46p NISTIR-4673
See also PB88-201538.

Keywords: *Fires, *Buildings, Computerized simulation, Mathematical models, Drafts(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 are available in each of the three rooms as well as in the corridors connecting the rooms. These two experiments provide an opportunity to investigate both two and three 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 has been enhanced by the addition of a simple fusible link algorithm previously used in the zone fire model LAVENT. The algorithm used in conjunction with the field model 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 (BFRL), Gaithersburg, MD.
Conditions in Corridors and Adjoining Areas Exposed to Post-Flashover Room Fires.
D. W. Stroup, and D. Madrzykowski. Sep 91, 75p NISTIR-4678
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 attached target room. The burn room was a 2.44 m square with a 2.44 m high ceiling. The corridor was 12.8 m long, 2.44 m wide, and 2.44 m high. The target room was composed of two parts, a rectangular area, 2.6 m by 2.4 m and 2.2 m high, and an entry alcove, 0.8 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 top 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, below that of a standard door, into the target room were effective methods of 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 gravity wave down the corridor. The measured 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 (BFRL), Gaithersburg, MD. Building and Fire Research Lab. Office.
Fire Models: The Future is Now.
Final rept.
R. W. Bukowski. 1991, 8p
Pub. in NFPA Jnl. 85, n2 p60-62, 64, 66-69 Mar/Apr 91.

Keywords: *Buildings, *Fires, *Models, Mathematical models, Safety engineering, Computer applications, Risk assessment, Reprints.

The types of available fire models and how they work are described in general terms. Typical assumptions and limitations are discussed and uncertainty of predictions is estimated. Ease of use, input and output features, and execution speed are addressed. Some examples of current applications are presented. The article is written to provide an introduction to modeling technology for persons who have no prior experience with it.

200,132
PB92-165463 Not available NTIS
National Inst. of Standards and Technology (CAML), Gaithersburg, MD.
Evaluating Fire Protection Investment Decisions for Homeowners.
Final rept.
S. K. Fuller. 1991, 12p
Pub. in Socio-Econ. Plann. Sci. 25, n2 p143-154 1991.

Keywords: *Fire protection, *Homeowner housing, *Decision support systems, Economic analysis, Risk assessment, Residential buildings, Decision making, Sprinkler systems, Fire detection systems, Smoke detectors, Benefit cost analysis, Statistical data, Reprints.

The paper examines the use of the Analytic Hierarchy Process (AHP) for evaluating fire protection systems for homeowners. It explores how to include in 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, policy makers, and others who make decisions about fire protection investments.

200,133
PB92-171891 PC **A09**/MF **A02**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Staging Areas for Persons with Mobility Limitations.
J. H. Klote, H. E. Nelson, S. Deal, and B. M. Levin. Feb 92, 186p NISTIR-4770
Prepared in cooperation with George Mason Univ., Fairfax, VA. Sponsored 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 from fire of persons who can not travel the building emergency exit routes in the same manner or as quickly as expected of able 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, service elevator lobbies, sections of corridor, 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) the operation of a properly designed sprinkler system eliminates the life threat to all occupants regardless of their individual abilities.

200,134
PB92-175579 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Building and Fire Research Lab. Office.
History of Fire Technology.
Final rept.
H. E. Nelson. 1991, 15p
Sponsored by Worcester Polytechnic Inst., MA.
Pub. in Proceedings of Conference on Fire Safety Design in the 21st Century, Worcester, MA., May 8-10, 1991, p1-15.

Keywords: *Fires, *Buildings, Technology assessment, Fire safety, History, Risk, Reprints.

The history of fire technology is explored for clues to guide future fire technology efforts. Emphasis is placed on those factors that encouraged, retarded, or restricted past efforts. The data were gathered from a series of interviews with persons involved in many of the past advances. Specific discussion is given to advances in the areas of risk appraisal, suppression, compartment fire modeling, and structural endurance.

200,135
PB92-175587 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Fire Science and Engineering Div.
Comparing Compartment Fires with Compartment Fire Models.
Final rept.
H. E. Nelson, and S. Deal. 1991, 10p
Pub. in Proceedings of International Symposium on Fire Safety Science (3rd), Edinburgh, Scotland, July 8-12, 1991, p719-728.

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 Quintiere and McCaffery in 1980. The models compared were FIRST9X, FAST, CCFM-VENTS, and FPETOOL.

200,136
PB92-187129 PC **A04**/MF **A01**
George Mason Univ., Fairfax, VA.
Human Behavior Aspects of Staging Areas for Fire Safety in GSA Buildings.
Final rept.
B. M. Levin, and N. E. Groner. Apr 92, 59p NIST/GCR-92/606
Contract SBNB1C6527
Sponsored by National Inst. of Standards and Technology, Gaithersburg, MD., and Public Buildings Service, Washington, DC.

Keywords: *Fires, *Office buildings, *Evacuation, Handicapped people, Fire safety, Human factors engineering, Skyscrapers, Human behavior, Federal buildings, Staging areas.

One approach for assuring 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 either they can be assisted out of the building or the fire is extinguished. GSA has retrofitted six office buildings with staging areas to upgrade 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 the emergency team and informing the occupants; and the need for special procedures for maintenance.

200,137
PB92-187137 PC **A03**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
Boussinesq Algorithm for Buoyant Convection in Polygonal Domains.
K. B. McGrattan, R. G. Rehm, H. C. Tang, and H. R. Baum. Apr 92, 27p NISTIR-4831
See also PB91-178848.

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

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

200,138
PB92-187145 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. Madrzykowski, and R. L. Vettori. May 92, 42p NISTIR-4833
See also PB88-164223, PB88-170196 and PB92-132984. Sponsored by Public Buildings Service, Washington, DC. Office of Real Property Management and Safety.

Keywords: *Fire tests, *Sprinklers, *Algorithms, Mathematical models, Cribs, Office buildings.

A study was conducted to develop a sprinkler fire suppression 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
PB92-197599 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.
Final rept.
J. G. Gross. 1991, 2p
Pub. in NCSBCS (National Conference of States on Building Codes and Standards) News XVI, n5 p4-5 Oct-Dec 91.

Keywords: *Buildings, *Fire tests, *Research management, 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 Laboratory. 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.
Summaries of BFRL Fire Research In-House Projects and Grants, 1992.
N. H. Jason. Sep 92, 182p NISTIR-4918
See also report for 1991, PB92-112218.

Keywords: *Fire prevention, *Fire 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) Fire Research Program and under its grants program from October 1, 1991 through September 30, 1992.

200,141
PB93-130417 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Fire Science and Engineering Div.

Engineering View of the Fire of May 4, 1988 in the First Interstate Bank, Los Angeles, California.
Final rept.
H. E. Nelson. 1989, 5p
See also PB89-183222.
Pub. in Fire Jnl., v83 n4 p28-32 Jul/Aug 89.

Keywords: *Fires, *Banks(Buildings), *Burning rate, Office buildings, Flame propagation, Investigations, Smoke, Fire detection systems, Fire damage, Smoke, Fire safety, Reprints.

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 propagation, detector 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.
E. Roback. Apr 92, 44p NISTIR-4816

Keywords: *Federal Deposit Insurance Corporation, *Telephone systems, *Secure communication, *Standards, Computer security, Telecommunication, Government policies, Administration, PBX security, Voice mail, Telephone fraud.

The report presents the Federal Deposit Insurance Corporation's (FDIC) generic security standards for phone system administrators and users throughout FDIC. It describes FDIC telephone policies, including those for system use, protection and acquisition. The history and current methods of PBX fraud are then presented. PBX Administration is considered in some detail, with a review of the duties and responsibilities of system administrations. These include: monitoring PBX options, setting passwords, educating users, reviewing billing records, protecting voice mail and limiting outgoing international calls. The Appendix consists of a brief list of terms and definitions used throughout the document.

Consumer Affairs

200,143
PB93-124956 PC **A03**/MF **A01**
National Inst. of Standards and Technology (TS), Gaithersburg, MD.
Checking the Net Contents of Packaged Goods as Adopted by the 77th National Conference on Weights and Measures, 1992, Third Edition. Supplement 3.
Handbook (Final).
K. Butcher. Oct 92, 33p NIST/HB-133-ED-3-SUPPL-3
Also available from Supt. of Docs. as SN003-003-03183-6. See also PB92-112549.

Keywords: *Packaging, *Commodities, *Labels, Handbooks, Revisions, Requirements, Sampling, Tests, Procedures, Handbook 133, National Institute of Standards and Technology.

Only minor additions and revisions to the National Institute of Standards and Technology (NIST) (formerly NBS) Handbook 133, Third Edition, 'Checking the Net Contents of Packaged Goods,' were adopted by the National Conference on Weights and Measures in 1992. A few editorial changes have also been made. The document consists of change pages to be added to Handbook 133, Third Edition, as amended by the 1991 Supplement.

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.
Final rept.
J. A. Koenig. 1988, 75p
Pub. in NCWM Publication No. 17, National Conference on Weights and Measures Task Force on Fraud, Fraud Survey Report, p1-74 Mar 88.

Keywords: *Weight measurement, States(United States), Recommendations, Consumer affairs, Surveys, Reprints, *Weights and measures, *Fraud.

The document reports the findings and recommendations of the National Conference on Weights and Measures (NCWM) Task Force on Fraud as a result of a survey of state and local weights and measures jurisdictions on fraudulent activities involving commercial weighing and measuring devices. The information in the report is based on responses from 22 states and the District of Columbia. The report summarizes 24 case histories of fraudulent activities and explores jurisdiction approaches to identifying and dealing with fraudulent activities including complaint handling programs, undercover purchases, and investigation procedures. The report outlines a comprehensive approach that weights and measures jurisdictions can take to reduce or prevent fraudulent use of commercial devices.

200,145
PB93-130466 PC **A16**/MF **A03**
National Inst. of Standards and Technology, Gaithersburg, MD.
Report of the National Conference on Weights and Measures (77th). Held in Nashville, Tennessee on July 19-23, 1992.
Special pub. (Final).
C. S. Brickenkamp, and A. H. Turner. Oct 92, 372p NIST/SP-845
Also available from Supt. of Docs. as SN003-003-03182-8. See also report for 1991, PB92-112465 and PB93-130474. Library of Congress catalog card no. 26-27766.

Keywords: *Weight measurement, *Regulations, *Meetings, Automotive fuels, Consumer affairs, Tolerances(Mechanics), Law(Jurisprudence), Railroad tracks, Food packaging, Metrology, Measuring instruments, Standardization, Specifications, Commodities, Training, Safety, *Weights and measures, National Type Evaluation Program, NTEP program.

The 77th Annual Meeting of the National Conference on Weights and Measures (NCWM) was held July 19 through 23, 1992, at the Stouffer Nashville Hotel in Nashville, Tennessee. The theme of the meeting was 'Partnerships for Progress.' Reports by the standing and annual committees of the Conference comprise the major portion of the publication, along with the addresses delivered by Conference officials and other authorities from government and industry. Special meetings included those of the Metrologists, the Associate Membership Committee, the Retired Officials Committee, the Scale Manufacturers' Association, the American Petroleum Institute, the Industry Committee on Packaging and Labeling, the regional weights and measures associations, and the National Association of State Departments of Agriculture Weights and Measures Division, and the National Council on State Metrication.

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.
Catalogue of U.S. Manufacturing Networks.
Technology commercialization.
G. A. Lichtenstein. Sep 92, 100p NIST/GCR-92/616
Grant NANB118084

Keywords: *Catalogs, Technology utilization, Coordination, Businesses, Small businesses, Industries, Product development, Manufacturers, Technology transfer, *Manufacturing networks, State Technology Extension Program, Total quality management.

The publication contains information on collaborative groups of firms that have come together to gain competitive advantages that an individual company might not achieve by working alone. The activities of these groups, or networks, can be quite diverse. They can engage in joint production, collective marketing, worker training, new product development, technology transfer or the adoption of total quality management practices. Through collaboration, these firms can reduce the costs of such projects, gain access to new markets and learn more important skills that will enhance their competitiveness. The purpose of the catalogue is to present examples of manufacturing networks in the United States. It is designed to serve as a tool for government officials, public policy makers economic development practioners and firm managers to gain a better understanding of what manufacturing networks are and how they work in the United States.

International Commerce, Marketing, & Economics

200,147
PB92-144385 Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD. Office of Standards Code and Information.
Commerce's NIST Offices Can Help U.S. Exporters Deal with the Sweeping Changes That 'EC 1992' Will Bring in Standards, Testing, and Certification.
Final rept.
M. Breitenberg. 1989, 2p
Pub. in Business America, p8-9, 9 Oct 89.

Keywords: *International trade, *United States, *Standards, Exports, Certification, Reprints, *European Community, NIST(National Institute of Standards and Technology), GATT.

The article describes the EC-related activities of the Office of Standards Code and Information of the National Institute of Standards and Technology within the U.S. Department of Commerce. These activities may be of interest to businessmen and government officials who are involved in trade between Europe and the United States or who have an interest in efforts related to the development of a single integrated EC market by 1992.

200,148
PB92-162544 PC **A05**/MF **A01**
National Inst. of Standards and Technology (TS), Gaithersburg, MD. Office of Standards Services.
Conformity Assessment Workshop on Wood Products (3rd). Held in Washington, DC. on November 6, 1991.
R. L. Gladhill. Mar 92, 84p NISTIR-4771
Sponsored by American Plywood Association, Tacoma, WA., National Forest Products Association, Washington, DC., and American Lumber Standards Committee, Germantown, MD.

Keywords: *Meetings, *Wood products, *United States, Conformity, European communities, Government policies, Standards, Recommendations, International trade, Conformity assessment, National Institute of Standards and Technology(NIST).

In April 1990 the National Institute of Standards and Technology (NIST) conducted a hearing at which a panel of government experts explored possible ways the government could serve the needs of U.S. industry in international standards development and conformity assessment. One of the conclusions in the analysis of the hearing record (NISTIR 4367) states that 'The Government should sponsor or co-sponsor with interested parties from the private sector a series of workshops with various industry sector...'. As a result, on November 6, 1991, a Wood Products Industry Workshop was held at the U.S. Department of Commerce Building, Washington, D.C., co-sponsored by NIST, the

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 conformity assessment activities aimed at gaining acceptance of its products in such international markets as the European Community (EC).

200,149
PB92-165885 Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD. Office of Standards Code and Information.
U.S. Benefits from FTA Standards Provisions.
Final rept.
D. R. Mackay. 1989, 1p
Pub. in Business America 110, v24 n1, 30 Jan 89.

Keywords: *International trade, *Canada, *Benefits, United States, Exports, Standards, Tests, International cooperation, Customs laws, Reprints, *CFTA(US-Canada Free Trade Agreement).

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 PC **A03**/MF **A01**
National Inst. of Standards and Technology (TS), Gaithersburg, MD. Office of Standards Services.
GATT Standards Code Activities of the National Institute of Standards and Technology 1991.
Annual rept.
J. R. Overman. Apr 92, 49p NISTIR-4829
See also report for 1990, PB91-187823.

Keywords: *International trade, *Standards, Technical assistance, Certification, Regulations, Tables(Data), *General Agreement on Tariffs and Trade, Notifications, 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 Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD. Office of Standards Code and Information.
New EC Approach to Harmonization of Standards and Certification.
Final rept.
P. Cooke, and D. R. Mackay. 1988, 2p
Sponsored by International Trade Administration, Washington, DC., American Society for Testing and Materials, Philadelphia, PA., and Standards Engineering Society, Dayton, OH.
Pub. in Business America 109, n16 p8-9, 1 Aug 88.

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 Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD. Office of the Director.
Competitiveness, Technology, and the Role of Government.
Final rept.
J. W. Lyons. 1990, 7p
Sponsored by American Inst. of Chemical Engineers, New York.
Pub. in Proceedings of Conference: Competitiveness of the U.S. Chemical Industry in International Markets, San Francisco, CA., November 9, 1989, p1-7 1990.

Keywords: *International trade, *Technology innovation, *National government, Competition, Technology utilization, Government policies, Legislation, Federal budgets, Reprints, Technology Competitiveness Act of 1989, National Institute of Standards and Technology.

After a brief review of the imbalances in the current accounts for manufactured goods and the role technology has played and can play in international trade, some possible reactions are presented and discussed. The response by the Federal government is in three parts: studies by policy analysis groups, legislation by the Congress, and implementation by the Administration. Of particular interest are the Technology Competitiveness Act of 1989, part of the Omnibus Trade Act, and the National Institute of Standards and Technology (NIST) authorization Act of 1989. These two new mechanisms for addressing civilian technology are available for the use of the Administration.

General

200,153
PB92-237205 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Office of Energy-Related Inventions.
Stimulating Competitiveness of Technology-Based Business Through an 'Inventions' Program.
Final rept.
G. P. Lewett. 1990, 3p
Pub. in Proceedings of AIChE Symposium Series Competitiveness of the U.S. Chemical Industry in International Markets, San Francisco, CA., November 9, 1989, p84-86 1990.

Keywords: Technology, Industries, Reprints, *Competitiveness, *Innovation, Energy Related Inventions Program.

The salient features and the accomplishments of the 'Energy-Related Inventions Program' are described. The extension of the Inventions Program to technologies, as authorized by the Omnibus Trade and Competitiveness Act is then outlined with particular emphasis on a series of publications called 'Opportunities for Innovation'.

CHEMISTRY

Analytical Chemistry

200,154
PB92-144146 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Approaches to Accurate Characterization of High Purity Metal Fluorides and Fluoride Glasses.
Final rept.
E. S. Beary, P. J. Paulsen, T. C. Rains, K. J. Ewing, J. Jaganathan, and I. Aggarwal. 1990, 10p
Pub. in Jnl. of Crystal Growth 106, n1 p51-60 1990.

Keywords: *Spectroscopic analysis, *Fluorides, *Fiber optics transmission lines, *Optical fibers, Near infrared radiation, Mass spectroscopy, Absorption spectroscopy, Emission spectroscopy, Chemical analysis, Metal fluorides, Heavy metals, Trace amounts, Contaminants, Iron, Reprints.

Fibers prepared from heavy metal fluoride glasses are predicted to have a minimum loss of 0.01 dB/Km at 2.55 micrometers making them ideal candidates for ultra low loss transmission of data in the infrared. Unfortunately, contaminants such as iron (II) have absorbance bands which impinge on the wavelength of lowest loss. Studies of the absorption characteristics of these contaminants in fluoride glasses indicate that their concentration must be in the picogram per gram range to achieve a minimum loss of 0.01 dB/Km at 2.55 micrometers. The analytical challenges posed by this problem require that new and innovative techniques be applied to analysis of these difficult matrices. Not only must the analytical techniques used be sensitive enough to detect extremely low levels of trace impurities, but also background interferences derived from the matrix (metal fluoride or glass) must be minimized. Analytical procedures developed for ppb determinations of contaminants in high purity materials have been applied to fluoride materials. Specifically, mass spectrometric, and absorption and emission spectroscopic techniques will be discussed. Direct solid analysis and solution analysis via these techniques will be compared.

200,155
PB92-144153 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Chemical Kinetics and Thermodynamics Div.
Classical Analysis: A Look at the Past, Present, and Future.
Final rept.
C. M. Beck. 1991, 11p
Pub. in Analytical Chemistry 63, n20 p993-1003, 15 Oct 91.

Keywords: *Chemical analysis, *Gravimetric analysis, *Volumetric analysis, History, Reviews, Reprints.

The purpose of the paper is to define and discuss the scope of classical analysis, and to explore why renewing the chemical community's interest in it is important. The histories of gravimetry and titrimetry are traced, including biographical sketches of some of the important personalities in the development of classical analysis in Europe and the United States. The significance of the events surrounding the Karlsruhe Congress of 1860 is discussed, and the importance of physical chemistry and organic reagents to the development of classical analysis is examined. The current crisis in the United States resulting from a shortage of qualified classical analysts is discussed. The future of the use of classical and instrumental analysis in tandem is examined. Because of the serious economic consequences to American industry and government that will result from the disappearance of classical analysis, a proposal is made for the renewal of education in classical analysis.

200,156
PB92-144484 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Microchemical and Molecular Dating.
Final rept.
L. A. Currie, T. W. Stafford, A. E. Sheffield, G. A. Klouda, S. A. Wise, R. A. Fletcher, D. J. Donahue, A. J. T. Jull, and T. W. Linick. 1989, 16p
Pub. in Radiocarbon 31, n3 p448-463 1989.

Keywords: *Radiocarbon dating, *Chemical analysis, Carbon 14, Bones, Amino acids, Collagen, Aromatic polycyclic hydrocarbons, Multivariate analysis, Mass spectroscopy, Reprints.

The depth and reliability of archaeological and environmental information on ages, sources and pathways of carbon are being greatly enhanced through a new synergism between advances in 'micro (14)C dating' and advances in micro-organic analytical chemistry and individual particle characterization. Recent activities at the National Institute of Standards and Technology (NIST, formerly NBS) involving this linkage include dating individual amino acids isolated from bone collagen and the apportionment or tracing of individual carbon compounds derived from anthropogenic sources. Important knowledge has been gained through 'direct' (sequential) and 'indirect' (parallel) links between microchemistry and (14)C measurement. The former is illustrated by (14)C measurements on specific amino acids and on the polycyclic aromatic hydrocarbon (PAH) class of compounds. Isolation of the respective molecular fractions from far greater quantities of extraneous carbon held the key to valid dating and source apportionment respectively. Parallel data on (14)C and molecular patterns promises new knowledge about the identity of sources of environmental carbon at the nanogram level through multivariate techniques such as principal component analysis and multiple linear regression. Examples are given for atmospheric particulate carbon, using PAH molecular patterns and laser microprobe mass spectral patterns.

200,157
PB92-144849 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Thermophysics Div.
Generalized Treatment of Spatial and Temporal Column Parameters, Applicable to Gas, Liquid and Supercritical Fluid Chromatography, II. Application to Supercritical CO2.
Final rept.
D. E. Martire, R. L. Riester, T. J. Bruno, A. Hussam, and D. P. Poe. 1991, 13p
Sponsored by Gas Research Inst., Chicago, IL., and Department of Energy, Washington, DC.
Pub. in Jnl. of Chromatography 545, p135-147 1991.

Keywords: *Supercritical fluid chromatography, *Carbon dioxide, Distribution(Property), Density(Mass/volume), Surface properties, Extraction columns, Reprints, Mobile phases.

Equations derived in Part I (D. E. Martire, J. Chromatogr., 461 (1989) 165) are used to calculate distribution functions, average densities and column profiles for supercritical fluid chromatography with carbon dioxide as the mobile phase. An approximation for the column-average capacity factor in terms of the local capacity factor is evaluated and conditions are given for its applicability.

200,158
PB92-149780 PC **A03**/MF **A01**
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. CAC Quality Assurance Task Group.
Use of NIST Standard Reference Materials for Decisions on Performance of Analytical Chemical Methods and Laboratories.
Special pub. (Final).
D. Becker, R. Christensen, L. Currie, B. Diamondstone, K. Eberhardt, T. Gills, H. Hertz, G. Klouda, J. Moody, R. Parris, R. Schaffer, E. Steel, J. Taylor, R. Watters, and R. Zeisler. Jan 92, 33p NIST/SP-829
Also available from Supt. of Docs. as SN003-003-03137-2. See also PB86-110897.

Keywords: *Chemical analysis, *Chemical laboratories, *Guidelines, *Analytical chemistry, Performance evaluation, Experimental design, Statistical analysis, Measurements, Quality assurance, Laboratory equipment, Standards, Bias, Certification, Concentration(Composition), Probability theory, *Standard reference materials.

NIST Standard Reference Materials (SRMs) are used extensively for the evaluation of analytical methods and laboratory performance. It is virtually impossible for SRMs to exactly match the compositions of laboratory samples, and the SRM uncertainty may not be negligible in some applications. As a result, professional judgment and analytical expertise are needed in the selection of the most appropriate SRM. In most cases, some compromises will be inevitable. Notwithstanding these limitations, the use of SRMs is considered to be one of the best available approaches for decisions on the accuracy of measurement data. The document describes specific guidelines and applications for using SRMs to help design measurement protocols and to interpret the accuracy of measurement data.

200,159
PB92-149806 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Intercomparison of Methods for the Identification and Quantitation of Butyltin Species in Aqueous Solution.
Final rept.
W. R. Blair, F. E. Brinckman, and R. Paule. Jan 92, 15p NISTIR-4704
See also PB86-189875. Sponsored by David Taylor Research Center, Annapolis, MD.

Keywords: *Tin organic compounds, *Chemical analysis, *Interlaboratory comparisons, Antifouling coatings, Water pollution, *Butyltins.

A comparison of measurement methods for the quantitation and speciation of butyltin species in water at low parts per trillion (ng/L) concentration levels has been completed with a specially prepared research sample. The report contains a summary of sample preparation techniques, analytical methods used in sample analysis and results of butyltin measurements made on the samples.

200,160
PB92-154236 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Automated Slurry Sample Introduction for Analysis of a River Sediment by Graphite Furnace Atomic Absorption Spectrometry.
Final rept.
M. S. Epstein, G. R. Carnrick, W. Slavin, and N. J. Miller-Ihli. 1989, 6p
Pub. in Analytical Chemistry 61, p1414-1419 1989.

Keywords: *Chemical analysis, *Sediments, *Metals, Rivers, Samplers, Atomic spectroscopy, Spectrum analysis, Performance evaluation, Water pollution detection, Reprints, *Graphite Furnace Atomic Absorption spectroscopy, *Standard reference materials, SRM 2704.

A prototype automated slurry sample introduction (SSI) system is used with a graphite furnace atomic absorption spectrometer (GFAAS) and Zeeman-effect background correction to determine lead, manganese, arsenic, and iron in a standard reference material (SRM) river sediment (SRM 2704). Different methods of slurry preparation are tested, optimum analysis parameters are determined, and sources of variability in the GFAAS measurements are characterized. Measurement variability is found to increase in proportion to the percent of analyte not extracted into the aqueous phase of the slurry solution and is highly dependent on the homogeneity of analyte distribution in the sample. Analytical results for the four elements determined in SRM 2704 are in good agreement with certified values and confirm the utility of SSI combined with GFAAS for analysis of a complex matrix.

200,161
PB92-154459 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Inorganic Analytical Research Div.
Optical Transmittance Standard Reference Materials for Ultraviolet and Visible Molecular Absorption Spectrometry.
Final rept.
J. D. Messman, and M. V. Smith. 1991, 10p
Pub. in Spectrochimica Acta 46B, n12 p1653-1662 1991.

Keywords: *Transmittance, *Optical filters, *Molecular spectroscopy, *Standards, Ultraviolet spectroscopy, Quality control, Accuracy, Reprints, *Standard reference materials, Molecular absorption spectroscopy.

Transmittance accuracy of ultraviolet/visible (UV/Vis) molecular absorption spectrometers is a necessary condition for meaningful intra- and inter-laboratory exchange and comparison of analytical data for research, quality control (QC) and regulatory compliance. Several important instrumental parameters may affect the analytical results of transmittance measurements. Included among the parameters is the accuracy of the transmittance scale which is determined ultimately by the linearity of the detection and signal processing system when other instrumental parameters--including wavelength accuracy, adequate spectral bandpass, stray radiation and photometric precision--are in control. Five optical transmittance Standard Reference Materials (SRMs) for monitoring instrument stability and for verifying the accuracy of the transmittance (or absorbance) scale of the spectrometer are described. As with any optical filter standard for verifying UV/Vis spectrometers, the transmittance SRMs must be used in a judicious manner for meaningful and valid QC measurements and data interpretation. The analytical attributes and limitations of the five transmittance SRMs are discussed to illustrate some of the measurement concerns for using optical filter standards to verify the proper functioning of UV/Vis absorption spectrometers.

200,162
PB92-154590 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Organic Analytical Research Div.
Preparation and Analysis of a River Sediment Standard Reference Material for the Determination of Trace Organic Constituents.
Final rept.
R. E. Rebbert, S. N. Chesler, F. R. Guenther, B. J. Koster, R. M. Parris, M. M. Schantz, and S. A. Wise. 1992, 9p
Pub. in Fresenius Jnl. of Anal. Chem. 342, p30-38 1992.

Keywords: *Trace amounts, *Sediments, *Chemical analysis, Sample preparation, Water pollution detection, Rivers, Gas chromatography, Mass spectroscopy, Aromatic polycyclic hydrocarbons, Polychlorinated biphenyls, Pesticides, Concentration(Composition), Reprints, *Standard reference materials, SRM 1939, SRM 1941.

A river sediment Standard Reference Material (SRM) has been prepared and analyzed for determination of the concentrations of trace organic constituents. SRM 1939, 'Polychlorinated Biphenyls (PCBs) in River Sediment A', has been certified for the concentrations of three PCB congeners using the results obtained from capillary column gas chromatography with electron capture detection (GC-ECD) and from multidimensional (dual column) capillary gas chromatography with mass spectrometric detection (MCGC-MSD). For SRM certification, two independent analytical procedures are usually required. If only one analytical technique is used or if the procedures are not independent, then the concentrations are reported as 'noncertified or informational' values rather than 'certified' values. Noncertified values for 14 additional PCB congeners and five chlorinated pesticides, determined by GC-ECD, are also reported as well as noncertified concentrations for five polycyclic aromatic hydrocarbons (PAHs), determined using gas chromatography with mass spectrometric detection (GC-MSD). SRM 1939 complements SRM 1941, 'Organics in Marine Sediment', since both materials have 12 PCB congeners, five PAHs and five chlorinated pesticides in common. However, the concentrations differ by an order of magnitude for PAHs, and from one to over two orders of magnitude for the PCB congeners and chlorinated pesticides.

200,163
PB92-156736 PC **A05**/MF **A01**
Idaho Univ., Moscow. Dept. of Chemistry.
Expert Systems Approach for Spectra-Structure Correlation for Vapor Phase Infrared Spectra.
Final progress rept. 1 Sep 88-30 Jun 89.
P. R. Griffiths. Mar 91, 83p NIST/GCR-91/587
Grant NANB7D0736
Sponsored by National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.

Keywords: *Expert systems, *Infrared spectroscopy, *Spectrum analysis, *Alcohols, *Aromatic compounds, Algorithms, Qualitative analysis, Molecular structure, Graphs(Charts).

An expert systems approach for correlating molecular structure features with vapor phase infrared spectral data was developed. The approach involved autoscaling the spectral data and subjecting the scaled data to principal components analysis. The method was illustrated by applying it to a library of vapor phase Fourier transform infrared spectra of 102 compounds to distinguish alcohols from nonalcohols and aromatics from nonaromatic compounds.

200,164
PB92-159060 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Organic Analytical Research Div.
Determination of Glycyrrhetinic Acid in Human Plasma by High-Performance Liquid Chromatography.
Final rept.
J. M. Brown-Thomas, R. G. Christensen, R. Rieger, W. Malone, and W. E. May. 1991, 7p
Pub. in Jnl. of Chromatography 568, p232-238 1991.

Keywords: *Glycyrrhetinic acid, *Liquid chromatography, Blood plasma, Extraction, Reprints.

A high-performance liquid chromatographic (HPLC) method has been developed for measuring 18 beta-glycyrrhetinic acid (GRA) in human plasma in the range of 0.1-3 microgram/ml. The acetate ester GRA is added to the plasma as an internal standard, plasma proteins are denatured with urea to release GRA, and the GRA and the internal standard are extracted in an ion-pairing solid-phase extraction process. An isocratic, reversed-phased HPLC separation is used, followed by ultraviolet absorbance detection at 248 nm. The results from the analysis of five GRA-fortified plasma pools show a mean relative standard deviation of 7% and are accurate to within 10%. With evaporative concentration of the extract, the limit of detection for GRA in plasma is approximately 10 ng/ml.

CHEMISTRY

Analytical Chemistry

200,165
PB92-159599 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Versatile Fundamental Alphas Program for Use with Either Tube or Secondary Target Excitation.
Final rept.
L. Feng, P. A. Pella, and B. Cross. 1990, 6p
Pub. in Advances in X-ray Analysis, v33 p509-514 1990.

Keywords: *X-ray analysis, X-ray scattering, Reprints, FLY-FPM computer program, NBSGSC computer program, COLA algorithm, Secondary targets.

Several influence coefficient algorithms have been published which use fundamental parameter equations for correction of interelement effects in x-ray analysis. The Comprehensive Algorithms of Lachance (COLA) is one such algorithm and is used in the program NBSGSC. 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 Kevex x-ray spectrometers which employ both tube and secondary targets for excitation. For direct tube excitation, the NIST tube spectral distribution algorithm is used in this program. For secondary target excitation the radiation is usually treated as being monochromatic, and fundamental parameter expressions 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 tube spectral 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 source x-ray scattering from secondary targets.

200,166
PB92-159607 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Utility of the Laser Microprobe for Source Identification of Carbonaceous Particulate Material.
Final rept.
R. A. Fletcher, and C. A. Currie. 1989, 3p
Pub. in Microbeam Analysis - 1989, p303-305.

Keywords: *Total suspended particulates, *Soot, *Carbon, *Spectrum analysis, *Mass spectroscopy, Air pollution, Aromatic polycyclic hydrocarbons, Microprobes, Lasers, Reprints, *Laser microprobe mass spectrometry.

The laser microprobe mass spectrometer has been applied to examining atmospheric particulate samples and some laboratory generated carbon soots. Effort was directed toward finding features in the spectra that allowed indentification of the source material. Positive ion spectra contain the most information. New results indicate that polyaromatic hydrocarbons may be useful for source identification. Summary of work to data is presented.

200,167
PB92-165265 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Organic Analytical Research Div.
Optimization of an Isocratic High-Performance Liquid Chromatographic Separation of Carotenoids.
Final rept.
N. E. Craft, S. A. Wise, and J. H. Soares. 1992, 6p
Pub. in Jnl. of Chromatography 589, p171-176 1992.

Keywords: *Carotenoids, *Liquid chromatography, Food analysis, Blood serum, Reprints.

Using a polymeric C18 high performance liquid chromatographic (HPLC) column, which demonstrated excellent separation selectivity toward carotenoid compounds in an earlier column evaluation, the effects of mobile phase modifier, modifier concentration, and column temperature were investigated. A seven-component carotenoid mixture was used to monitor changes in separation selectivity in response to variations in HPLC conditions. Both acetonitrile and tetrahydrofuran (THF) improved the resolution of echinenone and alpha-carotene; 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 beta-cartone/ lycopene were better at lower temperatures while echinenone/ alpha-carotene separation improved as temperature increased. An acceptable separation of all seven carotenoids was achieved at 20 C using 5% THF as a mobile phase modifier. Method applicability is demonstrated for serum and food carotenoids.

200,168
PB92-166032 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Office of Standard Reference Materials.
Standard Reference Materials: NBS-ASTM Cooperation.
Final rept.
S. D. Rasberry. 1991, 4p
Pub. in Jnl. of Testing and Evaluation 19, n1 p56-59 Jan 91.

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 initiation of the program in 1975, more than 200 SRM types have been completed and made available to the technical community. Besides describing the cooperative effort, the paper summarizes the status of the metal SRM program at NBS and shows how SRMs, in general, integrate with the standards-writing activities of ASTM. While this shared activity has been very successful over the past 12 years--in fact, a model for industry-government technical cooperation--a difficult technical problem must now be resolved to assure future success. That problem is a growing shortage of classical chemists who are expert in the analytical chemical metrology needed to certify SRMs. A proposal is made that the joint work of ASTM and NBS be expanded to include addressing this serious shortage.

200,169
PB92-166305 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
High Precision Isotopic Measurement of Lithium by Thermal Ionization Mass Spectrometry.
Final rept.
Y. K. Xiao, and E. S. Beary. 1989, 14p
Pub. in International Jnl. of Mass Spectrometry and Ion Processes 94, n1-2 p101-114 1989.

Keywords: *Mass spectroscopy, *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 Li2B4O7 as the loading material has been investigated. The (sup 6)Li(+1)/(sup 7)Li(+1) ion ratio is measured by thermal ionization mass spectrometry using a double filament technique to minimize fractionation. Ideal filament temperatures which prevent decomposition of the Li2B4O7, and promote ionization were established. Li isotopes in standard solutions have been measured with precisions of 0.023% rsd. The effects of sample loading parameters on precision, such as sample size and purity, Li:B ratio, have been evaluated. Using this procedure, Li isotope composition in urine samples have been compared.

200,170
PB92-171214 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Organic Analytical Research Div.
Determination of Methylbenzo(A)Pyrene Isomers in a Coal Tar Standard Reference Material Using Liquid Chromatography and Shpol'skii Spectrometry.
Final rept.
P. Garrigues, J. Bellocq, and S. A. Wise. 1990, 5p
See also PB90-149212.
Pub. in Fresenius Jnl. of Analytical Chemistry 336, n2 p106-110 1990.

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

Concentrations of individual methylbenzo(a)pyrene (MBP) isomers were determined on a coal tar standard reference material (SRM 1597) by using liquid chromatography (LC) (normal and reversed phase) and high resolution Shpol'skii spectrometry (HRS) at 15 K. 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
PB92-171396 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Inorganic Analytical Research Div.
High-Sensitivity Gamma-Ray Counting in Activation Analysis.
Final rept.
R. M. Lindstrom. 1992, 7p
Pub. in Appl. Radiat. Isot. 43, n1-2 p263-269 1992.

Keywords: *Radioactivation 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 samples 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 important source of environmental gamma-ray background is the interactions of cosmic-ray particles with the shield and the detector itself. Application of Cooper's criterion to two excellent modern detectors shows that for the ultimate sensitivity in quantitating a simple spectrum, high efficiency overwhelms good 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 summing corrections are large, when multiplets are present which the detector cannot fully resolve, when the total count rate is high, when background peaks (not continuum) are important, when positioning uncertainty limits the accuracy, or when requirements of sample shape dictate the counting configuration.

200,172
PB92-175074 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Inorganic Analytical Research Div.
Determination of Rare Earth Elements by Liquid Chromatographic Separation Using Inductively Coupled Plasma Mass Spectrometric Detection.
Final rept.
D. S. Braverman. 1992, 4p
Pub. in Jnl. of Analytical Atomic Spectrometry 7, p43-46 Feb 92.

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

High-performance liquid chromatography (HPLC) is used to separate the rare earth elements (REEs) prior to detection by 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 sub-ng/ml range and the response is linear over four orders of magnitude. A preliminary comparison of isotope dilution and external standard results for the determination of REEs in National Institute of Standards and Technology (NIST) Standard Reference Material (SRM 1633a) Fly Ash is presented.

200,173
PB92-175330 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Organic Analytical Research Div.
Analysis of Polychlorinated Biphenyls by Multidimensional Gas Chromatography.
Final rept.
F. R. Guenther, S. N. Chesler, and R. E. Rebbert. 1989, 4p
Pub. in Jnl. of High Resolution Chromatography 12, n12 p821-824 1989.

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

A multidimensional capillary gas chromatographic method that is capable of separating most PCB congeners is described. The method utilizes a non-polar capillary column to initially separate the congeners in boiling point order. The analyte congeners are then heart cut into a liquid crystal capillary column that separates by a molecular shape mechanism. The results of an analysis of river sediments are given.

200,174

PB92-197706 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Gas and Particulate Science Div.
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.
Final rept.
E. E. Hughes, A. J. Davenport, P. T. Woods, and W. L. Zielinski. 1991, 6p
Pub. in Environmental Science and Technology 25, n4 p671-676 1991.

Keywords: *Carbon monoxide, *Carbon dioxide, *Gravimetric analysis, *Gas analysis, Calibration standards, Interlaboratory comparisons, Chemical analysis, Great Britain, Standards, Concentration(Composition), United States, Reprints, *Standard reference materials, National Institute of Standards and Technology, National Physical Laboratory, Foreign technology.

Studies were carried out by the National Physical Laboratory (NPL) in England and the National Institute of Standards and Technology (NIST) in the United States to compare the agreement between primary gravimetric standards developed by these two laboratories. The studies involved the analyses of a set of CO and CO2 NIST SRM's by the NPL and a similar set of NPL primary standards by NIST. In each case, the exact concentration of the exchanged sets were unknown by the analyzing laboratory, and analyses were carried out using primary gravimetrics standards which were independently produced by the two laboratories. The CO and CO2 standards ranged in nominal concentration from 8% to 10 ppm and from 0.5% to 8% respectively. Excellent agreement was found in all standards analyzed by both laboratories. The main difference between the value assigned by the supplying laboratory and the value determined by the analyzing laboratory was less than 0.2% relative for both sets of CO and CO2 standards. The studies confirm that standards produced by NPL and NIST for their respective countries had a high degree of consistency, and that measurements obtained using these standards for ambient air measurements of CO and CO2 levels may be directly intercompared.

200,175

PB92-197755 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Office of Standard Reference Data.
Graphical Handling of Wide-Ranging Data: Graphing of Photon Cross-Section Data.
Final rept.
D. Janezic, M. Penca, B. B. Lide, and D. R. Lide. 1990, 3p
Pub. in Jnl. of Chemical Information and Computer Sciences 30, n1 p30-32 1990.

Keywords: *Photon cross sections, *Data management, *Computer graphics, Algorithms, Photoelectric cross sections, Pair production cross sections, Attenuation coefficients, Scattering coefficients, Chemical analysis, Reprints, XGAM data base, National Institute of Standards and Technology.

Graphical representation of photon cross-section data in the XGAM database, from the National Institute of Standards and Technology (NIST), is described. An algorithm has been designed to manage the very widely ranged data that are encountered in the application. The graphs are all generated on a personal computer (IBM or compatible) and can be used to calculate photon cross sections for scattering, photoelectric absorption, pair production, and total attenuation coefficients for any element, compound, or mixture.

200,176

PB92-236363 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Quantum Metrology Div.
Performance of a Tuneable Secondary X-ray Spectrometer.
Final rept.
S. Brennan, P. L. Cowan, R. D. Deslattes, A. Henins, D. W. Lindle, and B. A. Karlin. 1989, 4p
Pub. in Review of Scientific Instruments 60, n7 pt2B p2243-2246 Jul 89.

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 is critical to studies of x ray excited fluorescent x ray emission spectra. Even with the highest available incident flux of x rays the signal count rate can become unacceptably low when dispersed by an analyzing crystal. This problem is most serious in studies of gas targets, or at low energies where fluorescence yields are low. We have characterized the performance of a spectrometer based on the Rowland circle geometry with a variable radius curved (Johann) analyzing crystal. A position sensitive detector was used so that counts at a range of points on the Rowland circle corresponding to different wavelengths can be recorded in parallel. The efficiency of the spectrometer permits the observation of weak processes, such as subthreshold elastic and elastic x ray scattering from gases. Energy resolution at low energies is sufficient 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

PB92-236991 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Determination of Sulfur in Low Sulfur Steels by Isotope Dilution Thermal Ionization Mass Spectrometry.
Final rept.
W. R. Kelly, L. T. Chen, J. W. Gramlich, and K. A. Hehn. 1990, 6p
Pub. in Analyst 115, n8 p1019-1024 1990.

Keywords: *Sulfur, *Steels, *Mass spectroscopy, 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 using enriched (34)S as an internal standard. The concentrations of sulfur found in these alloys were the following (microg/g S): SRM 1764 - 118.8 + or - 2.4, SRM 1765 - 37.8 + or - 1.1, SRM 1766 - 23.5 + or - 1.5, SRM 1767 - 90.84 + or - 0.96, SRM 132b - 30.27 + or - 0.78 and SRM C2423 - 6.4 + or - 1.23. The uncertainties are 95% confidence intervals and include all known sources of random 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

PB92-237031 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Ion Chromatography and the Certification of Standard Reference Materials.
Final rept.
W. F. Koch. 1989, 4p
Pub. in Jnl. of Chromatographic Science 27, n8 p418-421 1989.

Keywords: *Chemical analysis, *Ion exchange chromatography, Laboratory equipment, Sample preparation, Fuels, Rain, Sulfur, Performance standards, Chlorine, Certification, Botany, Biological materials, Standards, Reprints, *Standard reference materials.

Ion chromatography is used extensively at the National Institute of Standards and Technology in the analysis of Standard Reference Materials. At present, the primary emphasis is on the determination of the nonmetals, especially sulfur and chlorine. Procedures have been developed and instrumentation adapted to improve the accuracy and precision of the technique. Sample preparation is a critical component of the analytical procedure. For combustible materials, the preferred method of sample preparation involves the use of a high-pressure oxygen bomb. The types of materials analyzed include fuels, botanicals, biologicals, and rainwater.

200,179

PB92-237221 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Defocus Modeling Correction for Wavelength Dispersive Digital Compositional Mapping with the Electron Microprobe.
Final rept.
R. B. Marinenko, R. L. Myklebust, D. S. Bright, and D. E. Newbury. 1989, 16p
Pub. in Jnl. Microsc. 155, n2 p183-198 1989.

Keywords: *Electron microprobe analysis, *Defocusing, Digital systems, Mapping, Correction, Pixels, Comparison, Reprints, Wavelength dispersive analysis.

A new, simplified procedure for correcting the defocusing observed in low-magnification digital maps taken with the electron microprobe 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 modelled standard map 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 (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Laser-Enhanced Ionization as an Element Specific Detector for Liquid Chromatography.
Final rept.
G. C. Turk, W. A. MacCrehan, K. S. Epler, and T. C. O'Haver. 1989, 4p
Pub. in Proceedings of International Symposium (4th) on Resonance Ionization Spectroscopy and Its Applications, Gaithersburg, MD., April 10-15, 1988, p327-330 1989.

Keywords: *Ion exchange chromatography, *Detectors, Ion density(Concentration), Ion spectroscopy, Chromatographic analysis, Concentration(Composition), Laser applications, Metals, Chemical analysis, Ionization, Reprints, *Laser-enhanced ionization, *Trialkyltin compounds.

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

200,181

PB92-237593 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.
Qualitative XRF Analysis with Pattern Recognition.
Final rept.
L. I. Yin, and S. M. Seltzer. 1990, 11p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Advances in X-ray Analysis 33, p603-613 1990.

Keywords: *X-ray fluorescence analysis, *Pattern recognition, Qualitative analysis, Correlation coefficients, Field tests, Pigments, Paints, Reprints, Geological 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 whether the chemical composition is changing from one sample to the next. We have investigated the use of pattern-recognition techniques in such applications. It will be demonstrated with experimental data that the pattern-recognition approach is extremely simple and fast. It uses only a single parameter, the normalized correlation coefficient, and can be applied directly to raw data. The efficacy of the method is illustrated with Si(Li) spectra of geological and pigment samples, and proportional counter spectra of geological samples. The pattern-recognition method should be ideally suited for field XRF applications, and the algorithm can be easily implemented on a personal computer.

200,182
PB93-125334 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Thermophysics Div.
Performance Studies of Partial Pressure Analyzers.
Final rept.
L. Lieszkovszky, and A. R. Filippelli. 1990, 2p
Pub. in Vacuum 41, p2142-2143 1990.

Keywords: *Partial pressure, *Pressure measurement, *Mass spectroscopy, Gases, Vacuum apparatus, Pressure dependence, Reprints.

Linearity and stability of the pressure response of five different quadrupole partial pressure analyzers (PPA) has been investigated over the range 10 to the -7th power to 0.1 Pa. Influence of ionizer parameters on both the sensitivity and the linearity of ion signal with pressure was also extensively examined for each PPA. Electron emission current and ion energy had an especially strong influence upon linearity with pressure above about 0.001 Pa. The effect of the presence of a gas different from that being measured was investigated, using Argon as the trace gas in a variety of matrix gases (H2, He, CO, N2, O2, and N2O). No evidence of interference was found except that which can be attributed to the effect of total pressure on linearity, provided that exposure to the matrix gas is not too long (only minutes) and the total pressure does not exceed about 0.0001 Pa. Long and short term stability of the absolute Argon sensitivity was also examined. In a peak monitoring mode at stable low pressures (< 0.0001 Pa), the sensitivity was found to drift by less than 1% in 8 hours. On the other hand, persistent shifts of 10% or even larger in the Argon sensitivities were observed following brief exposures to active gases at total pressures exceeding about 0.0001 Pa.

200,183
PB93-125342 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Thermophysics Div.
Metrological Characteristics of a Group of Quadrupole Partial Pressure Analyzers.
Final rept.
L. Lieszkovszky, A. R. Filippelli, and C. R. Tilford. 1990, 17p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Jnl. of Vacuum Science and Technology A 8, n5 p3838-3854 1990.

Keywords: *Mass spectrometers, Rare gases, Nitrogen, Helium, Argon, Mixtures, Nonlinearity, Sensitivity, Calibration, Linearity, Metrology, Stability, Reprints, *Partial pressure analyzers.

Linearity and stability of the pressure response of five different commercial quadrupole mass spectrometers, and the influence of ion source parameters (emission current, electron energy, and ion energy) on the response has been investigated over the range 10(sup -7) to 10(sup -1) Pa for He, N2, and Ar. The dependence of the signal developed from a constant-pressure (10(sup -6) Pa) trace gas as a function of the pressure of another gas (the matrix) was studied using He and Ar as the trace and matrix, and vice versa. The results demonstrate clearly that the signals from different components of a mixture may not always be independent. Brief exposures to certain active gases (O2, C3H8, CO2) were found to cause shifts as large as 10% in the instruments' inert gas sensitivities (He, N2, Ar). Tens of hours were required to return to pre-exposure sensitivities. Absolute argon sensitivity, monitored over a period of 220 days, for a standard set of operating parameters and with Faraday cup ion detection, showed initial one-directional changes as large as a factor of 2 for one instrument and a scatter of about + or - 20% in all the instruments.

200,184
PB93-125375 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Quality Assurance.
Final rept.
R. M. Lindstrom, and R. R. Greenberg. 1990, 13p
Pub. in Practical Aspects of Operating a Neutron Activation Analysis Laboratory, Chapter 9, p156-168 1990.

Keywords: *Activation analysis, *Quality assurance, Accuracy, Precision, Uncertainty, Standards, Reprints.

Quality assurance comprises a set of experimental and statistical procedures designed to test, systematically and continually, whether a measurement process 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 homogeneous 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, counts, and subsamples, provided 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. Chemical Kinetics and Thermodynamics Div.
NIST/EPA/MSDC Mass Spectral Database: Recent Developments and Innovations.
Final rept.
S. G. Lias, and S. E. Stein. 1989, 1p
See also PB90-254426.
Pub. in Mass Spec. Source XII, p26 1989.

Keywords: *Mass spectroscopy, *Data bases, Molecular structure, Molecular spectra, Personal computers, Reprints.

The old EPA/NIH Mass Spectral Database is now known as the NIST/EPA/MSDC Mass Spectral Database. The 1988 update of that database included spectra of 49,469 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 errors which appeared in earlier versions of the database have been corrected already. The new PC 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 hard 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
PB93-135317 Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.
Optimization of Large Scale Chromatography for Biotechnological Applications.
Final rept.
A. P. Peskin, and S. R. Rudge. 1992, 11p
Pub. in Applied Biochemistry and Biotechnology 34, n35 p49-59 1992.

Keywords: *Biotechnology, *Chromatography, Economic analysis, Pumps, Polymers, 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 models and the mass transfer model of Lapidus and Amundson to generate peaks. 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 rept.
R. L. Myklebust, and C. E. Fiori. 1989, 4p
Pub. in Microbeam Analysis, p219-222 1989.

Keywords: *Microanalysis, *Atomic numbers, Numerical integration, Electron scattering, Backscattering, X rays, Correction, Losses, Reprints, *Electron probe microanalysis.

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

Basic & Synthetic Chemistry

200,188
PB92-144435 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Chemical Kinetics and Thermodynamics Div.
Separation of Beta-Carotene Mixtures Precipitated from Liquid Solvents with High-Pressure CO2.
Final rept.
C. J. Chang, A. D. Randolph, and N. E. Craft. 1991, 4p
Grant NSF-CBT86-16493
Sponsored by National Science Foundation, Washington, DC.
Pub. in Biotechnology Progress 7, n3 p275-278 1991.

Keywords: *Carotenes, *Purification, Crystallization, Precipitation(Chemistry), Carbon dioxide, Solvents, High pressure, Reprints.

Solids precipitation from liquid solvents, with dissolution by high-pressure CO2 as an antisolvent 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 carotene oxidation products. Total beta-carotene was successfully separated from oxides, and an enriched trans-beta-carotene was obtained from its cis isomers. The separation was carried out in both batch and continuous modes. Relative solubility of the analytes and the antisolvent (CO2) have 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-octulopyranose and Its per-O-acetyl Derivative.
Final rept.
M. G. Ambrose, A. J. Fatiadi, and B. Coxon. 1990, 7p
Pub. in Carbohydrate Research 205, p377-383 1990.

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-octulopyranose and 1,3,4,5,8-penta-O-acetyl-2,7-anhydro-L-glycero-beta-D-manno- octulopyranose 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 rept.
M. C. Jones. 1991, 17p
Pub. in Supercritical Fluid Technology: Reviews in Modern Theory and Applications, Chapter 10, p365-381 1991.

Keywords: *Mass transfer, *Extraction, Supercritical fluids, Mathematical models, Reviews, Reprints, *Supercritical extraction, Adsorbent regeneration.

A review is presented of mass transfer in the extraction of materials from solid matrices using supercritical fluids (SCFs) as solvents. The purpose is to assemble the body of knowledge relevant to the quantitative aspects of mass transfer leading to mass-transfer fluxes and extraction times. Experimental results are available from studies of extraction of natural substances and fossil fuels and from the regeneration of industrial adsorbents. Factors relevant to extraparticle mass transfer are also discussed and, in addition, an outline of mathematical models of intraparticle mass transfer is presented leading to estimates of single particle extraction times.

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, NM.
Pub. in Cryogenics 31, p854-861 Oct 91.

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 than offsets the heat transfer gain, so that the net regenerator 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.
A. P. Peskin, M. K. Ko, and J. J. Pellegrino. 1991, 12p
Pub. in Jnl. of Membrane Science 60, p195-206 1991.

Keywords: *Ultrafiltration, *Membranes, *Mathematical models, Mass transfer, Solutes, Concentration(Composition), Reprints.

To characterize ultrafiltration membranes, it is important to understand their intrinsic, macromolecular-rejection properties. Defining these properties in terms of a membrane's permselectivity parameters requires an understanding of the mass transfer of 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 permselectivity 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.
Pub. in Proceedings of ASME (American Society of Mechanical Engineers) Winter Annual Meeting: Heat Transfer and Flow in Porous Media, Dallas, TX., November 25-30, 1990, p17-24.

Keywords: *Packed bed, *Convection, Computational fluid dynamics, Flow visualization, Mathematical models, Porous materials, Fiber optics, Reprints, Porous flow.

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 poured packing materials that are coarse relative to the dimensions of the confining vessel. This introduces a stochastic spatial element, due to an inherent randomness in poured 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.

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
Pub. in ACS (American Chemical Society) Symposium Series 411, p430-436 1989.

Keywords: *Catalysts, *Materials tests, Physical properties, Chemical properties, Ion exchange materials, Catalytic cracking, Silicon dioxide, Aluminum oxide, Catalyst supports, Area, Particle size, Laboratories, Reprints, *Standard reference materials, *Round robin tests.

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 Experiments 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.
Pub. in Proceedings of Symposium on Energy Engineering Sciences (9th), Argonne, IL., May 13-15, 1991, p126-133.

Keywords: *Flow distribution, *Beds(Process engineering), *Flow visualization Fiber optics, Tracer techniques, Fluorescent 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
PB92-236793 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Chemical Engineering Science Div.
HEPROP-88: A Computer Code for Helium Properties.
Final rept.
B. A. Hands, V. Arp, and R. D. McCarty. 1988, 4p
Sponsored by National Aeronautics and Space Administration, Moffett Field, CA. Ames Research Center.
Pub. in Proceedings of International Cryogenic Engineering Conference (12th), Southampton, UK, July 12-15, 1988, p460-463.

Keywords: *Helium, *Transport properties, *Temperature dependence, *Superfluidity, Equations of state, 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/or lack of engineering input parameters. We describe a new code for the range 0.8 to 1500 K, with pressures to the melting line or 10(8) Pascals, 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.

200,197
PB93-135333 Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.
Liquid-Vapor Surface Sensors for Liquid Nitrogen and Hydrogen.
Final rept.
J. D. Siegwarth, R. O. Voth, and S. M. Snyder. 1992, 7p
Contract NASA-C-32009-K
Sponsored by National Aeronautics and Space Administration, Cleveland, OH. Lewis Research Center.
Pub. in Cryogenics 32, n2 p236-242 1992.

Keywords: *Liquid-vapor interfaces, *Optical measuring instruments, *Liquid nitrogen, *Liquid hydrogen, Surfaces, 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 that optical sensors can reliably and rapidly detect the liquid-vapor interface of both hydrogen and nitrogen.

200,198
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
Pub. in Process Control and Quality 2, p59-68 1992.

Keywords: *Separators, Supercritical fluids, Process control, Food processing, Separation, Automation, Drugs, Reprints, *Supercritical fluid extraction, *Sepsol.

The paper describes a simple, automated produce separator (called Sepsol, shortened form for separator/solubilizer) 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 commercial broths or matrices. The device is 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 controller automatically draws product at the appropriate concentration, and provides for compensation of upset conditions.

Photo & Radiation Chemistry

200,199
PB92-154475 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Electron and Optical Physics Div.

CHEMISTRY

Photo & Radiation Chemistry

Photoemission Study of BaO Overlayers Adsorbed on W(110) and Their Interaction with H2O, CO2, and O2.
Final rept.
D. R. Mueller, R. L. Kurtz, R. L. Stockbauer, T. E. Madey, and A. Shih. 1990, 15p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Surface Science 237, p72-86 1990.

Keywords: *Barium oxides, *Monomolecular films, *Water, *Carbon dioxide, *Oxygen, Tungsten, Adsorption, Photoelectric emission, Adsorption, Surface chemistry, Energy levels, Reprints.

The electronic structure of barium oxide overlayers on W(110) and their interaction with H2O, CO2, and O2 has been examined using ultraviolet photo electron spectroscopy. At room temperature water vapor and carbon dioxide react with a c(5 x 1)-BaO monolayer adsorbed on W(110) to produce adsorbed OH and CO3 species. Heating the W(110)-c(5 x 1)-BaO surface following water or carbon dioxide exposure dissociates the adsorbed hydroxide or carbonate. On the lower coverage c(7 x 1)-BaO and c(2 x 4)-BaO adlayers complete dissociation of a fraction of the adsorbed species is evident at room temperature. The interaction 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(100).

200,200
PB92-154608 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Surface and Microanalysis Science Div.
State-Resolved Studies of the Laser-Induced Desorption of NO from Si(111) 7x7: Low Coverage Results.
Final rept.
L. J. Richter, S. A. Buntin, D. S. King, and R. R. Cavanagh. 1992, 15p
Contract DE-AI05-84ER13150
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Physics 96, n3 p2324-2338, 1 Feb 92.

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 x 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 report characterizes the low coverage channel. Most of the energy in the desorbed NO occurs as vibration and translation, with the rotations substantially cooler. The desorption is selective for production of the ground spin-orbit state. The energy partitioning shows strikingly little change as the desorption-laser wavelength was varied from 1907 to 355 nm. This, coupled with a quantitative study of the yield over the same photon energy range and selective coadsorption 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 x 7 reconstructed surface. It is suggested that the surface state hole drives the desorption by neutralization of a NO(-delta) adsorbate.

200,201
PB92-154749 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Measurement of the Internal Electric Field in a Ferroelectric Copolymer of Vinylidene Fluoride and Trifluoroethylene Using Electrochromic Dyes.
Final rept.
N. Tsutsumi, G. T. Davis, and A. S. DeReggi. 1991, 7p
Pub. in Macromolecules 24, n24 p6392-6398 1991.

Keywords: *Vinyl copolymers, *Electric fields, *Fluorohydrocarbons, Polarization(Charge separation), Electrochromism, Dipoles, Spectrophotometry, Ferroelectric materials, Reprints, *Internal electric fields, *Vinylidene fluoride-trifluoroethylene copolymers.

The paper presents a measurement of the internal electric field induced by poling in a ferroelectric copolymer of 75 mol % vinylidene fluoride and 25 mol % trifluoroethylene (VDF-TrFE copolymer) using the electrochromism of dyes, 4-(dimethylamino)-4'-nitrostilbene (DANS) and 2-methyl-4-nitroaniline (MNA), dissolved in the copolymer. As a result of poling, the absorption intensity decreases, the peak position of the original band shifts to longer wavelength, and the width of the band slightly increases. These changes in the absorption spectra of DANS and MNA after removal of the poling field have been interpreted to assess the internal electric field E(sub i) created by the oriented crystallite dipoles in the VDF-TrFE copolymer. E(sub i) values were calculated from an analysis of the differential spectrum after and before poling, using theoretical expressions involving the first and second derivatives of the original spectrum. E(sub i) values increase with increasing remanent polarization P(sub R), achieving a value of 3.4-3.9 MV/cm at P(sub R) = 6.1 microC/square cm after poling at a maximum electric field of 1.15 MV/cm.

200,202
PB92-159755 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Ionizing Radiation Div.
Low-Energy Electron Dose-Distribution Measurements with Thin-Film Dosimeters.
Final rept.
W. L. McLaughlin, H. M. Kahn, M. Farahani, M. L. Walker, J. M. Puhl, M. Seltzer, C. G. Soares, and C. E. Dick. 1991, 10p
Pub. in Beta-Gamma 4, n2-3 p20-29 1991.

Keywords: *Dosimetry, *Radiation curing, Electron beams, Crosslinking, Dosimeters, Thin films, Polymers, Reprints, *Radiochromic films, *Film dosimeters, Dose distributions.

The cross linking of polymeric webs, tubings, sheaths, and coatings by low-energy electron beams (150-400 keV) can be designed and operated with greater control by the precise measurement of absorbed dose distributions. Lateral- and depth-dose profiles are measured with accuracy using calibrated thin plastic dosimeter films interleaved in polymeric layers irridiated with stationary or scanned low-energy electron beams. Three types of very thin radiochromic films, Nylon base (FWT-60-00 (TM)), polychlorostyrene base (FWT-67-20 (TM)), and coated polyester (GafChromic (TM)) were calibrated and used for these measurements. Comparisons of the experimental results with Monte Carlo calculations of the central-axis depth dose for perpendicular incidence show agreement, except at the shallow depth in plastic absorbers, where disagreement may be partly due to the effects of electric charge accumulation in the insulating absorber. It is demonstrated that these three types of film dosimeters are useful for electron-beam diagnostics, giving high spatial resolution, accuracy, and precision in the measurement of dose distributions, due to the very thin and uniform radiographic imaging layer and the absence of dose-rate dependence of response to radiation.

200,203
PB92-160001 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Ionizing Radiation Div.
Hot Particle Dosimetry Using Extrapolation Chambers and Radiochromic Foils.
Final rept.
C. G. Soares, P. J. Darley, M. W. Charles, and J. W. Baum. 1991, 5p
Pub. in Radiation Protection Dosimetry 39, n1/3 p55-59 1991.

Keywords: *Dosimetry, *Radioactive aerosols, *Foils(Materials), *Extrapolation chambers, *Radiochromatography, Point sources, Hot atom chemistry, Comparison, Calibrating, Radiochemistry, Strontium 90, Yttrium 90, Radioaction protection, Reprints.

Results are presented of a comparison between extrapolation chambers and radiochromic foils for the dosimetry of small radioactive ('hot') particles. While it is possible to measure average dose over arbitrary areas using both methods, the radiochromic foil method has the advantage of displaying full two-dimensional dose distributions with a single measurement. With multiple layers of foils, three dimensional dose distributions are measurable. The foils used employ a new, relatively sensitive emulsion which is 6-8 micrometers thick and coated on a 0.1 mm thick polyester base. They require no processing; upon irradiation a very fine-grained, stable, blue image forms which is nearly linear over an absorbed dose range of 0.05 to 1.2 kGy. The readout is done with a scanning laser microdensitometer at a wavelength of 633 nm: a 100 micrometers diameter spot size is used which can be stepped in two dimensions in increments as small as 40 micrometers. The foils used for the study were calibrated using (90)Sr/(90)Y beta particle spectra and were found to respond nearly identically to (60)Co gamma rays. Results from such radiochromic foil measurements are compared with measurements with the same source using an extrapolation chamber. Pitfalls in the use of extrapolation chambers for these surface dose rate measurements are explored, including the effect of non-linear current relative to air gap functions on extrapolated slopes.

200,204
PB92-166180 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Radiation Source and Instrumentation Div.
Fast Pulse Amplifier for Pulse Radiolysis Measurements with Digitally Controlled DC Offset.
Final rept.
D. Tirosh, and J. K. Whittaker. 1989, 5p
Pub. in Nuclear Instruments and Methods in Physics Research 275, n2 p373-377 1989.

Keywords: *Pulse amplifiers, *Radiolysis, Digital circuits, Absorption spectra, Signal processing, Photomultipliers, Photodetectors, Reprints.

An amplifier circuit is described which uses digitally controlled means to remove the constant DC signal from the output of a photomultiplier photodetector used as a sensor in a pulse radiolysis measurement system. This enables the small absorption signal to be measured with much greater accuracy.

200,205
PB92-171040 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Physics Div.
Overtone-Excited HN3 (X tilde (sup 1) A'): Anharmonic Resonance, Homogeneous Linewidths, and Dissociation Rates.
Final rept.
B. R. Foy, M. P. Casassa, J. C. Stephenson, and D. S. King. 1990, 8p
See also PB90-117425.
Pub. in Jnl. of Chemical Physics 92, n5 p2782-2789 1990.

Keywords: *Nitrogen hydrides, Vibrational states, Electron transitions, High resolution, Molecular spectroscopy, Molecular beams, Line width, Time domain, Photodissociation, Predissociation, Reprints, Overtone spectroscopy.

High-resolution spectra have been obtained for the predissociative N-H stretching overtone levels 5nu1 (15,120/cm) and 6nu1 (17,670/cm) of HN3, cooled in a free-jet expansion. The spectral bandwidth (Doppler limited at 0.007/cm FWHM) is sufficiently narrow to reveal the homogeneous linewidths of individual rovibrational transitions in the 6nu1 band, for which the authors previously measured the dissociation lifetime in time-domain experiments. Two distinct manifestations of vibrational coupling characterize the spectra: (a) anharmonic mixing of the N-H stretch with other vibrational motions to give a complex spectrum of vibrational eigenstates and (b) homogeneous widths of the resultant states determined by the dissociation lifetime. The results are discussed with reference to previous overtone spectroscopy and intramolecular mixing. Time-domain measurements of dissociation rates are reported for four vibrational levels in the range 15100/cm to 17700/cm.

200,206
PB92-197672 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.
Demonstrated Measurement Traceability for Nuclear Power Radiochemistry Departments.
Final rept.
D. D. Hoppes. 1990, 4p
Pub. in Radioact. Radiochem. 1, n1 p9-12 1990.

Keywords: *Radiochemistry, *Radioisotopes, Nuclear energy, Measurement, Reprints, US Council for Energy Awareness, US NIST, Traceability.

Demonstrated measurement traceability to national standards for radionuclides has been recognized as a desireable concept for almost twenty years. The article describes the development of realistic programs at the National Institute of Standards and Technology (formerly the National Bureau of Standards) for realizing the concept in different fields. The emphasis is on a joint program for nuclear power radiochemistry departments, commercial service laboratories, and commercial-reference-material suppliers organized with the U.S. Council for Energy Awareness.

200,207
PB92-236223 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.
Chain-Propagation Length of Linoleic Acid Peroxidation in Aqueous Monomeric and Micellar Systems.
Final rept.
M. AlSheikhly, and M. G. Simic. 1989, 4p
Pub. in Jnl. of Physical Chemistry 93, n8 p3103-3106 1989.

Keywords: *Linoleic acid, *Polymerization, *Peroxy radicals, Micelles, Aqueous solutions, Moleculer structure, Chain length, Antioxidants, Reprints, *Peroxidation, Chain length, Oxygen uptake.

The chain-propagation (CPL) length of radiation induced autoxidation of linoleic acid in aqueous solutions was determined by oxygen uptake measurements for various states of aggregation (monomeric, oligomeric, spherical, and rod-shaped micelles) of the acid at pH 9. The theoretically expected linear oxygen uptake vs dose rate to the 0.5 power relationship was found to follow the Russell mechanism and to hold only for monomeric and small oligomeric aggregates over a temperature range of 0-50 C. Large increases in chain length with increasing structural features (e.g., 2 and 18 for oligomeric and rod-shaped micelles at 22 C, and 0.01 Gy/sec) and temperature (e.g., 0 at 0 C and 7 at 48 C) were explained by entropic and thermokinetic factors.

200,208
PB92-237361 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.
Photon Fluence Spectra and Absorbed Dose in Water Irradiated by Cladded (60)Co Source Plaques.
Final rept.
S. M. Seltzer. 1990, 5p
Pub. in Radiat. Phys. Chem. 35, n4-6 p703-707 1990.

Keywords: *Radiation doses, *Gamma ray spectra, Monte Carlo method, Gamma irradiation, Dosimeters, Water, Cobalt 60, Reprints, Radiation processing.

It seems there are little or no quantitative data on the photon fluence spectra as a function of depth in a product that pertain to the irradiation by large plaque sources used in radiation processing. Such data can be used to determine absorbed-dose correction factors for dosimeters whose energy response differs from that of the product material. The present work describes Monte Carlo calculations that have been done to obtain this information. The assumed configuration typifies the irradiation of a unit-density product by a large plaque source comprised of a uniform distribution of AECL Type C-188 source pencils. The calculations take into account pair-production, Compton, and photoelectric interactions in the (60)Co slug, the Zircalloy/steel inner/outer capsule wall materials, and the 45-cm thick water targets on both sides of the plaque source. The calculated photon fluence spectra are used to assess the ratio of the dose in various thick dosimeters to that in the water product. Dosimeter materials of C, LiF, Li2B4O7, SiO2, PMMA, nylon, and alanine and of ferrous sulfate, ceric sulfate, K-Ag dichromate, and ethanol-chlorobenzene solutions have been considered.

200,209
PB93-125276 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.
National Ionizing Radiation Secondary Calibration Laboratory System.
Final rept.
K. G. W. Inn, H. T. Heaton, K. C. Duvall, and B. M. Coursey. 1990, 6p
See also PB92-154335.
Pub. in Radioactivity and Radiochemistry, p17-22 1990.

Keywords: *Calibrating, *Quality assurance, *Ionizing radiation, *Health physics, Laboratory equipment, Certification, Standards, Radiochemistry, Environmental surveys, Radiation dosage, Radiation protection, Bioassay, Radiation effects, Performance evaluation, Laboratories, Reprints, *National Ionizing Radiation Secondary Laboratory System.

One mechanism that ORM invokes to improve the national radiation measurement base is the creation of programs for the National Ionizing Radiation Secondary Laboratory System to allow NIST to leverage its resources to significantly impact the quality of measurements at the user level. Presently, there are four secondary calibration laboratory programs in place which impact the state medical diagnostics and radiation protection needs, personnel radiation dosimetry sector, radiation survey instruments, and hospital radiation therapy facilities. Programs for federally owned laboratories, radiation processors, radiobioassay, and survey instrument type testing and certification are underway. New efforts for radon, environmental radioassay, and commercial radioactivity standards are being initiated. Benefits that the user community enjoy from this system include: assurance of product quality, demonstrated integrity of services, satisfaction of regulatory requirements, defense for litigation, public reassurance, cost effective and competitive operations, consistent technical assessments, reduced number of audits, and real input into the development of programs which impact its operations directly.

Physical & Theoretical Chemistry

200,210
AD-A253 551/6 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Molecular Physics Div.
Vibrational Spectra of Molecular Ions Isolated in Solid Neon: HCCH+ and HCC-.
D. Forney, M. E. Jacox, and W. E. Thompson.
c1992, 13p ARO-25664.12-CH
Contract ARO-MIPR-120-90
Availability: Pub. in Jnl. of Molecular Spectroscopy, v153 p680-691 1992. Available to DTIC users only. No copies furnished by NTIS.

Keywords: *Neon, *Solids, *Molecular ions, *Vibrational spectra, *Acetylenes, Reprints, Cations, Excitation, Carbon, Ground state, Argon, Chemical bonds, Microwave discharges, Polarizability, Stretching.

When a Ne:C2H2 sample is codeposited at approximately 5 K with a beam of neon atoms that has been excited in a microwave discharge, a sharp, prominent absorption assigned to upsilon(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, as well as the determination of the stretching and stretching-inter-action force constants. The absorptions of the carbon-13 substituted acetylene cations have also been 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-P007 915/2 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. Buntin, D. S. King, and R. R. Cavanagh. 22 May 92, 4p
Contract AI05-84ER13150
This article is from the 'Optical Society of America (OSA) Photonic Science Topical Meeting Series. Volume 3. The Microphysics of Surfaces: Beam-Induced Processes. Held in Santa Fe, New Mexico on 11-13 Feb 1991,' AD-254-135, p68-71. Supported in part by Department of Energy, Washington, DC.

Keywords: *Nitrogen oxides, *Silicon, Adsorbates, Coordinates, Heating, Photons, Semiconductors, Substrates, Energy transfer, Radiation pressure, Surface chemistry, *Laser induced desorption, *Nitrogen oxide(NO), Component Reports.

A wide variety of chemical processes at semiconductor surfaces have been observed to be promoted by radiation. 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 adsorbate 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 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.

200,212
PB92-144187 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Thermophysics Div.
Ellipsometry of the Liquid-Vapor Interface Close to the Critical Point; A Theoretical Analysis.
Final rept.
D. Bedeaux, E. M. Blokhuis, and J. W. Schmidt.
1990, 12p
See also PB87-161840.
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 may be written as the sum of three contributions. The first is found using Drude's formula and the dielectric constant profile which follows from the Fisk-Widom density profile. The second contribution is due to capillary wave like fluctuations of the position of the interface. Finally the third contribution is due to fluctuations of the density profile around the Fisk-Widom 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 in a binary fluid if one makes the necessary replacements.

200,213
PB92-144310 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Thermophysics Div.
Dynamic Electric Microfield in Ionic and Polar Media.
Final rept.
L. Blum, and J. B. Hubbard. 1990, 4p
See also AD-A222 534.
Pub. in Chemical Physics Letters 167, n4 p325-328 1990.

Keywords: *Electric fields, *Condensates, *Variations, *Stochastic processes, Probability theory, Correlations, Reprints.

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

200,214
PB92-144377 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
Energy Transfer from Optoacoustic Measurements and Fourier Transform Deconvolution.
Final rept.
W. Braun, B. C. Cadoff, I. Price, and N. C. Peterson. 1989, 19p
Pub. in International Jnl. of Chemical Kinetics 21, n11 p1029-1047 1989.

Keywords: *Sulfur hexafluoride, Discrete Fourier transforms, Carbon dioxide lasers, TEA lasers, Energy transfer, Acoustooptics, Argon, Reprints.

The rate of V->R,T energy relaxation following pulsed IR laser excitation is measured by employing an optoacoustic single pulse method. Under present experimental conditions, the operation of convolution applies. The experimental optoacoustic waveform can be viewed as the convolution of the kinetic relaxation waveform with an optoacoustic waveform obtained under very fast energy relaxation conditions. A discrete Fourier transform deconvolution method is applied to optoacoustic measurements on SF6 in argon to obtain the time constant, tau, or energy transfer. The present method gives tau P = 182 + or - 15 micros 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 convolution to apply, the differential equation describing the pressure pulse must be linear under the conditions of the experiment. The linearity of the system can usually be tested experimentally.

200,215
PB92-144401 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Thermophysics Div.
Vapor-Liquid Equilibrium for the Binary Systems of Nitrogen, Carbon Dioxide, and n-Butane at Temperatures from 220 K to 344 K.
Final rept.
T. S. Brown, V. G. Niesen, E. D. Sloan, and A. J. Kidnay. 1989, 8p
Pub. in Fluid Phase Equilibria 53, p7-14 Dec 89.

Keywords: *Binary mixtures, *Carbon dioxide, *Nitrogen, *Butanes, *Thermodynamic equilibrium, *Phase studies, Density(Mass/Volume), Mathematical models, Reprints, *Vapor liquid equilibrium.

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 311 to 394 K. The data were modeled with two commercial software packages, DDMIX and Equi-phase.

200,216
PB92-144633 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Thermophysics Div.
Thermophysical Properties of Gaseous Refrigerants from Speed-of-Sound Measurements. 3. Results for 1,1-Dichloro-2,2,2-Trifluoroethane (CHCl2-CF3) and 1,2-Dichloro-1,2,2-Trifluoroethane (CHClF-CClF2).
Final rept.
A. R. H. Goodwin, and M. R. Moldover. 1 Oct 91, 7p
Sponsored by Department of Energy, Washington, DC., American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA., and Environmental Protection Agency, Washington, DC.
Pub. in Jnl. of Chemical Physics 95, n7 p5236-5242, 1 Oct 91.

Keywords: *Refrigerants, *Fluorohydrocarbons, *Specific heat, Equations of state, Virial equation, Molecular relaxation, Acoustic velocity, Thermodynamic properties, Reprints.

The speed of sound in gaseous 1,1-dichloro-2,2,2-trifluoroethane (CHCl2CF3, commonly known as R123) 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 acoustic virial coefficients have been calculated from the results. The second and third acoustic virial coefficients are used to estimate the density virial coefficients B(T) and C(T) and an effective square-well potential. The acoustic estimates of B(T) and C(T) are consistent with B(T) and C(T) deduced from high-quality (p,Vm,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 (CHClF-CClF2, commonly known as R123a). This isomer of R123 is a significant impurity in R123 as manufactured and used. The authors provided estimates of the vibrational relaxation time for R123.

200,217
PB92-144724 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
Proton Affinities of Styrene, Trans-beta-Methylstyrene, and Indene: A Theoretical and Experimental Study.
Final rept.
S. A. Kafafi, M. Mautner, and J. F. Liebman. 1990, 5p
Pub. in Struct. Chem. 1, n1 p101-105 1990.

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/mol. The lower basicity of trans-beta-methylstyrene compared to styrene is due to the greater stabilizing effect of the methyl group in the neutral species compared to the cation.

200,218
PB92-144799 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Molecular Physics Div.
Ground Torsional State of Acetaldehyde.
Final rept.
I. Kleiner, J. T. Hougen, R. D. Suenram, F. J. Lovas, and M. Godefroid. 1991, 12p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Molecular Spectroscopy 148, p38-49 1991.

Keywords: *Acetaldehyde, *Ground state, Fourier transform spectrometers, Rotational states, Vibrational states, Least squares method, Microwave spectroscopy, Mathematical models, Torsion, 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), and a conventional Stark spectrometer in the region from 45 to 116 GHz (typical measurement uncertainty 40 kHz). These new ground state measurements and remeasurements have permitted a much better fit 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.

200,219
PB92-144955 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Thermophysics Div.
Alternative Refrigerant Properties Measurement and Correlation Program at NIST (National Institute of Standards and Technology).
Final rept.
G. Morrison. 1991, 8p
Sponsored by Department of Energy, Washington, DC., Electric Power Research Inst., Palo Alto, CA., and American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA.
Pub. in Pure and Applied Chemistry 63, n10 p1465-1472 1991.

Keywords: *Refrigerants, Equations of state, Dielectric properties, Acoustic velocity, Surface tension, Vapor pressure, Virial coefficients, Density, Reprints, US NIST.

The activities in the Thermophysics Division at NIST to produce both property measurements and correlations are discussed. These activities are directed toward providing information about materials 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.

200,220
PB92-145069 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Biotechnology Div.
Mobility Variance Determined from AC Electrophoretic Light Scattering.
Final rept.
B. Robertson. 1991, 4p
See also PB91-189514.
Pub. in Jnl. of Chemical Physics 95, n6 p3873-3876, 15 Sep 91.

Keywords: *Light scattering, Electrophoresis, Electric fields, Correlation functions, Variance(Statistics), Autocorrelation, Suspensions, Mobility, Reprints.

The homodyne correlation function for light scattered from an aqueous suspension of particles in a uniform oscillating electric field is calculated assuming the mobility varies from particle to particle. The correlation function has an exponential decay that is modulated at frequency omega/2pi with amplitude (1.E/sigma)squared <Delta (mu squared)>, where q is the scattering vector, E and omega/2pi are the amplitude and frequency of the oscillating field, and <Delta (mu squared)> is the variance of the mobility of the particles. The variance can be determined by fitting the theoretical correlation function to homodyne photon autocorrelation measurements. The technique has the advantage of insensitivity to convection of the particles from heating by the applied electric field.

200,221
PB92-145119 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Quantum Metrology Div.
Anisotropy of Polarized X-ray Emission from Molecules.
Final rept.
S. H. Southworth, D. W. Lindle, R. Mayer, and P. L. Cowan. 1991, 4p
See also PB91-175562.
Pub. in Physical Review Letters 67, n9 p1098-1101, 26 Aug 91.

Keywords: Emission spectra, Polarization(Waves), Excitation, Anisotropy, Reprints, *Chlorotrifluoromethane, X-ray emission.

Strongly anisotropic, polarized Cl 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.

200,222
PB92-148063 Not available NTIS
American Chemical Society, Washington, DC.
Journal of Physical and Chemical Reference Data, Volume 20, Number 4, July/August 1991.
Bimonthly rept.
D. R. Lide. c1991, 168p
See also PB92-148071 through PB92-148105 and PB92-110212. 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, 1115 16th St., NW, Washington, DC. 20036-9976.

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

Contents:
- Chemical Kinetic Data Base for Propellant Combustion. I. Reactions Involving NO, NO2, HNO, HNO2, HCN, and N2O;
- Ab-Initio Calculations and Ideal Gas Thermodynamic Functions of Cyclopentadiene and Cyclopentadiene 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.

200,223
PB92-148071 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
Chemical Kinetic Data Base for Propellant Combustion. 1. Reactions Involving NO, NO2, HNO, HNO2, HCN and N2O.
W. Tsang, and J. T. Herron. c1991, 55p
Included in Jnl. of Physical and Chemical Reference Data, v20 n4 p609-663 Jul/Aug 91. Available from American Chemical Society, 1155 16th St., NW, Washington, DC. 20036-9976.

Keywords: *Reaction Kinetics, *Combustion, *Propellants, Transport properties, Nitrogen oxides, Chemical equilibrium, Chemical reactions, Hydrogen, Oxygen, Oxygen compounds, Carbon monoxide, RDX, Explosives, Cyanides, Tables(Data).

The publication contains evaluated chemical kinetic data on a number of single elementary reactions involving small polyatomic molecules which are of importance in propellant combustion. The work involves the collection and evaluation of mechanistic and rate information and the use of various methods for the extrapolation and estimation of rate data where information does not exit. The conditions covered range from 500-2500K and 10 to the 17 power - 10 to the 22 power particles/cu cm. The results of the first years effort lead to coverage of all pertinent reactions of the following species; H, H2, H2O, O, OH, HCHO, CHO, CO, NO, NO2, HNO HNO2, HCN, and N2O. (Copyright (c) 1991 by the U.S. Secretary of Commerce.)

200,224
PB92-148089 Not available NTIS
Technion - Israel Inst. of Tech., Haifa.
Ab-Initio Calculations and Ideal Gas Thermodynamic Functions of Cyclopentadiene and Cyclopentadiene Derivatives.
M. Karni, I. Oref, and A. Burcat. c1991, 19p
Included in Jnl. of Physical and Chemical Reference Data, v20 n4 p665-683 Jul/Aug 91. Available from American Chemical Society, 1155 16th St., NW, Washington, DC. 20036-9976.

Keywords: *Thermodynamic properties, *Molecular orbitals, *Cyclopentadiene, Cycloalkenes, Combustion, Fuels, Ideal gas, Molecular structure, Enthalpy, Thermochemistry, Entropy, Free radicals, Tables(Data), Moments of inertia, Molecular vibrations, Specific heat, *Ab-initio calculations.

Analysis of recent experiments in combustion kinetics of cyclopentene (6), requires knowledge of the thermodynamic parameters of cyclopentadienyl radicals. Structures, frequencies and energies, ideal gas thermodynamic properties and values, have been calculated for cyclopentadiene, cyclopentadienols, and a number of radicals derived from them. The necessary molecular information for these calculations was found by ab-initio molecular orbital calculations. The geometries, vibrational frequencies and moments of inertia of 8 species are reported. In order to estimate the accuracy of the computations the molecular parameters were compared with known values reported in the literature whenever those were available. (Copyright (c) 1991 by the U.S. Secretary of Commerce.)

200,225
PB92-148097 Not available NTIS
R and D Associates, Los Angeles, CA.
Improved Fits for the Vibrational and Rotational Constants of Many States of Nitrogen and Oxygen.
R. R. Laher, and F. R. Gilmore. c1991, 28p
Contract DNA-001-88-C-0046
Sponsored by Defense Nuclear Agency, Washington, DC.
Included in Jnl. of Physical and Chemical Reference Data, v20 n4 p685-712 Jul/Aug 91. Available from American Chemical Society, 1155 16th St., NW, Washington, DC. 20036-9976.

Keywords: *Nitrogen, *Oxygen, *Molecular vibration, *Molecular rotation, *Constants, Molecular energy levels, Excitations, Ions, Graphs(Charts), Tables(Data), Spectrum analysis.

All pertinent measurements of the vibrational intervals delta G (upsilon + 1/2) and rotational constants b(sub upsilon) for 11 states of N2, four states of N2(+), the ground state of O2, and four states of O2(+) that could be found in published papers have been assembled and plotted against upsilon. (These are the states important in modeling the fluorescence produced when air is bombarded by fast electrons.) These values of delta G and B(sub upsilon) are compared with values calculated from the standard polynomials in powers of upsilon + 1/2, using the coefficients tabulated by Huber and Herzberg (1979), as well as coefficients derived by later analysts, when available. In about 25 percent of the states considered, the coefficients of Huber and Herzberg are found to still yield good fits to the latest available spectroscopic data. In another 25 percent, good fits are obtained from more recently published coefficients. For the remaining 50 percent of the states, new improved coefficients have been derived by least-squares fitting. The results are tabulated and plotted. (Copyright (c) 1991 by the U.S. Secretary of Commerce.)

200,226
PB92-148105 Not available NTIS
Leeds Univ. (England).
Solubilities of Solids and Liquids of Low Volatility in Supercritical Carbon Dioxide.
K. D. Bartle, A. A. Clifford, S. A. Jafar, and G. F. Shilstone. c1991, 42p
Included in Jnl. of Physical and Chemical Reference Data, v20 n4 p713-756 Jul/Aug 91. Available from American Chemical Society, 1155 16th St., NW, Washington, DC. 20036-9976.

Keywords: *Carbon dioxide, *Solubility, *Solids, *Liquids, *Solutes, Supercritical fluids, Temperature, Pressure, Tables(Data), Gravimetric analysis, Chromatographic analysis, Phase studies, Phase stability, Equations of state, Graphs(Charts), Spectrum analysis.

A table is given of the compounds of low volatility, whose experimental solubilities in supercritical carbon dioxide have been published up to the end of 1989, with the temperature and pressure ranges of the experimental measurements, the experimental method, and references to the source of data. The 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 a table. Procedures for estimating, 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.
Journal of Physical and Chemical Reference Data, Volume 20, Number 5, September/October 1991.
Bimonthly rept.
D. R. Lide. c1991, 289p
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.

Keywords: *Thermodynamic properties, *Energy levels, Aluminum ions, Krypton ions, Oxygen, Water, Steam, Multicharged ions, Wavelengths, Tables(Data).

Contents:
- Wavelengths and Energy Level Classifications for the Spectra of Aluminum (Al I through Al XIII);
- Energy Levels of Krypton, Kr I through Kr XXXVI;
- 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.

200,228
PB92-148121 Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD.
Wavelengths and Energy Level Classifications for the Spectra of Aluminum (Al I through Al XIII).
V. Kaufman, and W. C. Martin. c1991, 82p
Included in Jnl. of Physical and Chemical Reference Data, v20 n5 p775-858 Sep/Oct 91. Available from American Chemical Society, 1155 16th St., NW, Washington, DC. 20036-9976.

Keywords: *Aluminum ions, *Aluminum, *Energy levels, *Wavelengths, Atomic energy levels, Atomic spectra, Multicharged ions, Positive ions, Tables(Data).

Wavelengths and their classifications have been compiled for the spectra of the atom and all positive ions of aluminum (Z=13). The selections of data are based on the compilations of energy levels by Martin and Zalubas (1979, J. Phys. Chem. Ref. Data 8, 817-864), with some updating from the more recent literature. Wavelengths (or wavenumbers) 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 wherever 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 most 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 Al I through Al III and the other Al IV through Al XIII. (Copyright (c) 1991 by the U.S. Secretary of Commerce.)

200,229
PB92-148139 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Atomic Physics Div.
Energy Levels of Krypton, Kr I through Kr XXXVI.
J. Sugar, and A. Musgrove. c1991, 57p
Sponsored by Department of Energy, Washington, DC. Office of Magnetic Fusion Energy.
Included in Jnl. of Physical and Chemical Reference Data, v20 n5 p859-915 Sep/Oct 91. Available from American Chemical Society, 1155 16th St., NW, Washington, DC. 20036-9976.

Keywords: *Krypton ions, *Krypton, *Energy levels, Atomic energy levels, Multicharged ions, Ionized gases, Spectra, Tables(Data).

The energy levels of the krypton atom, in all stages of ionization for which experimental data are available, have been compiled. No data has yet been published for Kr XI through Kr XVII. For H-like krypton very accurate calculated level values are compiled. In all, data for 29 spectra are given. Experimental g-factors are included for Kr I and Kr II. Calculated percentage compositions of levels are given for 12 ions. A value for the ionization energy of each ion, either experimental or theoretical, is included. (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.
R. B. Stewart, R. T. Jacobsen, and W. Wagner.
c1991, 105p
Prepared in cooperation with Ruhr Univ., Bochum (Germany, F.R.). Inst. fur Thermo- und Fluiddynamik. Included in Jnl. of Physical and Chemical Reference Data, v20 n5 p917-1021 Sep/Oct 91. Available from American Chemical Society, 1155 16th St., NW, Washington, DC. 20036-9976.

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 has been used for the calculation of the property tables presented here, and for comparisons of calculated properties to the experimental data. The formulation by Stewart and Jacobsen is used 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 densities and the ideal gas heat capacity are included. Functions for calculating internal energy, enthalpy, entropy, isochoric heat capacity (Cv), isobaric heat capacity (Cp) and velocity of sound are also 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 0.10 percent, heat capacities within 2.0 percent, and velocity of sound values within 1.0 percent. These uncertainty values 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.
H. Sato, K. Watanabe, J. M. H. L. Sengers, J. S. Gallagher, P. G. Hill, J. Straub, and W. Wagner.
c1991, 22p
Prepared in cooperation with National Inst. of Standards and Technology (NML), Gaithersburg, MD. Thermophysics Div., British Columbia Univ., Vancouver. Dept. of Mechanical Engineering, Technische Univ. Muenchen (Germany, F.R.), and Ruhr Univ., Bochum (Germany, F.R.). Inst. fuer Thermo- und Fluiddynamik. Included in Jnl. of Physical and Chemical Reference Data, v20 n5 p1023-1044 Sep/Oct 91. 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, Density, Enthalpy, Virial coefficients, Temperature dependence, Tables(Data).

As part of the activities of the International Association for the Properties of Water and Steam, all reliable sources of experimental data on the thermodynamic properties of ordinary (light) water and steam have been collected and converted to common temperature, pressure, volume, mass and heat scales. 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 those 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 total data collection contains approximately 16,000 data points and covers a century of experimental work at temperatures from 253 to 1273 K and pressures up to 1 GPa. The report characterizes the data and gives the literature references. The actual data collection is available in computerized form. (Copyright (c) 1991 by the U.S. Secretary of Commerce.)

200,232
PB92-148162 Not available NTIS
American Chemical Society, Washington, DC.
Journal of Physical and Chemical Reference Data, Volume 20, Number 6, November/December 1991.
Bimonthly rept.
D. R. Lide. c1991, 346p
See also PB92-148170 through PB92-148220 and PB92-148113. Errata sheet inserted. 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.

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.

200,233
PB92-148170 Not available NTIS
Ruhr Univ., Bochum (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.
U. Setzmann, and W. Wagner. c1991, 95p
Included in Jnl. of Physical and Chemical Reference Data, v20 n6 p1061-1155 Nov/Dec 91. Available from American Chemical Society, 1155 16th St., NW, Washigton, DC 20036-9976.

Keywords: *Equations of State, *Thermodynamic properties, *Methane, Tables(Data), Pressures, Specific heat, Helmholtz free energy, Enthalpy, Phase transformation, Ideal gas, 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 explicit in the Helmholtz free energy. A new strategy for optimizing the structure of empirical thermodynamic correlation equations was used to determine the functional form of the equation. The Helmholtz function containing 40 fitted coefficients was fitted to selected experimental data of the following properties: (1) thermal properties of the single phase (P rho T) and (2) of the liquid-vapor saturation curve (P(sub s)rho' rho') including the Maxwell criterion, (3) speed of sound w, (4) isochoric heat capacity c upsilon, (5) isobaric heat capacity c(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 melting pressure as functions of temperature. 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 calculated property values are compared with selected experimental results and existing equations of state for methane. (Copyright (c) 1991 by the U.S. Secretary of Commerce.)

200,234
PB92-148188 Not available NTIS
National Aeronautics and Space Administration, Cleveland, OH. Lewis Research Center.
Thermodynamic Properties of the Aqueous Sulfuric Acid System to 350 K.
F. J. Zeleznik. c1991, 44p
Included in Jnl. of Physical and Chemical Reference Data, v20 n6 p1157-1200 Nov/Dec 91. Available from American Chemical Society, 1155 16th St., NW, Washington, DC. 20036-9976.

Keywords: *Thermodynamic properties, *Sulfuric acid, Electrolytes, Liquid phases, Specific heat, Enthalpy, Melting points, Electromotive force, Tables(Data), Osmosis, Activity coefficients, Heat of fusion, Solid phases, Gibbs free 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 composition from pure water to pure acid. The pure phases included anhydrous sulfuric acid, five of its hydrates and ice. Experimental data which were used in the correlation included measurements of the enthalpy of dilution, both solution and pure phase heat capacities, electromotive force and solution freezing points. The correlation yielded mutually consistent expressions for the Gibbs energy of each phase and these functions generally reproduce the experimental data to + or - 0.75 percent. The Gibbs energy functions of the pure solid phases were used to generate tables of their thermodynamic properties from O K to the melting points. The Gibbs 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 degrees from 200 to 350 K. (Copyright (c) 1991 by the U.S. Secretary of Commerce.)

200,235
PB92-148196 Not available NTIS
Alberta Univ., Edmonton. Dept of Chemical Engineering.
Solubility of Carbon Dioxide in Water at Low Pressure.
J. J. Carroll, J. D. Slupsky, and A. E. Mather. c1991, 9p
Included in Jnl. of Physical and Chemical Reference Data, v20 n6 p1201-1209 Nov/Dec 91. Available from American Chemical Society, 1155 16th St., NW, Washington, DC. 20036-9976.

Keywords: *Carbon dioxide, *Solubility, Henrys law, Low pressure tests, Water, Enthalpy, Vapor phases, Chemical 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 equilibrium 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 mole fraction basis) was developed. In(H21/MPa) = -6.8346 + 12817/T -3766800/sq T + 2.997 x 10 to the 8th power/cu T. The correlation is valid for 273 < T < 433 K(0 < t < 160 C) where 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.)

200,236
PB92-148204 Not available NTIS
Aerospace Corp., Los Angeles, CA.
Chemical Kinetic Data Sheets for High-Temperature Reactions. Part 2.
N. Cohen, and K. R. Westberg. c1991, 100p
Included in Jnl. of Physical and Chemical Reference Data, v20 n6 p1211-1311 Nov/Dec 91. Available from American Chemical Society, 1155 16th St., NW, Washington, DC. 20036-9976.

Keywords: *Reaction kinetics, *High temperature tests, *Combustion, *Atmospheric chemistry, *Propulsion, Vapor phases, Graphs(Charts), Thermochemistry, Oxygen atoms, Alkanes, Hydroxyl radicals, Halogen organic compounds, Oxygen, Ammonia.

Rate coefficient measurements for over fifty gas-phase bimolecular reactions were critically evaluated 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 single 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 expressed as a function of temperature, k(T) = AT(sup n) exp(-B/T), with probable uncertainty limits, a discussion of the basis for the recommendation, an equilibrium constant and a rate coefficient for the reverse reaction where applicable, and pertinent references. (Copyright (c) 1991 by the U.S. Secretary of Commerce.)

200,237
PB92-148212 Not available NTIS
Curtin Univ. of Technology, Bentley (Australia).
Atomic Weights of the Elements 1989.
J. R. De Laeter, and K. G. Heumann. c1991, 13p
Prepared in cooperation with Regensburg Univ. (Germany, F.R.).
Included in Jnl. of Physical and Chemical Reference Data, v20 n6 p1313-1325 Nov/Dec 91. Available from American Chemical Society, 1155 16th St., NW, Washington, DC. 20036-9976.

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 from 58.69 + or - 0.01 to 58.6934 + or - 0.0002 and for antimony from 121.75 + or - 0.03 to 121.757 + or - 0.003 due to new calibrated measurements. Because the measurement 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 + or - 0.03 to 200.59 + or - 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 231.03588 + or - 0.000 02. 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 Abridged to Five Significant Figures and current data on isotopic compositions of nonterrestrial material are included to benefit users who are more concerned with the length of time during which a 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).

200,238
PB92-148220 Not available NTIS
Curtin Univ. of Technology, Bentley (Australia).
Isotopic Compositions of the Elements 1989.
J. R. De Laeter, K. G. Heumann, and K. J. R. Rosman. c1991, 11p
Prepared in cooperation with Regensburg Univ. (Germany, F.R.).
Included in Jnl. of Physical and Chemical Reference Data, v20 n6 p1327-1337 Nov/Dec 91. Available from American Chemical Society, 1155 16th St., NW, Washington, DC. 20036-9976.

Keywords: Atomic weights, Chemical elements, Mass spectroscopy, Tables(Data), *Isotopic composition.

The Subcommittee for Isotopic Abundance Measurements (SIAM) of the IUPAC Commission on Atomic Weights and Isotopic Abundances has carried out its biennial review of isotopic compositions, as determined by mass spectrometry and other relevant methods. The Subcommittee's critical evaluation of the published literature element by element forms the basis of the Table of Isotopic Compositions of the Elements as Determined by Mass Spectrometry 1989, which is presented in the Report. Atomic Weights calculated from the tabulated isotopic abundances are consistent with A(sub r)(E) values listed in the Table of Standard Atomic Weights 1989. (Copyright (c) 1991 by the U.S. Secretary of Commerce).

200,239
PB92-149749 PC **E99**/MF **A06**
National Inst. of Standards and Technology (PL), Gaithersburg, MD.
Wavenumber Calibration Tables from Heterodyne Frequency Measurements.
Special pub. (Final).
A. G. Maki, and J. S. Wells. Dec 91, 647p NIST/SP-821
Also available from Supt. of Docs. as SN003-003-03136-4. Sponsored by National Aeronautics and Space Administration, Washington, DC. Upper Atmospheric Research Program.

Keywords: *Molecular spectra, *Infrared spectra, Carbon monoxide, Carbon disulfide, Nitric oxide, Nitrous oxides, Infrared spectrometers, Frequencies, Tables(Data), *Calibration atlases, Carbonyl 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 methodology are used for difference frequency measurements within each band investigated by frequency measurement techniques. Data from these complementary techniques include the best Fourier transform measurements available. Included in the text portion 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 lineshape parameters. A 350-entry bibliography which contains all data sources used and a subsequent section on errors conclude 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 constants derived for the work. The primary calibration molecules are the linear triatomics, carbonyl sulfide and nitrous oxide, which cover portions of the infrared spectrum ranging from 488 to 3120 cm(-1). Some gaps in the coverage afforded by OCS and N2O are partially covered by NO, CO, and CS2. An additional region from 4000 to 4400 cm(-1) based on CO is also included.

200,240
PB92-149939
(Order as PB92-149889, PC **A08**)
National Inst. of Standards and Technology, Boulder, CO.
Molar Heat Capacity (C (sub v)) for Saturated and Compressed Liquid and Vapor Nitrogen from 65 to 300 K at Pressures to 35 MPa.
J. W. Magee. 1991, 16p
Included in Jnl. of Research of the National Institute of Standards and Technology, v96 n6 p725-740 Nov/Dec 91.

Keywords: *Liquid nitrogen, *Specific heat, *Nitrogen, Pressure dependence, High pressure, Calorimetry, Vapors, Tables(Data).

Molar heat capacities at constant volume (C(sub v)) for nitrogen have been measured with an automated adiabatic calorimeter. The temperatures ranged from 65 to 300 K, while pressures were as high as 35 MPa. Calorimetric data were obtained for a total of 276 state conditions on 14 isochores. Extensive results which were obtained in the saturated liquid region demonstrate the internal consistency of the C(sub v)(rho,T) data and also show satisfactory agreement with published heat capacity data. The overall uncertainty of the C(sub v) values ranges from 2% in the vapor to 0.5% in the liquid.

200,241
PB92-149954
(Order as PB92-149889, PC **A08**)
National Inst. of Standards and Technology, Gaithersburg, MD.
Investigation of the Interaction of Sodium Chloride and Two Amino Sulfonic Acids, HEPES and MOPSO, by EMF Measurements.
Y. C. Wu, D. Feng, and W. F. Koch. 1991, 6p
Included in Jnl. of Research of the National Institute of Standards and Technology, v96 n6 p757-762 Nov/Dec 91.

Keywords: *Thermodynamic activity, *Sodium chloride, Electrochemistry, Ion selective electrodes, Sulfonic acids, pH, Physiology, Amino acids, Reaction kinetics, Electromotive force, *Standard reference materials, *Piperazine-N-ethane sulfonic acid/N-hydroxyethyl, *Propane sulfonic acid/(N-morpholino)-hydroxy).

The interaction between an amino acid and a neutral salt in solution can be described in terms of the activity coefficients of the components. In one laboratory, they decided to establish HEPES(N-2-hydroxyethylpiperazine-N'-2-ethanesulfonic acid) and MOPSO(3-(N-Morpholino)-2-hydroxypropanesulfonic acid) as candidates for an SRM in the physiological pH range. Ionic interactions in the two systems NaCl-HEPES and NaCl-MOPSO have been studied. Activity coefficients for each component of the two systems and for corresponding buffers are calculated from emf measurements of solutions containing NaCl, the aminosulfonic acid, and its conjugate base in a NaISE/solution/AgCl-Ag cell at 5, 15, 25, and 37 C.

200,242
PB92-154186 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Thermophysics Div.
Compressed Liquid Densities and Saturation Densities of Chlorodifluoromethane (R22).
Final rept.
D. R. Defibaugh, and G. Morrison. 1992, 4p
Pub. in Jnl. of Chemical and Engineering Data 37, n1 p107-110 Jan 92.

Keywords: *Density(Mass/volume), *Fluorohydrocarbons, High pressure, Pressure dependence, Temperature dependence, Refrigerants, Isotherms, Reprints, *Chlorodifluoromethane, Saturation densities.

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 between 263 and 373 K and pressures between 1000 and 6200 kPa. The accuracy of the data is estimated to be + or - 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 Physics Div.
Molecular-Beam Spectrum of the 3.3-mum nu12 Band of Benzene.
Final rept.
J. L. Domenech, M. L. Junttila, and A. S. Pine. 1991, 8p
Sponsored by National Aeronautics and Space Administration, Washington, DC. Upper Atmospheric Research Program.
Pub. 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 nu(12)e(1u) fundamental band of C6H6 has been recorded under collisionless low-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) permits resolution 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 z-Coriolis perturbation is observed in the Kl = -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. Molecular Physics Div.
Optothermal-Detected Microwave-Sideband CO2-Laser Spectroscopy of NCH-NH3.
Final rept.
G. T. Fraser, A. S. Pine, W. A. Kreiner, and R. D. Suenram. 1991, 9p
See also PB91-236679.
Pub. in Chemical Physics 156, p523-531 1991.

Keywords: *Hydrogen cyanide, *Ammonia, *Complexes, Laser spectroscopy, Van der Waals forces, Intermolecular 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 the infrared spectrum of the NH3 umbrella vibration in NCH-NH3 at a resolution of approx. 3 MHz. The infrared radiation is produced by mixing Lamb-dip-stabilized CO2 laser radiation with synthesizer-derived microwave radiation in a CdTe-buffered GaAs stripline electrooptic waveguide modulator. For NCH-NH3 a symmetric top spectrum is observed with a band origin at 1041.7/cm, blue-shifted approx. 91.8/cm from the hypothetical inversion-free nu(2) band origin of free NH3, which indicates a decrease in the van der Waals zero-point binding energy, D(O), for the excited state. The observed Delta B of -14.3 MHz, implying a hydrogen-bond extension, is consistent with this blue shift. The vibrationally excited complex does not predissociate within the approx. 1 ms transit time between the laser excitation region and the bolometer detector, implying that D(O) 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. Thermophysics Div.
Thermophysical Properties of Gaseous Refrigerants from Speed-of-Sound Measurements. 2. Results for 1,1-dichloro-1-fluoroethane (CCl2FCH3).
Final rept.
A. R. H. Goodwin, and M. R. Moldover. 1991, 6p
See also Part 3, PB92-144633. Sponsored by Department of Energy, Washington, DC., and Environmental Protection Agency, Washington, DC.
Pub. in Jnl. of Chemical Physics 95, n7 p5230-5235, 1 Oct 91.

Keywords: *Refrigerants, Acoustic velocity, Virial coefficients, Specific heat, Thermophysical properties, Reprints, *Ethane/dichloro-fluoro.

The speed of sound in gaseous 1,1-dichloro-1-fluoroethane (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 effective square-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.

200,246
PB92-154293 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Thermodynamic Activity Predictions for Molten Slags and Salts, IX.
Final rept.
J. W. Hastie, D. W. Bonnell, and E. R. Plante. 1989, 5p
Pub. in Proceedings of International Conference on Molten Slags and Fluxes (3rd), Glasgow, Scotland, June 27-29, 1988, p254-258 1989.

Keywords: *Thermodynamic activity, *Slags, *Fused salts, *Mathematical models, Silicates, Thermodynamic properties, Reprints.

A predictive model has been developed for calculating detailed equilibrium phase compositions and activities. The model has been demonstrated for such non-ideal mixtures as molten salts and polymeric oxide slag, glass, and ceramic systems. Examples considered in the present study include the systems FeO - Al2O3, an MHD (magnetohydrodynamic) coal slag, a steel blast furnace slag, and CaCi - PbCl2. The model is based on assigning, in a formal thermodynamic sense, solution complex-components, such as alkali-silicates or halide-associates, which account for the non-ideal solution interactions. These complex-components, together with the non-complexed constituent components, are explicitly included in an extensive database of standard Gibbs energies of formation at high temperatures. Multicomponent equilibrium codes are then used to determine the equilibrium concentration of each component in any phase, subject to such restrictions as the phase rule. These concentrations are found to be equivalent to activities through comparisons of model and experimental values.

CHEMISTRY

Physical & Theoretical Chemistry

200,247
PB92-154301 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Molecular Physics Div.
Intense-Field Photodissociation of H2(+): Comparison of Time-Dependent and Time-Independent Calculations.
Final rept.
R. W. Heather, and F. H. Mies. 1991, 13p
Sponsored by North Atlantic Treaty Organization, Brussels (Belgium), and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Physical Review A 44, n1 p7560-7572, 1 Dec 91.

Keywords: *Hydrogen ions 2 plus, *Photodissociation, Multi-photon processes, Time dependence, Laser radiation, Bound state, Wave functions, Comparison, Reprints.

The decay of the initial bound-state population and the fragment kinetic-energy distribution produced by the intense-field photodissociation of H2+ are calculated using both a time-dependent and a time-independent method. The time-dependent method calculates the time evolution of the wave function describing H2+ interacting with a classical time-dependent laser field by repeated application of a short-time propagator. The time-independent method constructs a wave packet using the energy eigenstates of the total molecule-plus-field Hamiltonian with the field expressed as a superposition of quantized photon number states. Specifically, the wave packet represents an initial bound-state wave function of the field-free molecule subjected to a coherent photon state that simulates the classical radiation field at t=0. The subsequent decay of this nonstationary state can be viewed as a laser-induced predissociation of field-dressed bound states into field-dressed continuum states with various numbers of photons absorbed from the field.

200,248
PB92-154319 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Molecular Physics Div.
Product Energy Correlations in the Dissociation of Overtone Excited NO Dimer.
Final rept.
J. R. Hetzler, M. P. Casassa, and D. S. King. 1991, 10p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Physical Chemistry 95, n21 p8086-8095 1991.

Keywords: *Photodissociation, Laser induced fluorescence, Excited state, Predissociation, Molecular beams, Lifetime, Reprints, *Nitric oxide dimers.

The photodissociation spectra, predissociative lifetimes, fragment internal state and translational energy distributions, and product energy and vector correlations of overtone excited nitric oxide dimer, (NO)2, have been measured using pulsed molecular beam and Doppler profile analysis techniques. The nu(1) + nu(5) and 2nu(5) modes of (NO)2 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 dimer are 34 + or - 6 and 20 + or - 3 ps, respectively. The results are discussed in terms of the dissociation and energy partitioning mechanisms.

200,249
PB92-154483 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Coherent Quasielastic Neutron Scattering Study of the Rotational Dynamics of C60 in the Orientationally Disordered Phase.
Final rept.
D. A. Neumann, J. R. D. Copley, R. L. Cappelletti, W. A. Kamitakahara, R. M. Lindstrom, K, M. Creegan, D. M. Cox, W. J. Romanow, N. Coustel, J. P. McCauley, N. C. Maliszewskyj, J. E. Fischer, and A. B. Smith. 1991, 4p
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review Letters 67, n27 p3808-3811, 30 Dec 91.

Keywords: *Fullerenes, Rotational states, Neutron scattering, Elastic scattering, Temperature dependence, Reprints, *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 which is uncorrelated with the motions of adjacent molecules. The rotational diffusion constant D(R) is (1.4 + or - 0.4) x 10 to the 10th power/s at 260 K and (2.8 + or - 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 35 + or - 15 meV.

200,250
PB92-154541 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Molecular Physics Div.
Self-Broadening and Line-Mixing in HCN Q Branches.
Final rept.
A. S. Pine, and J. P. Looney. 1992, 11p
Sponsored by National Aeronautics and Space Administration, Washington, DC. Upper Atmospheric Research Program.
Pub. in Jnl. of Chemical Physics 96, n3 p1704-1714, 1 Feb 92.

Keywords: *Hydrogen cyanide, Pressure dependence, Tunable lasers, Infrared lasers, Reprints, Self broadening, Q branches.

Q-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) (2599/cm) difference hot 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) Pi bending mode and are within experimental error of those reported previously for other Sigma and Pi vibrational bands.

200,251
PB92-154566 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Surface and Microanalysis Science Div.
Comparisons of SIMS, SNMS, ISS, RBS, AES, and XPS Methods for Surface Compositional Analysis.
Final rept.
C. J. Powell, D. M. Hercules, and A. W. Czanderna. 1991, 21p
Pub. in Ion Spectroscopies for Surface Analysis, Chapter 7, p417-437 1991.

Keywords: *Surface analysis, Auger electron spectroscopy, Ion scattering analysis, Rutherford scattering, X-ray photoelectron spectroscopy, Comparison, Reviews, Reprints, 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
PB92-154632 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Fe-K (Iron-Potassium) System.
Final rept.
J. Sangster, C. W. Bale, and B. P. Burton. 1991, 4p
Pub. in Jnl. of Phase Equilib. 12, n1 p46-49 1991.

Keywords: *Iron, *Phase studies, *Potassium, Solubility, Reprints.

The system Fe-K is evaluated, particularly with respect to the solubility of Fe in liquid K.

200,253
PB92-154657 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Thermophysics Div.
Solubility Near the Solvent's Critical Point.
Final rept.
J. M. H. Levelt Sengers. 1991, 8p
Pub. in Jnl. of Supercritical Fluids 4, n4 p215-222 1991.

Keywords: *Supercritical fluids, Thermodynamic properties, Correlation functions, Critical point, Solubility, Divergence, Mixtures, Reprints, Krichevskii 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)(sup c)(sub V,T), which the authors call the Krichevskii parameter. This parameter also governs the linear increase of ln x with density in super-critical solvents. The authors relate the derivative to direct correlation function integrals. They make some remarks about the nature of the divergence of total correlation function integrals. Contrary to statements they made in the literature, 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
PB92-154715 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Surface and Microanalysis Science Div.
Calculations of Electron Inelastic Mean Free Paths. 2. Data for 27 Elements Over the 50-2000 eV Range.
Final rept.
S. Tanuma, C. J. Powell, and D. R. Penn. 1991, 16p
See also PB89-157978 and Part 3, PB92-154723.
Pub. in Surface and Interface Analysis 17, p911-926 1991.

Keywords: *Mean free path, *Electron scattering, Auger electron spectroscopy, X ray photoelectron spectroscopy, Inelastic scattering, EV range 10-100, EV range 100-1000, KeV range 1-10, Chemical elements, Reprints.

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 Bi). The work extends their previous calculations (Surf. Interface Anal. 11,577 (1988)) for the 200-2000 eV range. Substantial variations were found in the shapes of the IMFP versus energy curves from element to element over the 50-200 eV range and they attribute these variations to the different inelastic scattering properties of each material. Their calculated IMFPs were fitted to a modified form of the Bethe equation for inelastic electron scattering in matter: 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 expressions for the four parameters can therefore be used to estimate IMFPs in other materials. The uncertainties in the algorithm used for their IMFP calculation are difficult to estimate but are believed to be largely systematic. 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.

200,255
PB92-154723 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Surface and Microanalysis Science Div.
Calculations of Electron Inelastic Mean Free Paths. 3. Data for 15 Inorganic Compounds Over the 50-2000 eV Range.
Final rept.
S. Tanuma, C. J. Powell, and D. R. Penn. 1991, 13p
See also Part 2, PB92-154715.
Pub. in Surface and Interface Analysis 17, p927-939 1991.

Keywords: *Mean free path, *Electron scattering, X ray photoelectron spectroscopy, Auger electron spectroscopy, Gallium arsenides, Gallium phosphides, Indium arsenides, Indium phosphides, Indium antimonides, Potassium chloride, Sodium chloride, Lead sulfides, Lead tellurides, Silicon carbides, Silicon nitrides, Silicon dioxide, Zinc sulfides, Alumina, Inelastic scattering, Reprints.

The authors report calculations of electron inelastic mean free paths (IMFPs) of 50-2000 eV electrons in a group of 15 inorganic compounds (Al2O3, GaAs, GaP, InAs, InP, InSb, KCl, LiF, NaCl, PbS, PbTe, SiC, Si3N4, SiO2 and ZnS). As was found in similar calculations for 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 associated with the different inelastic electron scattering characteristics of each material. Comparisons are made of the calculated IMFPs and the values calculated from the predictive IMFP formula TPP-2 developed from the IMFP calculations for the elements. Deviations in the comparison are found, which correlated with uncertainties of the optical data from which the IMFPs were calculated. The TPP-2 IMFP formula is therefore believed to be a more reliable means for determining IMFPs for these compounds than the direct calculations.

200,256
PB92-159086 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD.
Physical Chemistry of Stressed Solids.
Final rept.
J. W. Cahn. 1989, 5p
Pub. in Berichte der Bunsen Gesellschaft fur Physikalische Chemie 93, n11 p1169-1173 1989.

Keywords: *Solid solutions, Physical chemistry, Thermodynamics, Equilibrium, Diffusion, Stresses, Reprints.

This is a summary of a plenary lecture given to the Bunsengesellschaft in Siegen, Germany in May. In it the author tries to summarize for physical chemists the work with Larche on Stressed Solids.

200,257
PB92-159177 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Office of Standard Reference Data.
Thermodynamic Properties of the Alkaline Earth Hydroxides: A JANAF Case History.
Final rept.
M. W. Chase, and R. D. Levin. 1989, 8p
See also PB88-169867.
Pub. in High Temperature Science 26, p207-214 1989.

Keywords: *Alkaline earth metal compounds, *Hydroxides, *Thermodynamic properties, Tables(Data), Thermochemistry, Molecular spectra, Molecular structure, Reprints, Electronic energy levels.

In light of a considerable amount of new experimental and theoretical data, the thermodynamic properties of the alkaline earth hydroxides, MOH(g) and M(OH)2(cr,l,g), have been reevaluated. The new information is compared with that used in the older evaluations so as to emphasize not only the source of the changes in the thermodynamic functions, but also the magnitude of the changes. Recommended thermochemical tables for the hydroxide species are being derived. Information concerning the deuterated species, MOD(g), is included in the reevaluation process. Recent detailed spectroscopic studies on the gaseous (mono)hydroxides, except for the beryllium and radium species, yield definitive values for the molecular structure, vibrational frequencies (except for the O-H stretch), and the electronic energy levels. Theoretical data is available for the beryllium species. The data for the radium species is estimated.

200,258
PB92-159276 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
Flash Photolysis Investigation of the Gas Phase UV Absorption Spectrum and Self-Reaction Kinetics of the Neopentylperoxy Radical.
Final rept.
P. Dagaut, and M. J. Kurylo. 1990, 11p
See also PB88-239413.
Pub. in International Jnl. of Chemical Kinetics 22, n11 p1177-1187 1990.

Keywords: *Free radicals, *Reaction kinetics, *Spectrum analysis, Ultraviolet spectroscopy, Photolysis, Temperature dependence, Pressure dependence, Low pressure, Reprints, *Peroxy radicals.

The ultraviolet absorption spectrum of the neopentylperoxy radical, (CH3)3CCH2O2 (or C5H11O2), and the kinetics of its self-reaction have been studied in the gas phase using a flash photolysis technique. The room temperature absorption cross-section at 250 nm was determined to be (5.18 + or - 0.78) x (10 to the -18th power) sq cm/molecule and was used to normalize the radical absorption spectrum between 210 and 300 nm. Detailed modeling of the self-reaction system was used to extract kinetic information from the recorded transient absorption curves over the temperature range 228-380 K at total pressures between 25 and 100 Torr. The results are discussed in relation to previous measurements of alkylperoxy radical spectra and kinetics.

200,259
PB92-159284 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
Gas Phase UV Absoprtion Spectrum of Methylperoxy Radicals: A Reinvestigation.
Final rept.
P. Dagaut, and M. J. Kurylo. 1990, 8p
Pub. in Jnl. of Photochem. Photobiol. A 51, n2 p133-140 1990.

Keywords: *Free radicals, *Ultraviolet spectroscopy, *Spectrum analysis, Reprints, *Methyl peroxy radicals.

The gas phase UV absorption spectrum of methyl peroxy radicals has been remeasured. The new results coupled with reaction modeling calculations indicate that earlier results from this laboratory were not corrupted by secondary radical absorption.

200,260
PB92-159292 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
Flash Photolysis Resonance Fluorescence Investigation of the Gas Phase Reactions of Hydroxyl Radicals with Cyclic Ethers.
Final rept.
P. Dagaut, R. Liu, T. J. Wallington, and M. J. Kurylo. 1990, 3p
See also PB90-193475.
Pub. in Jnl. of Physical Chemistry 94, n5 p1881-1883 1990.

Keywords: *Hydroxyl radicals, *Dioxanes, *Reaction kinetics, Temperature dependence, Activation energy, Photolysis, Ethers, Molecular structure, Chemical reactivity, Reprints.

Absolute rate constants were measured for the gas phase reactions of hydroxyl radicals with a series of dioxanes and other cyclic ethers using the flash photolysis resonance fluorescence technique. At 298K, the rate constants obtained (in units of 10 to the -12th power cc/molecule/sec) were: 1,3-dioxane, (9.15 + or - 0.43); 1,4-dioxane, (10.9 + or - 0.5); 4-methyl-1,3-dioxane, (11.3 + or - 0.6); trimethylene oxide, (10.3 + or - 0.6); tetrahydropyran, (13.8 + or - 0.7), and oxepane (15.4 + or - 1.3). Kinetic data for 1,3-dioxane and 1,4-dioxane, reactions (1) and (2), over the temperature range 240 to 440K were used to derive the Arrhenius expressions: k(sub 1) = (9.4 + or - 0.2) x 10 to the -12th power exp((10 + or - 60)/T), cc/molecule/sec; k(sub 2) = (8.3 + or - 2.2) x 10 to the -12th power exp((80 + or - 90)/T), cc/molecule/sec. These results are compared to the authors' earlier measurements for aliphatic ethers and are discussed in terms of reaction mechanisms and the prediction of reaction rates for such compounds from group reactivity values.

200,261
PB92-159300 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
Gas Phase Reactivity of Aliphatic Polyethers Towards OH Radicals: Measurements and Predictions.
Final rept.
P. Dagaut, R. Liu, T. J. Wallington, and M. J. Kurylo. 1989, 8p
Pub. in International Jnl. of Chemical Kinetics 21, n12 p1173-1180 1989.

Keywords: *Hydroxyl radicals, *Polyethers, *Reaction kinetics, Temperature dependence, Activation energy, Photolysis, Chemical reactivity, Reprints.

Using flash photolysis resonance fluorescence technique, absolute rate constants were determined for the gas phase reactions of hydroxyl radicals with a series of aliphatic polyethers. At 298K, the measured rate constants (in units of 10 to the -12th power cc/molecule/sec) were: 2,2-dimethoxypropane, (3.9 + or - 0.2); 2,2-diethoxypropane, (11.7 + or - 1.3); 1,2-dimethoxypropane, (14.3 + or - 1.5); 2-methoxy-ethylether, (17.5 + or - 1.1); 2-ethoxyethylether, (26.8 + or - 2.4); 1,1-dimethoxyethane, (8.9 + or - 1.0); and 1,1,3-trimethoxypropane, (16.7 + or - 1.0). The temperature dependencies of the rate constants for 2,2-dimethoxypropane and 2,2-diethoxypropane, reactions (1) and (2), were studied over the temperature range 240 - 440 K and are expressed by the Arrhenius equations: k(sub 1) = (3.55 + or - 0.39) x 10 to the -12th power exp ((30 + or - 35)/T), cc/molecule/sec; k(sub 2) = (1.06 + or - 0.25) x 10 to the -12th power exp ((15 + or - 75)/T), cc/molecule/sec. Implications of the results are discussed in terms of reactions mechanisms and the prediction of gas phase OH radical reaction rates for aliphatic polyethers.

200,262
PB92-159342 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Physics Div.
Internal Rotation in 1,4-Dimethylnaphthalene Studied by High Resolution Laser Spectroscopy.
Final rept.
P. U. de Haag, R. Spooren, M. Ebben, L. Meerts, and J. T. Hougen. 1990, 16p
Pub. in Molecular Physics 69, n2 p265-280 1990.

Keywords: Laser induced fluorescence, Supersonic jet flow, Laser spectroscopy, Electron transitions, Molecular beams, Rotational states, Rotational spectra, High resolution, Reprints, *Naphthalene/dimethyl.

The high resolution laser induced fluorescence spectrum of the 0(sup 0)(sub 0) S(sub 1)((sup 1)A(sub 1)) S(sub 0)((sup 1)A(sub 1)) electronic transition in 1,4-Dimethylnaphthalene has been studied in a molecular beam. The residual Doppler width of 12 MHz allowed rotational resolution and the study of the effects of the internal rotation of the two methyl groups. All strong lines were assigned and the rotational constants in both the ground and excited electronic states were determined. The internal rotation of the two methyl groups manifests itself in the spectrum by a splitting of each rotational transition into three lines. The splitting of the lines is 40 + or - 1 MHz and constant up to J = 11 and K = 11. The intensity ratio of the lines is 1:2:1 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 570 + or - 10/cm in the excited S(sub 1) state is concluded.

200,263
PB92-159375 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Thermophysics Div.
Measurements of the Viscosities of Compressed Gaseous Carbon Dioxide, Ethane, and Their Mixtures, at Temperatures up to 500K.
Final rept.
D. E. Diller, and J. F. Ely. 1989, 8p
Pub. in High Temperatures - High Pressures 21, n6 p613-620 1989.

Keywords: *Ethane, *Carbon dioxide, *Viscosity, *Compressed gases, Binary mixtures, Equations of state, High temperature, High pressure, Temperature dependence, Pressure dependence, Reprints.

Shear viscosity coefficients of compressed gaseous 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 in good agreement (+ or - 3 percent) with an extended corresponding states model.

200,264
PB92-159383 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Thermophysics Div.
Measurements of the Viscosities of Saturated and Compressed Fluid Chlorotrifluoromethane (R13).
Final rept.
D. E. Diller, and L. J. Van Poolen. 1989, 4p
Pub. in Cryogenics 29, n11 p1063-1066 Nov 89.

Keywords: *Fluorohydrocarbons, *Viscosity, *Refrigerants, High pressure, Pressure dependence, Temperature dependence, Cryogenics, Reprints, *Chlorotrifluoromethane, Molar volume.

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 1.5 and 17.7 mol/L. The dependences of the fluidity (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 percent.

200,265
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 rept.
A. Fahr, and A. H. Laufer. 1990, 4p
Pub. in Jnl. of Physical Chemistry 94, n2 p726-729 1990.

Keywords: *Chemical radicals, *Disproportion, *Reaction kinetics, Photolysis, Spectrophotometry, 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 (VUV) flash photolysis of divinylmercury was used to generate vinyl radicals and VUV absorption kinetic spectroscopy used to monitor the time history of vinyl radicals through their absorption at 1647A. The absolute rate 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 combination/disproportionation rate constants was measured using gas chromatographic analysis of the final reaction products. Absorption coefficients for the vinyl radical absorption in the 1650A region were redetermined. The absolute rate constants for combination and disproportionation are then 8.2 x 10 to the -11 power cc/molecule/sec-1 and 1.8 x 10 to the -11 power cc/molecule/sec-1, respectively.

200,266
PB92-159540 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Observation of a Speed-Dependent Collisional Inhomogeneity in H2 Vibrational Line Profiles.
Final rept.
R. L. Farrow, G. J. Rosasco, L. A. Rahn, and G. O. Sitz. 1989, 4p
Pub. in Physical Review Letters 63, n7 p746-749 1989.

Keywords: *Hydrogen, *Molecular spectra, *Vibration, *Spectrum analysis, Spectrum analysis, Spectral lines, Raman spectroscopy, Reprints.

The authors report the first observations, to the authors' knowledge, of inhomogeneous broadening in the vibrational line profiles of a gas in the 'impact' density regime. In measurements up to 27 amagat (where the spectra are clearly dominated by collision broadening), non-Lorentzian, asymmetric features are observed in Raman Q-branch transitions of H2 dilute in a heavy perturber gas. The authors compare these measurements with an inhomogeneous line-profile model based on strong speed dependences in the collisional shift cross-sections. Quantitative agreement is obtained only when spectral line narrowing resulting from speed-changing collisions is included.

200,267
PB92-159839 Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Thermophysics Div.
Thermal Conductivity and Heat Capacity of Fluid Nitrogen.
Final rept.
R. A. Perkins, H. M. Roder, D. G. Friend, and C. A. Nieto de Castro. 1991, 31p
Sponsored by Department of Energy, Washington, DC. Div. of Chemical Sciences.
Pub. in Physica A 173, p332-362 1991.

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 nitrogen made with a transient hot wire instrument. The instrument measures the thermal conductivity with an uncertainty less than + or - 1% and the thermal diffusivity with an uncertainty of + or - 5% except at the fluid critical point. The data cover the region from 80 to 300 K at pressures to 70 MPa. The data consist of 8 supercritical isotherms, 3 vapor isotherms, and 4 liquid isotherms. A surface fit is developed for our nitrogen thermal conductivity data from 80 to 300 K at pressures to 70 MPa. The data are compared with a recent theory for the first density coefficient of thermal conductivity and a new mode-coupling theory for the thermal conductivity critical enhancement. Isobaric heat capacity results were determined from the simultaneously measured values of thermal conductivity and thermal diffusivity, using the density calculated from an equation of state.

200,268
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 rept.
J. C. Rainwater. 1991, 106p
See also PB90-206996. Sponsored by Department of Energy, Washington, DC.
Pub. in Supercritical Fluid Technology: Reviews in Modern Theory and Applications, Chapter 2, p57-162 1991.

Keywords: *Liquid-vapor equilibrium, *Binary mixtures, Critical point, Asymptotic series, Mathematical models, Interfacial tension, Azeotropes, Reprints, *Leung-Griffiths model.

The chapter is a review of vapor-liquid equilibria (VLE) of binary mixtures and their correlation with the Leung-Griffiths model as modified by Moldover and Rainwater. The model is specifically designed for an extended critical region from the mixture critical pressure down to one half that pressure, and explicitly incorporates scaling-law critical exponents. The various possible types of mixture phase diagrams are reviewed, with emphasis on the class 1 mixture that has a continuous critical locus. Criteria are established for thorough measurement of VLE in the extended critical region, and a comprehensive bibliography is presented of 129 thoroughly measured mixtures composed of 73 pure fluids; the distribution of critical points of those fluids is examined and it is demonstrated that most mixtures of two of these fluids are class 1. The mathematical structure of the model is briefly reviewed and a systematic procedure is established with guidelines on the optimal number of adjustable parameters based on a quantitative measure of fluid dissimilarity. Parameters are listed and analyzed for 42 successful nonazeotropic mixture fits to date. The utility of the model is discussed for several related problems including ternary mixtures, liquid-liquid equilibrium, explicit asymptotic expansions, azeotropy, a novel technique for critical density measurement, and interfacial tension.

200,269
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 rept.
J. V. Sengers, J. M. J. van Leeuwen, and J. W. Schmidt. 1991, 20p
Pub. in Physica A 172, p20-39 1991.

Keywords: *Capillary waves, *Liquid-vapor interfaces, Sulfur hexafluoride, Temperature dependence, Surface tension, Critical point, Binary fluids, Reflectivity, Reprints.

A fluid interface near a critical point is commonly pictured as an intrinsic interface broadened by thermally excited capillary waves. A comparison of the capillary-wave theory with experiments is hampered by the presence of two short-wavelength cutoff parameters in the theory. The authors review a procedure introduced earlier for fixing these cutoff parameters, so that a definite comparison can be made with experimental reflectivity data reported by Huang and Webb for a binary liquid (methanol + cyclohexane) near the consolute temperature, and by Wu and Webb for a one-component fluid (sulfurhexafluoride) near the critical temperature. The authors show that the temperature dependence of the reflectivity data for the binary liquid is consistent with a nonuniversal temperature dependence predicted by capillary-wave theory. The reflectivity data of the vapor-liquid interface of SF6 do not appear to be consistent with the binary-liquid reflectivities and do not show the predicted temperature dependence.

200,270
PB92-159995 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Chemical Engineering Science Div.
Aqueous Two-Phase Extraction in Bioseparations: An Assessment.
Final rept.
S. K. Sikdar, K. D. Cole, R. M. Stewart, D. C. Szlag, P. Todd, and H. Cabezas. 1991, 4p
Pub. in Bio/Technology 9, p253-256 Mar 91.

Keywords: *Extraction, *Fermentation, Thermodynamics, Cost analysis, Cultured cells, Culture media, Ligands, Reprints.

Aqueous two-phase extraction has promise as a technique for protein recovery from fermentation or cell culture broths. Several impediments exist to its widespread commercial practice, however. Availability of low-cost phase and ligand systems, reliable measurement methods for partition coefficients, accurate thermodynamic data, predictive models, and engineering methods of phase contacting will accelerate the use of the technique. The authors discuss recent progress in these areas, with particular reference to contribution by NIST.

200,271
PB92-160019 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Thermophysics Div.
Shearing Apparatus for Neutron Scattering Studies on Fluids: Preliminary Results for Colloidal Suspensions.
Final rept.
G. C. Straty, H. J. M. Hanley, and C. J. Glinka. 1991, 9p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Statistical Physics 62, n5/6 p1015-1023 Mar 91.

Keywords: *Test equipment, *Suspensions, *Dispersions, Small angle scattering, Neutron scattering, Shear tests, Shear flow, Concentric cylinders, Couette flow, Microspheres, Reprints, *Colloidal suspensions, *Shearing cells.

A Couette-type concentric cylinder apparatus to investigate liquids at equilibrium and under shear has been constructed and tested. The apparatus is designed for a neutron facility and is optimized as a general purpose adjunct to the small-angle neutron scattering (SANS) equipment. It is versatile and rugged; a wide range of shear rates and operating temperatures can be covered; and controls are fully automated. Test results with sheared colloidal suspensions of 91-nm polystyrene spheres are presented. Evidence of shear-induced structure changes is clear.

200,272
PB92-160035 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Biotechnology Div.
Separation Physics.
Final rept.
P. Todd. 1991, 64p
Pub. in Low-Gravity Fluid Dynamics and Transport Phenomena, v130 p539-602 1991.

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: electrokinetic methods, biphasic extraction and ultrafiltration membrane casting. Of these, electrophoresis has been investigated most intensely, including free zone electrophoresis, free flow electrophoresis, isoelectric focusing and isotachophoresis. It is generally found that gravity-independent, as well as gravity dependent processes, previously poorly understood, are revealed through low-gravity studies. In each of these fields, accomplishments in laboratory research and in low-gravity (space) research are summarized, in some cases with critiques. Governing equations for most conditions are provided, and studies of the role of thermal convection are cited. Approximately 120 scientific articles appear in the bibliography.

200,273
PB92-165042 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Quantum Physics Div.

Stimulated Raman Probing of Supercooling and Phase Transitions in Large N2 Clusters Formed in Free Jet Expansions.
Final rept.
R. D. Beck, M. F. Hineman, and J. W. Nibler. 1990, 11p
Sponsored by National Science Foundation, Washington, DC., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Chemical Physics 92, n12 p7068-7078, 15 Jun 90.

Keywords: *Solid clusters, *Nitrogen, Phase transformations, Solidified gases, Liquefied gases, Free jets, Raman spectroscopy, Supercooling, Reprints.

High resolution stimulated Raman spectroscopy (SRS) has been used to examine N2 and N2/He free jet expansions and also equilibrium samples of N2 from 15 to 110 K. The jet spectra show the formation of large liquid clusters which supercool and subsequently freeze to form crystalline beta-N2 solid and, in He expansions, undergo a further transformation to a partially annealed alpha-N2 form. CW-SRS frequency and linewidth 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. Analysis 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 63.2 K at which equilibrium samples freeze. The results show that the high spectral and spatial resolution of nonlinear Raman methods such as SRS and CARS provide a unique probe of the condensation processes in free jet expansions.

200,274
PB92-165083 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Molecular Physics Div.
Infrared and Microwave Spectra of SrO and BaO.
Final rept.
C. E. Blom, H. G. Hedderich, F. J. Lovas, R. D. Suenram, and A. G. Maki. 1992, 10p
Pub. in Jnl. of Molecular Spectroscopy 152, p109-118 1992.

Keywords: *Barium oxides, *Strontium oxides, *Infrared spectra, *Microwave spectra, Vibrational spectra, Rotational spectra, Calcium oxides, Magnesium oxides, High resolution, Reprints, Laser ablation.

The high-resolution infrared spectrum of strontium oxide has been observed in a low-pressure flame. A total of 43 Delta nu = 1 transitions has been measured for the three most abundant isotopomers of SrO. New microwave measurements have also been made for SrO and BaO using a laser ablation technique. The measurements were combined in a least-squares fit with other data taken from the literature to obtain a set of Dunham potential constants and Dunham rovibrational coefficients. The accurate values obtained for the first terms in the Dunham potential function enabled the authors to calculate several higher-order rovibrational constants that could not be determined from a direct fit to the experimental data. Constants, determined in a parallel fashion, are given for SrO, BaO, CaO, and MgO. The nuclear quadrupole coupling constants have been determined for (87)SrO, nu = 0, 1, and 2, and for nu = 0 of (135)BaO and (137)BaO.

200,275
PB92-165208 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Quantum Physics Div.
Temperature Dependence of the Quenching of I*((XX)P3/2) by I2 from 300 to 800 K.
Final rept.
J. I. Cline, and S. R. Leone. 1991, 4p
Grant NSF-CHE87-13646
Sponsored by National Science Foundation, Washington, DC., and Weapons Lab., Kirtland AFB, NM.
Pub. in Jnl. of Physical Chemistry 95, n7 p2917-2920 1991.

Keywords: *Iodine, Temperature dependence, Room temperature, Laser radiation, Quenching, Reprints.

The quenching rate of I* (doublet P(1/2)) by I2 is measured over the temperature range 297-800 K by using a time-resolved diode laser absorption/gain method. The room-temperature bimolecular quenching rate constant is determined to be k(q) = (2.89 + or - 0.06) x 10 to the -11 power cc/(molecule-s), in good agreement with several previous determinations. The rate is found to be independent of temperature over the temperature range 300-800 K within experimental uncertainty; at 800 K the quenching rate is k(q) = (3.02 + or - 0.30) x 10 to the -11 power cc/(molecule-s). The temperature dependence is consistent with a quenching mechanism involving the formation of an I3 intermediate complex. The quantum yield for I* formation from the 480-nm photolysis of I2 is measured to be 0.304 + or - 0.001 at 297 K and increases slightly with temperature. The quantum yield is significantly larger than that previously determined.

200,276
PB92-165216 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Bomb Calorimetric and NMR Studies on Crystalline Hexaglycine.
Final rept.
J. C. Colbert, E. S. Domalski, B. Coxon, and D. L. Vanderhart. 1989, 19p
Pub. in Thermochimica Acta 153, p123-141 1989.

Keywords: *Amino acids, *Heat of combustion, *Heat of formation, *Crystals, Calorimetry, Thermochemistry, Spectrum analysis, Molecular structure, Nuclear magnetic resonance, Water, Reprints, *Hexaglycine, *Oligoglycines.

The enthalpy of combustion of crystalline hexaglycine (C12H20N6O7,cr) has been determined by combustion bomb calorimetry. The molar enthalpy of combustion at 298.15 K for the following reaction: C12H20N6O7(cr) + 13.5O2(g) = 12CO2(g) + 10H2O(1) + 3N2(g) is delta(c)H(sup o)/mol = -(5930.3 + or - 11.3) kJ/mol; the corresponding enthalpy of formation at 298.15 K is delta(f)H(sup o)/mol = -(1650.1 + or - 11.7) kJ/mol. Because of the difficulty in establishing the moisture content of the sample, the enthalpy of combustion is based upon the mass of carbon dioxide formed in each calorimetric experiment rather than upon the mass of sample prior to combustion. A variety of NMR measurements have been made, both proton NMR and CP-MAS (13)C, to characterize hexaglycine and several other oligoglycines, and to determine the water content of the hexaglycine. The energy contribution to the enthalpy of formation of crystalline hexaglycine 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 (PL), Boulder, CO. Time and Frequency Div.
Molecular Parameters of Chromium Hydride in Its X(6)Sigma+ State Determined by Far-Infrared Laser Magnetic Resonance Spectroscopy.
Final rept.
S. M. Corkery, J. M. Brown, S. Beaton, and K. M. Evenson. 1991, 17p
Contract NASA-W15-047
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Molecular Spectroscopy 149, p257-273 1991.

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 CrH radical in the nu = 0 level of its Chi(sup 6)Sigma(+) state has been studied in detail. Signals associated with the five lowest rotational transitions have been detected. Nearly 500 resonances for (52)CrH have been assigned and used to determine molecular parameters which describe the rotational energy, the fine and proton hyperfine splittings, and the Zeeman effect. These parameters are well determined and their implications for the structure of CrH are discussed. A fourth-order correction to the spin-spin coupling has been identified for the first time. Precise zero-field rotational transition frequencies have been calculated which may allow the detection of the CrH 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.
E. S. Domalski, and E. D. Hearing. 1988, 16p
See also PB89-145155.
Pub. in Physical Property Prediction in Organic Chemistry, p103-118 1988.

Keywords: *Organic compounds, *Specific heat, *Entropy, *Gibbs free energy, *Enthalpy, *Chemical equilibrium, Molecular structure, Thermodynamic properties, Gases, Liquids, Solids, Reprints.

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 other thermodynamic properties (Gibbs energy of formation, equilibrium constants, enthalpies and entropies of transition) which extend predictive capabilities, (2) descriptions of the Benson notation, group values and their application to the estimation of thermodynamic properties, and (3) explanations of unique solutions to the estimation of two selected classes of organic compounds.

200,279
PB92-165364 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Quantum Physics Div.
Germane Discharge Chemistry.
Final rept.
J. R. Doyle, D. A. Doughty, and A. Gallagher. 1991, 9p
Contract SERI-XG-1-1216
Sponsored by Solar Energy Research Inst., Golden, CO.
Pub. in Jnl. of Applied Physics 69, n8 p4169-4177, 15 Apr 91.

Keywords: *Germanes, Glow discharges, Chemical radicals, Amorphous materials, Solar cells, Dissociation, Reprints.

The stable gas products of germane dissociation and subsequent radical reactions have been measured in pure germane glow discharges. Characteristics of the initial germane 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 beta of depositing neutral radicals has been measured to be 0.61 + or - 0.09 on the grounded electrode. Major differences between germane and silane discharges occur in all these observables. Possible explanations of these differences are given, but much less chemical data exists for germane, thereby precluding definitive judgments. A probable cause of the normally much poorer semiconductor quality of alpha-Ge:H films, compared to alpha-Si:H, is suggested. 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 (NML), Gaithersburg, MD. Surface Science Div.
Phenomenological Model of Melting in Lennard-Jones Clusters.
Final rept.
I. L. Garzon, M. A. Borja, and E. Blaisten-Barojas. 1989, 11p
Pub. in Physical Review B 40, n7 p4749-4759 1989.

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

Extensive molecular dynamics simulations were coupled to infinitely fast quenches by steepest descent in order to obtain more information on the melting transition of Lennard-Jones small clusters (N=12-14). A procedure is devised to measure the fraction of times f that the local minima of the potential energy surface are accessed in the transition region during a long trajectory. The computer experiment shows that f depends on temperature and presents a sigmoid shape. The temperature at which f 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 excursions of the cluster 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 f at Tm is high. Such is the case of clusters the 12- and 13-atom. The 14-atom cluster evaporates before melting.

200,281
PB92-165547 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Office of Nondestructive Evaluation.
Interaction Induced Absorption in Simple to Complex Liquids.
Final rept.
B. Guillot, and G. Birnbaum. 1989, 36p
Pub. in NATO ASI Ser., Ser. C React. Flexible Mol. Liq. 291, p1-36 1989.

Keywords: *Absorption spectra, Far infrared radiation, Infrared spectra, Charge transfer, Liquid nitrogen, Benzene, Iodine, Mixtures, Reprints.

An attempt is made to provide a theoretical basis for dealing with the collision-induced absorption spectra of complex liquids from a consistent viewpoint. One of the most important approximations is the decoupling of translational and rotational motions. This makes it possible to compute separately the spectrum resulting from each of these motions by a three-variable Mori-Zwanzig theory. The parameters in the equation for the translational spectrum are estimated by a lattice gas model that is extended to include two component mixtures. The theory, in which there are no adjustable parameters, is first tested on the far infrared (FIR) spectrum of liquid N2 by assuming that the spectrum arises from the point quadrupole and point polarizability induced-dipole (QID) mechanism. Satisfactory agreement was obtained with a computer simulation, although both theory and simulation have somewhat less high frequency intensity than experiment. The FIR spectra of liquid C6H6 and I2 was also computed on the basis of the point QID mechanism. Finally, the FIR spectrum of a dilute solution of I2 in C6H6 was computed.

200,282
PB92-165562 Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Thermophysics Div.
Order in a Simple Colloidal Mixture Suspension.
Final rept.
H. J. M. Hanley, G. C. Straty, and P. Linder. 1991, 14p
Pub. in Physica A 174, p60-73 1991.

Keywords: Small angle scattering, Neutron scattering, Structure factors, Polystyrene, Silica, Latex, Water, Mixtures, Particles, Reprints, *Colloidal suspensions.

Preliminary SANS (small angle neutron scattering) measurements from a well characterized binary colloidal suspension of 91 nm polystyrene latex and 54 nm silica particles in water are reported for the Q range 0.02 < Q (nm (sup -1)) < 0.12, where Q is the scattering wave vector. The polystyrene-to-silica number ratio was 1.7 to 1 and the mixture volume fraction phi = 0.15. Key measurements were the scattered intensity of the mixture, and the partial scattered intensities of the polystyrene and silica in the mixture. The partial scattered intensity of one species was obtained by contrast matching the other species in the appropriate mixture of H2O and D2O. Partial structure factors and pair distribution functions are compared with computer simulation data for a soft sphere mixture and with the hard sphere expressions of Ashcroft and Langreth.

200,283
PB92-165679 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
Two Photon Resonance Enhanced Multiphoton Ionization Detection and Spectroscopy of Gas Phase Germyl (G3H3) Radicals.
Final rept.
J. W. Hudgens, R. D. Johnson, and B. P. Tsai. 1989, 3p
Pub. in AIP Conference Proceedings, v191 p475-477 1989.

Keywords: *Germanium hydrides, Multi-photon processes, Vibrational spectra, Rydberg states, Free radicals, Reprints, *Germyl radicals, Multiphoton ionization.

GeH3 radicals were observed by resonance enhanced multiphoton ionization (REMPI) spectroscopy in the region of 370 - 430 nm. The spectrum arises from two-photon resonances with the 5p doublet A(double prime)(2) (D(3h)) Rydberg state which has its origin at 419.1 nm. Absorption of a third photon ionized the radicals. A vibrational progression of about 756/cm was assigned to the 'umbrella' mode, nu(2). The observed (X tilde) doublet A(1) (C(3v)) v(double prime)(2)=2 to v(double prime)(2)=0 vibrational interval is 663/cm which leads to an estimated barrier to inversion of 1530/cm.

200,284
PB92-165687 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Quantum Metrology Div.
Multiconfiguration Dirac-Fock Calculations of Transition Energies with QED Corrections in Three-Electron Ions.
Final rept.
P. Indelicato, and J. P. Desclaux. 1990, 11p
See also DE84700269.
Pub. in Physical Review A 42, n9 p5139-5149, 1 Nov 90.

Keywords: *Energy levels, Electron transitions, Relativistic effects, Correction, Reprints, *Lithium-like ions.

We present accurate calculations of the 1s (2)2s and 1s (2)2p energy levels of lithium-like ions for 15 = or < 2Z = or < 92. The multiconfiguration Dirac-Fock method has been used to calculate relativistic effects. One-electron radiative corrections and estimated screening corrections have been calculated. These results are in good agreement with relativistic many-body calculations. General agreement with experimental transition energies (available up to Z=92) is very good.

200,285
PB92-165745 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
Ab Initio Calculations of the Electronic Structure and Vibrational Frequencies of the Dichloromethyl Radical and Cation.
Final rept.
S. A. Kafafi, and J. W. Hudgens. 1989, 6p
Pub. in Jnl. of Physical Chemistry 93, n9 p3474-3479 1989.

Keywords: *Electronic structure, *Vibrational spectra, Chemical bonds, Molecular orbitals, Cations, Reprints, *Dichloromethyl radicals, Ab initio calculations.

Ab initio molecular orbital calculations on the (X tilde) doublet A(1) (C(2v)) state of the CHCl2 cation and on several valence states of the CHCl2 radical are reported. The qualitative features of the molecular orbital interactions are presented. Using the 6-31G* basis set, optimized structures were computed with the Hartree-Fock and second order Moller-Plesset levels of theory. The optimized structure of the CHCl2 cation is a C(2v) structure. The optimized structure of the ground state radical predicts that the C-H bond lies 15.5 deg out of the Cl-C-Cl plane. Frozen core single point calculations using fourth order Moller-Plesset theory and the 6-31* basis set predict that the barrier to inversion in the (X tilde) doublet A' (C2) state of CHCl2 radical is 220/cm. Vibrational frequencies for each CHCl2 species were computed from the HF/6-31G* optimized structures. These calculated frequencies compare favorably with previously reported experimental frequencies.

200,286
PB92-165786 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Electric Field Effects on Autoionizing Resonances.
Final rept.
D. E. Kelleher. 1989, 14p
See also PB88-175666.
Pub. in Proceedings of International Conference on Spectral Line Shapes (9th), Torum, Poland, July 25-29, 1988, p149-162 1989.

Keywords: *Autoionization, Electric fields, Excited states, Resonance, Atoms, Reprints.

We present an overview of results obtained over the past decade on the effect of d.c. electric fields on autoionizing (AI) resonances. In particular, we will focus on doubly excited resonances in atoms with two or more valence electrons. These are states with two excited electrons, neither one of which by itself has enough energy to ionize, but which constitute a quantum state whose total energy lies in the continuum. These states can spontaneously ionize (hence the name autoionization), via Coulombic coupling between the two excited electrons. This coupling provides a mechanism for two electrons to share their energy, and for one to ionize while the other de-excites to form a bound state of the 'daughter' ion.

200,287
PB92-165794 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Estimation Methods and Combustion Calorimetry on Organic Phosphorus Compounds.
Final rept.
D. R. Kirklin, and E. S. Domalski. 1985, 15p
Pub. in Proceedings of U.S. Army Chemical Research and Development Center Scientific Conference on Chemical Defense Research, Aberdeen Proving Ground, MD., November 1985, p189-203.

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 compiled for 45 organic phosphorus compounds. The additivity principle is used to derive group contribution values. Data evaluation and estimation schemes lead to formulation of an experimental calorimetric program to determine the thermochemical properties of key organic phosphorus compounds. A series of combustion bomb calorimetric measurements on triphenyl phosphine oxide were performed to obtain (a) data for the establishment of triphenyl phosphine oxide as a secondary standard for combustion calorimetry of organic phosphorus compounds and (b) an accurate enthalpy of formation of this key organic phosphorus compound. This datum and other enthalpies of formation which will be determined are necessary for the development of an estimation scheme for organic phosphorus compounds.

200,288
PB92-165802 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Impact of Ion Chromatography on the Enthalpies of Formation of Organic Phosphorus Compounds.
Final rept.
D. R. Kirklin, and E. S. Domalski. 1987, 8p
Sponsored by Department of the Army, Washington, DC.
Pub. in Proceedings of U.S. Army Chemical Research, Development, and Engineering Center Scientific Conference on Chemical Defense Research, Aberdeen Proving Ground, MD., November 17-20, 1987, p715-722.

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 rotating bomb calorimeter was used to produce a homogeneous solution of the various oxyacids 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, triphenylphosphine oxide, and triphenylphosphate. Ion chromatography quantitatively identifies the side reactions for which thermochemical corrections must be applied to the calorimetric data. A significant increase in the reliability of data on the enthalpies of combustion and formation of organic phosphorus compounds is now possible.

200,289
PB92-165919 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 (DCCD)2, (DCCH)2, DCCD-DCCH, DCCH-DCCD, HCCH-DCCD, and HCCH-DCCH.
Final rept.
K. Matsumura, F. J. Lovas, and R. D. Suenram. 1991, 21p
Pub. in Jnl. of Molecular Spectroscopy 150, p576-596 1991.

Keywords: Microwave spectra, Rotational spectra, Deuterium compounds, Hydrogen bonds, Molecular beams, Ultralow temperature, Reprints, *Acetylene dimers.

Microwave spectra of the deuterated acetylene dimers, produced in a molecular beam at 1 K from samples of HCCH, DCCH, and DCCD, were observed using a Fourier transform microwave spectrometer. The authors observed all variations of deuterated acetylene dimers in which a deuterium atom participates in the hydrogen bond; i.e., (DCCD)2, (DCCH)2, DCCD-DCCH, DCCH-DCCD, HCCH-DCCD, and HCCH-DCCH. Deuterated acetylene dimers with the hydrogen atom located in the hydrogen bond could not be detected. Precise molecular constants were determined for each species. Among the dimers identified, (DCCD)2, (DCCH)2, DCCD-DCCH, and DCCH-DCCD showed evidence of an interconversion tunneling motion like the tunneling observed for (HCCH)2. The tunneling potential of (DCCD)2 was analyzed using a one-coordinate model and the potential depth was determined to be V4 = 35.577/cm, which is 2.371/cm deeper than that of (HCCH)2 studied by Fraser et al. (J. Chem. Phys. 89, 6028-6045 (1988)). A one-coordinate model was also applied to the other deutered acetylene dimers by adopting a further assumption of a composite potential.

200,290
PB92-165950 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
High-Resolution Spectroscopy on the A tilde(sup 1)B1 (0,6,0) <- X tilde(sup 1)A1 (0,0,0) Transition in SiCl2.
Final rept.
G. Meijer, J. Heinze, W. L. Meerts, J. J. Ter Meulen, and J. T. Hougen. 1989, 13p
Pub. in Jnl. of Molecular Spectroscopy 138, p251-263 1989.

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

High-resolution laser-induced fluorescence spectra of Si(35)Cl2 and Si(35)Cl(37)Cl have been observed in a molecular beam. A spectral resolution of 8 MHz was obtained on the (A tilde) singlet B(1)(0, 6, 0) <- (X tilde) singlet A(1)(0, 0, 0) transition around 323 nm, which allowed the dense rotational structure of this electronic transition to be completely resolved. The rotational constants in the (A tilde) singlet B(1)(0, 6, 0) state reflect the almost 22 deg opening of the ClSiCl bond angle on going from (X tilde) to (A tilde), whereas the SiCl bond length decreases slightly.

200,291
PB92-165968 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Molecular Physics Div.
Wave-Packet Analysis of Laser-Induced Half-Collision Processes.
Final rept.
F. H. Mies, and A. Giusti-Suzor. 1991, 13p
Sponsored by North Atlantic Treaty Organization, Brussels (Belgium), and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Physical Review A 44, n11 p7547-7559, 1 Dec 91.

Keywords: *Multi-photon processes, Hydrogen ions 1 plus, Gas ionization, Photoionization, Photodissociation, 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 Hamiltonian for the scattered particles, which 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 yields a Lorentzian distribution of product-state energies in the infinite-depletion limit. Here the authors demonstrate how a full-collision Floquet ansatz can be derived from a fully quantal wave packet 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 close-coupled wave functions for scattering in the field generated by quantized radiation number states. The resultant Floquet scattering states are energy normalized and stationary, and the quasienergy is real. The authors show how to use these states to construct a coherent-state wave packet that describes the decay of an arbitrarily prepared bound state, and yields a half-collision Floquet ansatz without any commitment to a complex quasienergy. The product energy and quantum-state distribution in the infinite-depletion limit are obtained without approximation to exponential decay.

200,292
PB92-165976 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Quantum Physics Div.
Optically Pumped Ultra-Violet Laser on SO(B(3)Sigma(-)-X(3)Sigma(-)).
Final rept.
H. C. Miller, K. Yamasaki, J. E. Smedley, and S. R. Leone. 1991, 5p
Contract AFWL-WLK-0-017
Sponsored by Weapons Lab., Kirtland AFB, NM.
Pub. in Chemical Physics Letters 181, n2-3 p250-254, 21 Jun 91.

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 pulsed optical pumping of transitions in the (0, 2) band of SO(B triplet sigma(1-)-X triplet Sigma(1-)) at 256 nm. The SO is produced by 193 nm photolysis of sulfur dioxide. Stimulated emission is observed in the (0, 8), (0, 9), (0, 10), and (0, 11) bands between 300 and 350 nm.

200,293
PB92-166040 Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Thermophysics Div.
Nonequilibrium Molecular Dynamics Simulations of n-Butane and Isobutane Viscosity.
Final rept.
R. L. Rowley, and J. F. Ely. 1991, 21p
See also PB91-195636.
Pub. in Molecular Simulation 7, p303-323 1991.

Keywords: *Viscosity, *Butanes, *Lennard-Jones potential, *Dynamics, Simulation, Rheology, Thermodynamic properties, Reprints, *Nonequilibrium molecular dynamics.

Nonequilibrium molecular dynamics simulations of Lennard-Jones site-site models representing n-butane and isobutane were performed over much of the density range for which experimental viscosity data are available. Simulated viscosities extrapolated to zero shear agreed very well with experimental data over the entire density range. The shear perturbs the equilibrium structure of the fluid and produces shear birefringence or molecular alignment. The relative ability of the molecules to orient in the shear field accounts for their relative shear-thinning rheology. Saturation of the shear birefringence produces a change in the observed rheology at higher shear rates. The effect of shear on thermodynamic properties is also investigated.

200,294
PB92-166099 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Laser Diagnostics for Investigation of Particle Formation Processes.
Final rept.
H. G. Semerjian, M. R. Zachariah, and C. Presser. 1988, 14p
Pub. in Material Research Society Symposium Proceedings, v117 p137-150 1988.

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 and ceramic powders. Laser diagnostic techniques are used to develop a fundamental understanding of these processes. Formation of carbonaceous soot particles has been studied in laminar, coannular, hydrocarbon diffusion flames. Similar techniques have been used to study silica particle formation in an opposed jet diffusion flame, where silicon is introduced in the form of silane (SiH4) into the fuel stream (H2/Ar); the oxidant is an O2/Ar mixture. The advantage of this geometry is that, along the stagnation point streamline, the flow may be considered one-dimensional. This should allow the extension of the results of this study to practical CVD of MCVD processes for optical fibers. Laser diagnostic techniques are also being 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 (NML), Gaithersburg, MD. Chemical Kinetics Div.
Ionic Hydrogen Bond and Ion Solvation. 8. RS(-)...HOR Bond Strengths. Correlation with Acidities.
Final rept.
L. W. Sieck, and M. Mautner. 1989, 3p
See also PB88-238829.
Pub. in Jnl. of Physical Chemistry 93, n4 p1586-1588 1989.

Keywords: *Solvation, *Organic ions, *Hydrogen bonds, *Acidity, *Heat of dissociation, Enthalpy, Entropy, Mass spectroscopy, Equilibrium, Chemical bonds, Stability, Reprints, *Ion clustering.

The stabilities 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 in order to define the delta H(sup o) and delta S(sup o) values for solvation. Dissociation energies, delta H(sup o, sub D) were found to decrease as the difference between the acidities (delta H(sup o)(sub a)) of the two molecular components increased. For C6H5S(-1)(dot)HOR complexes, a linear correlation of the form delta H(sup o, sub D) = 22.1-0.20 del(delta H(sup o)(sub a)) was obtained, while for complexes incorporating HS(-1) or CH3S(-1) as core ions, the expression was delta H(sup o, sub D) = 19.9-0.15 del(delta H(sup o)(sub a)) both in kcal/mol. Bonds involving CF3CH2OH deviated substantially from the correlations, suggesting multiple interactions. The successive hydration of HS(-1) and CH3S(-1) was also investigated, and the delta H(sup o, sub D) values found for the respective monohydrates, 14.2 and 15.0 kcal/mol, are in excellent agreement with recent ab initio calculations.

200,296
PB92-166198 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Multiphoton Excitation Spectroscopy of the B(1)Sigma(+) and C(1)Sigma(+) Rydberg States of CO.
Final rept.
P. J. H. Tjossem, and K. C. Smyth. 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, Electron transitions, Rotational spectra, Polarization, Spectroscopy, Reprints.

Two-photon absorption spectra of the B<-<-X and C<-<-X transitions in CO have been observed. Q-head polarization ratios (linear/circular) are found to exceed 80:1 for B<-<-X; o and S branches are reported for the first time.

200,297
PB92-166206 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
Rate Constants for the Decomposition and Formation of Simple Alkanes Over Extended Temperature and Pressure Ranges.
Final rept.
W. Tsang. 1989, 16p
Pub. in Combustion and Flame 78, n1 p71-86 1989.

Keywords: *Reaction kinetics, *Ethane, *Butanes, *Propane, *Methane, *Pyrolysis, Free radicals, Temperature dependence, Pressure dependence, Reprints, *Unimolecular reactions, Collision theory.

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 300-1100K. 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 Lineshift Measurements on OCS.
Final rept.
M. D. Vanek, J. S. Wells, and A. G. Maki. 1991, 8p
Sponsored by National Aeronautics and Space Administration, Washington, DC. Upper Atmospheric Research Program.
Pub. in Jnl. of Molecular Spectroscopy 147, p398-405 1991.

Keywords: *Infrared spectrometers, Frequency shift, Pressure dependence, Computerized control systems, Line broadening, Infrared spectra, Vibrational spectra, Tunable lasers, 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 to illustrate its use. Two OCS absorption lines, R(3) and P(30), have been measured for a vibrational transition near 10 micrometers. An average pressure-induced shift coefficient of -0.37 + or - 0.04 kHz/Pa (-49 + or - 5 kHz/Torr) was observed for the two lines. The self-broadening coefficient for each line has also been measured.

200,299
PB92-166271 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Large Electroclinic Effect in New Liquid Crystal Material.
Final rept.
P. A. Williams, N. A. Clark, M. Blanca Ros, R. T. Vohra, D. M. Walba, and M. D. Wand. 1991, 4p
See also AD-A227 935. Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of the International Conference on Ferroelectric Liquid Crystals (3rd), Boulder, CO., June 23-28, 1991, p143-146.

Keywords: *Liquid crystals, Temperature dependence, Reprints, Electroclinic effect.

We report a new liquid crystal material (W317) which has an unusually large electroclinic effect in a phase tentatively identified as smectic A. We show electroclinic tilt angles as large as 21 deg, and measurable tilt angles over a 40 C temperature range.

200,300
PB92-170653 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.
D. G. Archer. 1990, 5p
Pub. in Jnl. of Chemical and Engineering Data 35, n3 p340-344 Jul 90.

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. A method is described for the adjustment of ion-interaction parameters, resulting from differences in the Debye-Huckel limiting law coefficients. This method, for many equations, obviates the need for refitting 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.

200,301
PB92-170711 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.
Fractals in Molecule-Surface Collisions.
Final rept.
V. Balasubramanian, N. Sathyamurthy, and J. W. Gadzuk. 1989, 9p
Pub. in Surface Science 221, pL741-L749 1989.

Keywords: *Molecule collisions, Surface reactions, Diatomic molecules, Vibrational states, Ground state, Fractals, Reprints.

For a model diatomic molecule-surface collision we show that the dynamics, as viewed in terms of the final vibrational action as a function of initial vibrational phase, exhibits a behavior that is characteristic of fractals with a dimension about 0.6 for the diatom in its ground vibrational state (n(1) = 0) approaching the surface with a relative translational energy (E(trans)) of 0.25 eV.

200,302
PB92-170802 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
Kinetic Measurements of the Gas-Phase Reactions of OH Radicals with Hydroxy Ethers, Hydroxy Ketones, and Keto Ethers.
Final rept.
P. Dagaut, R. Liu, T. J. Wallington, and M. J. Kurylo. 1989, 3p
See also PB89-101562. Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Physical Chemistry 93, n23 p7838-7840, 16 Nov 89.

Keywords: *Reaction kinetics, *Hydroxyl radicals, *Hydroxy compounds, *Ethers, *Ketones, Temperature dependence, Activation energy, Reprints.

Absolute rate constants were determined for the gas-phase reactions of hydroxyl radicals with a series of hydroxy ethers as well as the simplest hydroxy ketone and keto ether with use of the flash photolysis resonance fluorescence technique. At 298 K, the measured rate constants were as follows (in units of 10 to the -12th power xcc/molecule/sec): 2-methoxyethanol, 12.5 + or - 0.7; 2-ethoxyethanol, 18.7 + or - 2.0; 2-butoxyethanol, 23.1 + or - 0.9; 3-ethoxy-1-propanol, 22.0 + or - 1.3; 3-methoxy-1-butanol, 23.6 + or - 1.6; acetol, 3.0 + or - 0.3; and methoxyacetone, 6.8 + or - 0.6. The kinetic data for 2-methoxyethanol obtained between 240 and 440 K were used to derive the following Arrhenius expression: k(sub1)=(4.5 + or - 1.4)x(10 to the -12th power) exp((325 + or - 100)/T)xcc/molecule/sec). The results for all seven reactants are discussed in terms of the prediction of OH rate constants for oxygenated organic compounds.

200,303
PB92-170844 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Thermochemistry of High Energy Reactions.
Final rept.
E. S. Domalski, and T. L. Jobe. 1990, 7p
Sponsored by Department of the Army, Washington, DC.
Pub. in Proceedings of U.S. Army Chemical Research, Development and Engineering Center Scientific Conference on Chemical Defense Research, Aberdeen, MD., November 14-17, 1989, p339-345 Aug 90.

Keywords: *Hydrocarbons, *Heat of reaction, *Exothermic reactions, Heat of formation, Heat of combustion, Enthalpy, Fluorine, Oxygen, Thermite, Incendiary mixtures, Reprints.

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 Thermite reactions were examined as well for exothermic characteristics. Some conclusions were derived from the study with respect to the reactions which possessed high exothermicity.

200,304
PB92-170885 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Physics Div.
Molecular Alignment from Circular Dichroic Photoelectron Angular Distributions in (n + 1) Resonance Enhanced Multiphoton Ionization.
Final rept.
R. L. Dubs, and V. McKoy. 1989, 4p
See also AD-A198 277.
Pub. in Jnl. of Chemical Physics 91, n9 p5208-5211 1989.

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

The theory for determination of molecular alignment from circular dichroism in photoelectron angular distributions (CDAD) is generalized to treat the case in which the excitation polarization direction and the laboratory z-axis do not coincide. A new method of data analysis is presented here. Alignment created by surface scattering or photofragmentation should be obtainable by these procedures. For studies of orientation with elliptically polarized excitation, differential cross sections at a given collection angle are found to be, to a good approximation, independent of excited state alignment. Orientation can thus be obtained from differential cross sections by the methods developed by Kummel, Sitz and Zare (J. Chem. Phys., 88, 6707 (1988)).

200,305
PB92-171107 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.
Electron Scattering from Molecules Adsorbed on Surfaces.
Final rept.
J. W. Gadzuk, and M. Sunjic. 1990, 13p
Pub. in AIP Conference Proceedings 204, p118-130 1990.

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

Some of the special features associated with molecules adsorbed on metal surfaces which influence electron-molecule scattering, beyond that inferred from straight-forward extensions of gas phase pictures, 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.
Extended Corresponding States Models for High-Temperature Aqueous Solutions.
Final rept.
J. S. Gallagher. 1990, 8p
Pub. in Properties of Water and Steam, p387-394 1990.

Keywords: *Aqueous solutions, Concentration(Composition), High temperature, Specific heat, Sodium chloride, Carbon dioxide, Nitrogen, Argon, Solubility, Dilution, Water, Reprints, Corresponding states.

An extended corresponding-states model based upon an accurate Helmholtz function representing water as a reference fluid has been used to model a variety of dilute aqueous solutions. This model is particularly successful in the near- and super-critical regions where traditional Gibbs-function-based representations fail. Examples of properties described include apparent molar volumes and heat capacities, solubilities and coexisting phases, and the critical line. The solutes examined here include NaCl, argon, nitrogen and carbon dioxide.

200,307
PB92-171198 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Chemical Technology.
Transferability of Molecular Distributed Polarizabilities from a Simple Localized Orbital Based Method.
Final rept.
D. R. Garmer, and W. J. Stevens. 1989, 8p
Pub. in Jnl. of Physical Chemistry 93, n25 p8263-8270 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 polarizability 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 invoking intramolecular interactions between induced dipoles. A catalog of these transferable LMO properties is developed for a number of different types of bonds and lone pairs. A set of molecular dipole polarizabilities is then reproduced from the catalog as a successful test of this idea.

200,308
PB92-171271 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Physics Div.
Microwave Spectra and Molecular Conformation of Methoxy Difluorophosphinoxide.
Final rept.
C. W. Gillies, L. Rickus, J. Z. Gillies, H. Justnes, R. D. Suenram, F. J. Lovas, and T. DiGuiseppe. 1990, 14p
Pub. in Jnl. of Molecular Structure 223, p273-286 Jun 90.

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

Two closely spaced a type low resolution microwave band series were observed for the normal, (13)C and d3 isotopic forms of methoxy difluorophosphinoxide. The lower frequency series of the three isotopic species were found and assigned employing a pulsed beam Fabry-Perot cavity Fourier transform microwave spectrometer. The a and b type spectra of the three species were fit to a Watson Hamiltonian which gave A=4568.215(1) MHz, B=2500.471(9) MHz, and C=2453.863(8) MHz for the normal species. Stark effect measurements of CH3OP(O)F2 determined the electric dipole components. Moments of inertia and electric dipole data show that the lowest energy conformation has C2 symmetry. The data is most consistent with an assignment of the observed conformer to the trans configuration. The second a type low resolution microwave band series not observed in the pulsed beam cavity spectrometer arises from a methoxy torsional excited state of the trans conformer or a second higher energy conformation. The absence of A-E splitting in the a and b type spectrum gives a lower limit of approximately 2500 cal/mol to the V3 methyl internal rotation barrier.

200,309
PB92-171289 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Molecular Physics Div.
Microwave Spectral and Ab Initio Investigation of Ozone-Water.
Final rept.
J. Z. Gillies, C. W. Gillies, R. D. Suenram, F. J. Lovas, T. Schmidt, and D. Cremer. 1991, 20p
Pub. in Jnl. of Mol. Spectrosc. 146, n2 p493-512 1991.

Keywords: *Complexes, *Ozone, *Water, Van der Waals forces, Microwave spectra, Rotational spectra, Oxygen complexes, Molecular structure, Deuterium compounds, Electric dipoles, Dipole moments, Reprints, Ab initio calculations.

Microwave spectra of O3-H2O, O3-H2(18)O, O3-HDO and O3-D2O have been observed with a pulsed beam Fabry-Perot cavity Fourier transform microwave spectrometer. Two tunneling states designated A1 and A2 are found for the normal and dideuterated isotopic forms while only one state is observed for the O3-HDO isotope. The A1 state of O3-H2O, O3-H2(18)O and O3-D2O as well as the O3-HDO spectrum were fit to a Watson Hamiltonian. The A2 states of O3-H2O and O3-D2O could not be fit to a Watson Hamiltonian which implies that there is a low barrier to internal rotation of water about its local C2 axis in the complex.

200,310
PB92-171412 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Molecular Physics Div.
Measurement and Analysis of the Fermi Resonance between nu5 and 2nu9 of Nitric Acid.
Final rept.
A. G. Maki, and J. S. Wells. 1992, 11p
Sponsored by National Aeronautics and Space Administration, Washington, DC. Upper Atmospheric Research Program.
Pub. in Jnl. of Molecular Spectroscopy 152, p69-79 1992.

Keywords: *Nitric acid, *Fermi resonance, Atmospheric composition, Molecular spectroscopy, Laser spectroscopy, Infrared absorption, Measurement, Reprints.

New tunable diode laser measurements have been made on the nu5 and 2nu9 infrared absorption bands of HNO3 between 853 and 919/cm. These two bands are 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 (nu5, J, k + 2(vertical stroke)2nu9, 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 Wf = 8.13 + or - 0.14/cm and the unperturbed band separation is 6.0 + or - 0.4/cm. Other higher-order interactions were also considered in the analysis, including a deltaK = + or - 2 Coriolis interaction. Over 1400 diode laser transitions were fitted with a rms deviation of 0.00099/cm. Transition wavenumbers, assignments, and lower state energies are made available for the strong transitions of HNO3 between 853 and 920/cm.

200,311
PB92-171560 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Thermophysics Div.
Ergodicity and Activated Dynamics in Supercooled Liquids.
Final rept.
R. D. Mountain, and D. Thirumalai. 1992, 4p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Physical Review Letters 45, pR3380-R3383 1992.

Keywords: Ergodic processes, Temperature dependence, Self-diffusion, Supercooling, Mixtures, Glass, Reprints, *Supercooled liquids, Molecular dynamics.

We show, using constant-pressure molecular-dynamics 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 of the ergodicity diffusion parameter 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 in supercooled liquids are dominated by fluctuations in domains of the finite length.

200,312
PB92-171586 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Chemisorbed Hydrogen and Hydrogenous Molecules.
Final rept.
J. M. Nicol. 1992, 15p
Pub. in Spectrochimica Acta 48A, n3 p313-327 1992.

Keywords: *Chemisorption, *Hydrogen, Neutron scattering, Inelastic scattering, Adsorption, Adsorbates, Catalysts, Palladium, Platinum, Nickel, Sulfides, Reprints, Deuterium 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, are reviewed. Deuterium isotope dilution neutron spectroscopy of adsorbed hydrogen is exemplified as a probe of H-H interactions on surfaces. These studies illustrate the utility of inelastic neutron scattering for studying the vibrational spectroscopy and chemical interactions of surface species.

200,313
PB92-175355 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Sodium Activity Measurements in Protein Solutions with Sodium Amalgam Electrodes.
Final rept.
P. C. Gunaratna, G. Marinenko, and W. F. Koch. 1991, 5p
Pub. in Electroanalysis 3, n2 p125-129 1991.

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 measurements and residual liquid junction potential of sodium in protein-containing solutions. It has been applied to aqueous sodium chloride solutions to test the reliability 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 differ from that of pure aqueous solutions. A functional relationship has been established between the concentration of protein and the percent bias in the measurements. Emf measurements made in protein-containing solutions do not show any evidence of protein effect on liquid junction potential.

200,314
PB92-175389 Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Thermophysics Div.
Structure of a Binary Colloidal Suspension Under Shear.
Final rept.
H. J. M. Hanley, J. Pieper, G. C. Straty, R. P. Hjelm, and P. A. Seeger. 1990, 16p
Sponsored by Department of Energy, Washington, DC.
Pub. in Faraday Discuss. Chem. Soc. 90, p91-106 1990.

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

Neutron scattering intensities from an aqueous mixture suspension of 91 nm polystyrene latex particles and 54 nm silica particles are reported in the range 0.02<Q/nm(-1)<0.2, where Q is the momentum transfer. The suspension was dense 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. The shear-influenced behavior of the mixture is compared with and contrasted to that of a pure polystyrene suspension that can form a crystal lattice in equilibrium, 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.

CHEMISTRY

Physical & Theoretical Chemistry

High-Resolution Measurements of the Bands of Carbonyl Sulfide between 2510 and 3150(cm-1).
Final rept.
A. G. Maki, J. S. Wells, and J. B. Burkholder. 1991, 9p
Sponsored by National Aeronautics and Space Administration, Washington, DC. Upper Atmospheric Research Program.
Pub. in Jnl. of Molecular Spectroscopy 147, p173-181 1991.

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

The four strongest absorption bands of OCS in the region from 2500 to 3150/cm have been measured with FTS spectrometers with effective resolutions of about 0.010/cm or better. A total of 25 different vibrational transitions have been identified in the spectrum and have been analyzed to obtain improved band centers and rovibrational constants. Included in the bands identified are a few transitions due to the less abundant isotopomers (16)O(12)C(34)S, (16)O(12)C(33)S, (16)O(13)C(32)S, and (18)O(12)C(32)S. Relative values are given for the transition moments of some of the overlapping bands.

200,316
PB92-175892 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.
Accurate Far-Infrared Rotational Frequencies of Carbon Monoxide.
Final rept.
T. D. Varberg, and K. M. Evenson. 1992, 3p
Pub. in Astrophysical Jnl. 385, p763-765, 1 Feb 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 sigma errors of the last digits in parentheses): B0 = 57635.96826(12) MHz, D0 = 0.18350552(46) MHz, H0 = 1.7249(59) x 10 to the -7 power MHz, and L0 = -3.1(23) x 10 to the -13 power MHz. A table of calculated CO rotational frequencies is given for the range J double prime = 0-45; these frequencies are accurate to < or = 10 kHz (2 sigma) for J double prime < or = 28.

200,317
PB92-197425 Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Thermophysics Div.
Comparison of Heat Capacities Measured by Adiabatic Calorimetry and By Scanning Calorimetry: Thermodynamic Properties of 9-Methylcarbazole at Temperatures between 4 K and 345 K.
Final rept.
J. E. Callanan, K. M. McDermott, R. D. Weir, and E. F. Westrum. 1992, 11p
Pub. in Jnl. of Chemical Thermodynamics 24, p233-243 1992.

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 345K 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 obtained from these values are tabulated at selected temperatures.

200,318
PB92-197458 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Two-Dimensional Carbon-13 NMR Spectrum Editing of Carbohydrates.
Final rept.
B. Coxon. 1986, 25p
Pub. in Proceedings of Scientific Conference, Arlington, VA., September 21-24, 1986, 25p.

Keywords: *Nuclear magnetic resonance, *Carbohydrates, *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 display 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 J(CH)-resolved (13)C NMR spectroscopy. Generation of separate 2D NMR subspectra of chemical groups (for example, separate (13)C NMR spectra for CH, CH2, 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.

200,319
PB92-197466 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Organic Analytical Research Div.
Two-Dimensional NMR Spectrum Editing of Carbohydrates.
Final rept.
B. Coxon. 1990, 19p
Pub. in Basic Life Science 56, p27-45 1990.

Keywords: *Nuclear magnetic resonance, *Carbohydrates, Protons, Carbohydrate conformation, Carbon 13, Reprints, *NMR spectrum editing.

The application of two-dimensional (2D) (13)C NMR spectrum editing methods to carbohydrates and their derivatives is discussed, particularly the use of pulse sequences for the 2D POMMIE J(CH)-resolved and 2D POMMIE carbon-proton chemical shift correlation techniques. Four classes of spectrum editing computations are described, based on linear combinations of three 2D data matrices using either unit coefficients, or two, four, or six floating point coefficients. Non-theoretical behavior of POMMIE (13)C intensities at low (1)H decoupler pulse powers is discussed, and methods for overcoming this and other problems are described. Results are shown for methyl 2,3-di-O-methanesulfonyl-alpha-D-glucopyranoside, methyl alpha-D-glucopyranoside tetraacetate, oleandomycin, and a mixture of seven methyl hexosides.

200,320
PB92-197789 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
Electronic Spectra of SF2 Radicals between 295 and 495 nm Observed with Resonance-Enhanced Multiphoton Ionization Spectroscopy.
Final rept.
R. D. Johnson, and J. W. Hudgens. 1990, 4p
Pub. in Jnl. of Physical Chemistry 94, n8 p3273-3276 1990.

Keywords: *Sulfur fluorides, Near ultraviolet radiation, Visible radiation, Vibrational spectra, Ultraviolet spectra, Gas discharges, Free radicals, Reprints, Multiphoton ionization.

Spectra of the SF2 radical were observed between 295 and 495 nm by 2 + 1, 2 + 2, and 3 + 1 resonance-enhanced multiphoton ionization (REMPI) spectroscopy. Vibrational progressions associated with two Rydberg states were assigned. Evidence for the C bar state which lies between 57,000 and 60,000/cm is presented. The SF2 was produced by a variety of methods, including passing SF6 through a microwave discharge, which provides direct evidence that discharges produce SF2 radicals.

200,321
PB92-197797 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
New Electronic State of SiH and SiD Radicals Observed by Resonance Enhanced Multiphoton Ionization Spectroscopy.
Final rept.
R. D. Johnson, and J. W. Hudgens. 1989, 3p
Pub. in Jnl. of Physical Chemistry 93, n17 p6268-6270 1989.

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

A previously unreported electronic state of the silylidyne radicals, SiH and SiD, was observed by resonance enhanced multiphoton ionization spectroscopy. The spectra of the SiH and SiD radicals appeared over the laser wavelength interval between 426 and 430 nm. The spectra arose from simultaneous two photon absorption which prepared the F (4p) Rydberg state that lies at 46700/cm. Absorption of a third laser photon ionized the radicals.

200,322
PB92-197920 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Thermophysics Div.
Solubility in Near- and Supercritical Water.
Final rept.
J. M. H. Levelt Sengers, and M. L. Japas. 1988, 14p
Sponsored by Electric Power Research Inst., Palo Alto, CA.
Pub. in Proceedings of Conference on Cycle Chemistry in Fossil Plants (2nd), Seattle, WA., August 30-September 1, 1988, 14p.

Keywords: *Solubility, *Supercritical state, *Water, *Steam electric power generation, Thermodynamics, Critical point, Reprints.

The solubility of solids in supercritical solvents, and that of gases in near-critical solvents, show strong variations in large regions around the solvent's critical point. The authors discuss the thermodynamic principles governing the universal anomalous behavior. Some applications are made to solutions occurring in steam power cycles.

200,323
PB92-197961 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Adsorption from Solution on Hydroxyapatite: Role of Hydrogen-Bonding.
Final rept.
D. N. Misra. 1991, 17p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Phosphorus Research Bulletin 1, p255-271 1991.

Keywords: *Hydrogen bonds, *Adsorption, *Surface chemistry, *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 preconditioning. The reversibility and orientation of adsorbed molecules on the hydrated apatite depend 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 solvents 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 hydrophobic moieties or groups of the adsorbate molecule may impel it to orient in a manner to interact effectively with the solvent or the substrate. Adsorption rarely occurs on a molecular level from aqueous solutions where the pH of the solution together with the concentrations of other constituent ions, e.g., calcium and phosphate, play a very important role.

200,324
PB92-198043 Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Metallurgy of Quasicrystals.
Final rept.
R. J. Schaefer, and L. A. Bendersky. 1988, 32p
Pub. in Aperiodicity and Order: Introduction to Quasicrystals, Chapter 3, v1 p111-142 1988.

Keywords: *Metastable states, *Nucleation, *Crystal growth, *Crystal structure, Phase transformations, Reprints, *Quasicrystals.

The types of alloy systems in which quasicrystal phases form are discussed, with emphasis upon the relationship between quasicrystals and periodic crystals containing icosahedral groups of atoms. The nucleation and growth processes of the metastable quasicrystal phases are described, as well as the orientation relationships between quasicrystals and periodic phases. The phase transformation behavior of quasicrystals is concluded to be very different from that of metallic glasses, in which no nucleation occurs, but to be closely related to the formation of certain other amorphous materials which show strong chemical ordering.

200,325
PB92-198092 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Surface and Microanalysis Science Div.
Electron Stimulated Desorption of Neutral Species from (100) KC1 Surfaces.
Final rept.
M. Szymonski, A. Poradzisz, P. Czuba, J. Kolodziej, P. Piatkowski, J. Fine, L. Tanovic, and N. Tanovic. 1992, 9p
Pub. in Surface Science 260, p295-303 1992.

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

Composition changes of a (100) KCl surface bombarded by I keV electrons have been studied by Auger electron spectroscopy. Intensity 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 100C, 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 excitonic mechanism of electron stimulated desorption (ESD).

200,326
PB92-217637 PC **A05**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
Journal of Research of the National Institute of Standards and Technology, May-June 1992. Volume 97, Number 3.
1992, 89p
Also available from Supt. of Docs. as SN703-027-00046-6. See also PB 92-217645 through PB92-217686, and PB92-192079.

Keywords: *Radiometers, *Water, *Robots, *Specific heat, *Polychlorotrifluoroethylene, *Solubility, Urinary calculi, Thermodynamic properties, Density(Mass/volume), Precipitation(Chemistry), Cranes(Hoists), Photodiodes, *Calcium hydrogenurate hexahydrate.

Contents: A radiometer for precision coherent radiation measurements; ITS-90 density of water formulation for volumetric standards calibration; Heat capacity and thermodynamic properties of poly(chlorotrifluoroethylene) from 2.5 to 620 K; Precipitation and solubility of calcium hydrogenurate hexahydrate; The NIST SPIDER, a robot crane.

200,327
PB92-217652
(Order as PB92-217637, PC **A05**/MF **A01**)
Jones (Frank E.), Potomac, MD.
ITS-90 Density of Water Formulation for Volumetric Standards Calibration.
F. E. Jones, and G. L. Harris. 1992, 6p
Prepared in cooperation with National Inst. of Standards and Technology, Gaithersburg, MD.
Included in Jnl. of Research of the National Institute of Standards and Technology, v97 n3 p335-340 May/Jun 92.

Keywords: *Water, *Density(Mass/volume), Compressibility, Temperature dependence, Tables(Data), Standards, Volumetric standards.

A new formulation of the density of air-saturated water as a function of temperature on the 1990 International Temperature Scale (ITS-90) is presented. Also, a new equation for calculating isothermal compressibility as a function of temperature on ITS-90 was developed. The equations are to be 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.

200,328
PB92-217660
(Order as PB92-217637, PC **A05**/MF **A01**)
National Inst. of Standards and Technology, Gaithersburg, MD.
Heat Capacity and Thermodynamic Properties of Poly(chlorotrifluoroethylene) from 2.5 to 620 K.
S. S. Chang, and J. J. Weeks. 1992, 23p
Included in Jnl. of Research of the National Institute of Standards and Technology, v97 n3 p341-363 May/Jun 92.

Keywords: *Polychlorotrifluoroethylene, *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 crystallinities 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 associated with these anomalies were positive (exothermic) for quenched samples and negative (endothermic) for annealed samples. Therefore these anomalies were believed to be associated with a relaxation phenomenon similar to that of a glass transition. For highly quenched low crystallinity films, a much larger heat capacity discontinuity of greater than 15% was observed, amidst a crystallization exotherm.

200,329
PB92-217678
(Order as PB92-217637, PC **A05**/MF **A01**)
Institut Rudjer Boskovic, Zagreb (Yugoslavia).
Precipitation and Solubility of Calcium Hydrogenurate Hexahydrate.
V. Babic-Ivancic, H. Furedi-Milhofer, N. Brnicevic, and M. Markovic. 1992, 8p
Prepared in cooperation with National Inst. of Standards and Technology, Gaithersburg, MD.
Included in Jnl. of Research of the National Institute of Standards and Technology, v97 n3 p365-372 May/Jun 92.

Keywords: *Precipitation(Chemistry), *Solubility, Phase transformations, Phase diagrams, Urinary calculi, Thermodynamic properties, Uric acid, Hydrochloric acid, Calcium hydroxides, Water, *Calcium hydrogenurate hexahydrate.

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 conditions for calcium hydrogenurate hexahydrate, Ca(C5H3N4O3)2.6H2O, precipitation. The precipitates were identified by chemical and thermogravimetric analyses, x-ray powder diffraction, infrared spectroscopy, light microscopy, and scanning electron microscopy. In the precipitation diagram the concentration region in which calcium hydrogenurate hexahydrate precipitated as a single solid phase was established. The data are presented in the form of tables and chemical potential diagrams. By using the data the thermodynamic solubility products of calcium hydrogenurate hexahydrate were determined. The formation of calcium hydrogenurate hexahydrate crystals in urinary tract of patients with pathologically high concentrations of calcium and urates (hypercalciuria and hyperuricosiuria) is possible.

200,330
PB92-236280 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Organic Analytical Research Div.
15N NMR Investigation of Azo-Hydrazone Acid-Base Equilbria of FD and C Yellow No. 5 (Tartrazine) and Two Analogs.
Final rept.
S. J. Bell, E. P. Mazzola, and B. Coxon. 1989, 7p
Pub. in Dyes Pigm. 11, n2 p93-99 1989.

Keywords: *Nuclear magnetic resonance, *Nitrogen 15, *Azo dyes, *Hydrazones, pH, Chemical shift, Dyes, Acid-base equilibrium, Reprints, *Tartrazine.

FD&C Yellow No. 5 (I) and two analogs have been characterized by (15)N NMR at several pH values. (15)N chemical shift data indicate the existence of azo-hydrazone, acid-base equilibria and suggest that these compounds are present in the hydrazone form at pH 7 and the azo form at pH 12. Approximately equal concentrations of these two species are observed at pH 10.3.

200,331
PB92-236348 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Studies of the Structure and Properties of Amorphous Zirconium Iron Hydride (a-Zr76Fe24Hx).
Final rept.
R. C. Bowman, A. J. Maeland, K. M. Unruh, E. L. Venturini, J. J. Rush, and J. S. Cantrell. 1989, 6p
See also AD-A214 646.
Pub. in Z. Phys. Chem. 163, n2 p373-378 1989.

Keywords: Amorphous materials, Magnetic susceptibility, Mossbauer effect, X ray diffraction, Spin lattice relaxation, Electronic structure, Reprints, *Zirconium iron hydrides.

The a-Zr(76)Fe(24)H(x) samples with x = or < 173 have been shown to remain amorphous after reaction of the glassy alloy with gaseous hydrogen. Magnetic susceptibility and Mossbauer spectroscopy indicate the electronic structure of the alloy is modified upon hydrogen absorption. Proton spin-lattice relaxation times suggest a strong hyperfine interaction with the iron d-states. The vibrational spectrum of a-Zr(76)Fe(24)H(173) from inelastic neutron scattering shows hydrogen occupancy in a distribution of tetrahedral interstitial sites. Calorimetry and x-ray diffraction demonstrate that a-Zr(76)Fe(24)H(x) with x>140 irrevisibly crystallizes into c-ZrH(x) and (possibly) ZrFe2.

200,332
PB92-236496 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Two-Dimensional Magnetic Correlations and Magnetic Ordering of Dy and Er in DyBa2Cu3O7 and ErBa2Cu3O7.
Final rept.
T. W. Clinton, J. W. Lynn, J. Z. Liu, Y. X. Jia, and R. N. Shelton. 1992, 2p
Pub. in Jnl. of Magnetism and Magnetic Materials 104-107, p625-626 1992.

Keywords: *Two-dimensional calculations, *Dysprosium, *Erbium, *Magnetic properties, Temperature dependence, Neel temperature, Copper oxides, Barium oxides, Reprints, Magnetic ordering, Barium copper oxides.

The authors have observed two-dimensional magnetic behavior associated with the magnetic ordering of Dy in DyBa2Cu3O7, and have studied the 2D magnetic correlations of Dy in DyBa2Cu3O7 as well as Er in ErBa2Cu3O7. The temperature dependence of the rod of scattering, characteristic of 2D behavior, has been measured above and below the Neel temperature (T(sub N) approximately 0.9 K for Dy, T(sub N) approximately 0.62 K for Er). For both systems the rod intensity, which is proportional to the magnetic susceptibility, is observed to increase as the temperature is decreased until T(sub N) is reached. Below T(sub N) the intensity decreases rapidly. The 2D magnetic correlation length is seen to grow continuously with decreasing temperature and then peak at the respective Neel temperatures when long range magnetic order sets in.

200,333
PB92-236603 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.

Energy Transfer from Vibrationally Excited SF6 to Benzene, Hexafluorobenzene, Fluorobenzene and Toluene.
Final rept.
P. Dagaut, W. Braun, and T. J. Wallington. 1988, 15p
Pub. in Jnl. of Photochemistry and Photobiology A 45, n2 p151-165 1988.

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

200,334
PB92-236611 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
UV Absorption Spectra and Kinetics of the Self Reactions of CH2ClO2 and CH2FO2 Radicals in the Gas Phase.
Final rept.
P. Dagaut, M. J. Kurylo, and T. J. Wallington. 1988, 12p
Pub. in International Jnl. of Chemical Kinetics 20, n10 p815-826 1988.

Keywords: *Peroxy radicals, *Chemical reactions, *Reaction kinetics, Photolysis, Ultraviolet spectroscopy, Temperature dependence, Pressure dependence, Reprints, Absorption crosssection.

The ultraviolet absorption spectra of chloromethylperoxy and fluoromethylperoxy radicals, CH2ClO2 and CH2FO2, and the kinetics of their respective self reactions have been studied in the gas phase using a flash photolysis technique. The absorption spectra for both radicals were quantified over the wavelength range 210 to 290 nm. The measured absorption cross-sections were used to derive the observed self-reaction rate constants (for reactions 1 and 2) over the temperature range 228 - 380K, where X represents Cl or F. (1) CH2ClO2 + CH2ClO2 -> Products, (2) CH2FO2 + CH2FO2 -> Products. The rate constants at 298K were found to be independent of pressure over the range 25 - 400 Torr N2 with values of k(sub 1)(298K) - (3.78 + or - 0.45) x 10 to the -12th power and k(sub 2)(298K) - (3.07 + or - 0.65) x 10 to the -12th power in units of cc/molecule/s.

200,335
PB92-236629 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
Gas Phase Studies of Substituted Methylperoxy Radicals: The UV Absorption Spectrum and Self-Reaction Kinetics of Methoxymethylperoxy Radical. The Reaction of Chlorodifluoromethylperoxy Radical with Chlorine Atoms.
Final rept.
P. Dagaut, T. J. Wallington, and M. J. Kurylo. 1989, 12p
Pub. in Jnl. Photochem. Photobiol. A 48, n2-3 p187-198 1989.

Keywords: *Peroxy radicals, *Chemical reactions, *Reaction kinetics, Photolysis, 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 methoxy-methylperoxy radical, CH3OCH2O2, over the wavelength range 210-290 nm. Reaction (1) was then studied by kinetic absorption spectroscopy, (1) CH3OCH2O2 + CH3OCH2O2 -> Products, and the rate constant was derived using an absorption crosssection of 3.65 + or - 0.35 x 10 to the 18th power/sq cm/molecule. The self-reaction rate constants were observed to be in the fall-off region over the temperature range 228 to 380 K at pressures between 25 and 800 Torr (using N2) and were fit using the formulation developed by Troe. Attempts at similar studies for CF2ClO2 radicals were hindered by secondary formation of ClO. The experimental observations in this radical formation system are consistent with the occurrence of a rapid reaction between CF2ClO2 and Cl yielding ClO. (2) Cl + CF2ClO2 -> ClO + CF2ClO. An analysis of the transient absorption decay was used to obtain kinetic data on the pressure dependence of the ClO radical recombination reaction at room temperature.

200,336
PB92-236645 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Molecular Physics Div.
Analysis of the nu8 Band of Methylene Fluoride.
Final rept.
R. D'Cunha, M. N. Deo, A. Weber, and W. B. Olson. 1991, 13p
Pub. in Jnl. of Molecular Spectroscopy 149, p412-424 1991.

Keywords: *Infrared spectra, Absorption spectra, Vibrational spectra, Rotational spectra, High resolution, Band spectra, Reprints, *Methylene fluorides, Fourier transform infrared spectroscopy.

The high resolution infrared absorption spectrum of the nu(8) band of methylene fluoride has been measured on a BOMEM DA 3.002 Fourier transform spectrometer in the region 1400-1465/cm. More than 900 transitions have been assigned in this A-type band centered at 1435.6355/cm. The data have been combined with the upper state microwave measurements in a weighted least-squares fit to obtain molecular constants for the upper state resulting in an overall standard deviation of 0.0004/cm.

200,337
PB92-236652 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
Methyl Cation Affinities of N, O, and C Lone-Pair Donors.
Final rept.
C. A. Deakyne, and M. Mautner. 1990, 8p
Pub. in Jnl. of Physical Chemistry 94, n1 p232-239 1990.

Keywords: *Affinity, *Organic ions, *Gibbs free energy, *Chemical reactivity, *Cations, Reaction kinetics, Nitriles, Chemical reactions, Reprints, *Methyl cation affinity.

Methyl cation transfer equilibria were measured using pulsed high pressure mass spectrometry. A ladder of deltaG(sup o)(sub 600) values gives relative methyl cation affinities (MCAs) for several cyanides, ethers and iodides, spanning a range of 15 kcal/mol. The ladder is anchored to an estimated MCA((CH3)2O) = 93 kcal/mol, giving the following MCA values: CH3CN, 99; HCCCN, 95; i-C3H7CN, 100; 1,4-dioxane, 96; THP, 98; THF, 98; CH3I, 86; C2H5I, 90 kcal/mol. The MCAs of (CH3)2O, CH3CN and HCCCN, and several model compounds were calculated by ab initio 6-31G(star) to 6-311++G(double star)/MP2, MP3 and MP4 methods, with 6-31G(double star)/MP2 giving the best results.

200,338
PB92-236819 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Thermophysics Div.
Correlation of Aqueous Henry's Constants from 0C to the Critical Point.
Final rept.
A. H. Harvey, and J. M. H. Levelt Sengers. 1990, 8p
Pub. in AIChE Jnl. 36, n4 p539-546 Apr 90.

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

Recent theoretical results (Japas and Levelt Sengers, 1989) for the temperature dependence of Henry's constant near the solvent's critical point are used to obtain a linear expression which, for aqueous solutions of nonpolar gases, fits experimental Henry's constant data at temperatures from water's critical point down to roughly the normal boiling point. A small correction with only one additional adjustable parameter extends the correlation to 0C. The final result is a three-parameter correlation, covering the entire range of temperatures, which fits the available data as well as or better than existing four-parameter empirical expressions and better than a recently proposed three-parameter expression. Since the correct near-critical behavior is built in, the new correlation should be especially useful for estimating Henry's constants in systems where little or no data exist at high temperatures. Fitted parameters are given for ten nonpolar gases in H2O and six nonpolar gases in D2O.

200,339
PB92-236884 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Thermophysics Div.
Coexistence Curve of Tetra N-Pentyl Ammonium Bromide in Water Near the Consolute Point.
Final rept.
M. L. Japas, and J. M. H. Levelt Sengers. 1990, 7p
Pub. in Proceedings of International Conference (11th) on Properties of Water and Steam, Prague, Czechoslovakia, September 4-8, 1989, p196-202 1990.

Keywords: *Electric conductivity, *Organic ions, *Aqueous solutions, Coulomb interactions, Critical temperature, Phase transformations, Thermodynamics, Reprints, *Coexistence curve, *Tetra-n-pentyl ammonium bromide.

There have been repeated statements in the recent literature that ionic systems display classical critical behavior. In order to test this hypothesis, we have performed measurements of the coexistence curve and electrical conductivity for the system tetra n-pentyl ammonium bromide in water, for which we report a consolute point at 404.90 + or - 0.01 K at 0.0296 + or - 0.0005 in mole fraction of salt. The compositions of the coexisting phases were measured from 373 K to within 0.03 K from the critical point. The conductivity was measured in the supercritical regime, at 413 K, over the range of compositions of interest. From these data, the degree of dissociation was estimated to be higher than 20% at the critical composition. The analysis of the data shows nonclassical behavior over the entire range of the data, notwithstanding the presence of a large number of ions.

200,340
PB92-237015 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Enthalpy of Combustion of 1,4-Dimethyl Dicarboxylate.
Final rept.
D. R. Kirklin, K. L. Churney, and E. S. Domalski. 1989, 9p
Pub. in Jnl. of Chemical Thermodynamics 21, n11 p1105-1113 1989.

Keywords: *Hydrocarbons, *Esters, *Heat of combustion, Heat of formation, Calorimetry, Thermodynamic properties, Reprints, *Cubane dicarboxylate/dimethyl, Strain energy.

The energy of combustion of crystalline 1,4-dimethyl cubane dicarboxylate was measured in the NIST aneroid adiabatic rotating calorimeter. The standard molar enthalpy of combustion at 298.15 K and P(sup o)= 100,000 Pa for the reaction: C12H12O4(cr) + 13 O2(g) = 12 CO2(g) + 6 H2O(1) is -(6518.09 + or - 1.42) kJ/mol. The derived enthalpy of formation for crystalline 1,4-dimethyl cubane dicarboxylate is -(218.99 + or - 2.12) kJ/mol. An estimated enthalpy of formation of an unstrained crystalline 1,4-dimethyl cubane dicarboxylate is calculated to be -809.7 kJ/mol using group-contribution values. The corresponding strain energy is +590.7 kJ/mol.

200,341
PB92-237056 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Physics Div.
Polarizabilities of Alkali Clusters.
Final rept.
M. Krauss, and W. J. Stevens. 1989, 3p
Pub. in Chemical Physics Letters 164, n5 p514-516 1989.

Keywords: *Cesium, *Polarization characteristics, Alkali metals, Solid clusters, Polyhedrons, Surfaces, Reprints.

The static dipole polarizabilities of polyhedral clusters of Cs atoms are compared with linear clusters. The component of the polarizability parallel to the linear cluster increases approximately with the square of the number of atoms. As a result the dependence of the average polarizability with the number of atoms is qualitatively different in the two types of clusters, and may lead to strong geometrical preferences for Cs clusters interacting with surfaces.

200,342
PB92-237098 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.
Synchrotron Radiation Studies of Water Adsorption on Titania(110).
Final rept.
R. L. Kurtz, R. Stockbauer, T. E. Madey, E. Roman, and J. L. de Segovia. 1989, 23p
Pub. in Surface Science 218, n1 p178-200 1989.

Keywords: *Titanium dioxide, *Water vapor, *Adsorption, Photoelectric emission, Surface chemistry, Crystal defects, Temperature dependence, Reprints.

Synchrotron radiation photoemission has been used to study the interaction of H2O with defective and nearly-perfect TiO2(110) surfaces at temperatures between 160 and 300 K. Defect sites have been implicated in the adsorption process and by tuning the photon energy to 47eV we find that a resonant photoemission process gives an enhanced photoemission sensitivity to these Ti(3+)3d defect states. Defects are produced on TiO2(110) by annealing to 1000 K in UHV; subsequent exposure to 10(4)LO2 produces nearly perfect surfaces, based on the suppressed Ti3d emission. Both nearly perfect and defective surfaces give rise to dissociative adsorption at 300 K but the defective surface has a saturation coverage that is nearly an order of nearly perfect TiO2(110). The enhanced sensitivity to the Ti(3+) defect states has allowed the observation of a surprising effect: the dissociative adsorption results in increased defect state intensity on both the nearly perfect and the defective surfaces. This apparent charge-transfer to the substrate implies that a new model for the dissociation process is needed. At 160 K H(2)O adsorbs molecularly on both the nearly-perfect and the defective surfaces.

200,343
PB92-237262 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
Quantitative Analysis of Temporally-Varying Multicomponent Mixtures.
Final rept.
R. I. Martinez, and J. T. Herron. 1990, 1p
Pub. in Trends in Analytical Chemistry 9, n1 p2 1990.

Keywords: *Reaction kinetics, *Quantitative chemical analysis, *Meetings, Mixtures, Reprints.

A report on the Second International Conference on Chemical Kinetics, held in Gaithersburg, MD, USA, 24-27 July, 1989 is presented.

200,344
PB92-237304 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.
Experimental and Theoretical Determination of Oxide Glass Vapor Pressures and Activities.
Final rept.
E. R. Plante, D. W. Bonnell, and J. W. Hastie. 1988, 18p
Pub. in Proceedings of International Conference on Advances in the Fusion of Glass (1st), Alfred, NY., June 14-17, 1988, p26.1-26.18.

Keywords: *Potassium, *Sodium, *Glass, *Vapor pressure, *Silicates, Gibbs free energy, Phase diagrams, Slags, Mathematical models, Reprints.

Results of experimental and thermodynamic solution model data on the activities and vapor pressures of potassia or soda in representative glasses and glassy slags are reviewed or newly presented. The data are based on partial pressure measurements using a modulated beam mass spectrometry system with comparison model results obtained using a novel approach to simulate the strong non-ideal activity behavior present in the liquid and glass phase of high-order glass systems. Measurements include K and O2 pressures over the K2O-SiO2 binary system from K2Si2O5 to the K2O-poor phase boundary, K pressures over a slag approximating the composition of a blast furnace slag, and K and O2 pressures over the K2O-SiO2-Al2O3 glass system and a Standard Reference Material mixed alkali glass, SRM 621. A review of activity data available in the literature on the N2O-SiO2 system is also given. These results are compared with those obtained from a theoretical model utilizing the SOLGASMIX multicomponent equilibrium code to predict activity and vapor pressure data, which can be validated using the experimental data.

200,345
PB93-124246 PC **A06**/MF **A02**
National Inst. of Standards and Technology, Gaithersburg, MD.
Journal of Research of the National Institute of Standards and Technology, July-August 1992. Volume 97, Number 4.
1992, 107p
Also available from Supt. of Docs. as SN703-027-00047-4. See also PB93-124253, PB93-124261 and PB92-217637.

Keywords: *Molecular spectra, *Infrared spectra, *Computer graphics, Infrared spectrometers, Parallel processing, Curve fitting, Exponential functions, Logarithm functions, Computation, Frequencies, Polymers, Calibration atlases, Wavenumbers, Symmetric level index arithmetic.

Contents: New Wavenumber Calibration Tables From Heterodyne Frequency Measurements; Symmetric Level Index Arithmetic in Simulation and Modeling.

200,346
PB93-124253
(Order as PB93-124246, PC **A06**/MF **A02**)
National Inst. of Standards and Technology, Gaithersburg, MD.
New Wavenumber Calibration Tables from Heterodyne Frequency Measurements.
A. G. Maki, and J. S. Wells. 1992, 62p
Included in Jnl. of Research of the National Institute of Standards and Technology, v97 n4 p409-470 Jul/Aug 92. Prepared in cooperation with National Inst. of Standards and Technology, Boulder, CO.

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

The primary purpose of the work is to provide an atlas of molecular spectra and associated tables of wavenumbers to be used for the calibration of infrared spectrometers. This new calibration atlas is based on frequency rather than wavelength calibration techniques for absolute references. Included in the text relating to the atlas are a description of the heterodyne frequency measurement techniques and details of the analysis, including the Hamiltonians and least-squares-fitting and calculation. Also included are other relevant considerations such as intensities and lineshape parameters. A 390-entry bibliography which contains all data sources used and a subsequent section on errors conclude the text portion. The primary calibration molecules are the linear triatomics, carbonyl sulfide and nitrous oxide, which cover portions of the infrared spectrum ranging from 488 to 3120/cm. Some gaps in the coverage afforded by OCS and N2O are partially covered by NO, CO, and CS2. An additional region from 4000 to 4400/cm is also included.

200,347
PB93-125227 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Quantum Physics Div.
Close-Coupling Anion Curves for HF(-) and HCl(-).
Final rept.
T. Gorczyca, and D. W. Norcross. 1992, 8p
Grants NSF-PHY86-04504, NSF-VAXG0
Sponsored by National Science Foundation, Washington, DC.
Pub. in Physical Review A 45, n1 p140-147, 1 Jan 92.

Keywords: *Hydrogen chloride, *Hydrogen fluoride, Molecular structure, Negative ions, Reprints.

We extend previous calculations on H2(-) to the lowest doublet sigma(+) states of HF(-) and HCl(-). Anion potential-energy curves are computed in the single-configuration close-coupling approximation. Fixed-nuclei electron-molecule eigenphase sums are also computed. Static-exchange results are improved by including a correlation-polarization potential. The avoided crossing between the lowest anion state and the infinite series of dipole-bound states for HF(-) is tracked as the neutral and anion curves approach each other at smaller internuclear separations. The present method goes beyond previous calculations of this nature by retaining all long-range multipole moments in the asymptotic potential.

200,348
PB93-125367 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.
Photoelectron Spectroscopic Study of the Interaction of Thin Fe Films with MoS2(0001) Surface.
Final rept.
J. R. Lince, T. B. Stewart, M. M. Hills, P. D. Fleischauer, J. A. Yarmoff, and A. Taleb-Ibrahimi. 1989, 17p
See also AD-A214 348.
Pub. in Surface Science 223, n1-2, p65-81 1989.

Keywords: *Molybdenum disulfide, *Iron, Photoelectron spectroscopy, Valence bands, Metal films, Thin films, Surface chemistry, Temperature dependence, Interfaces, Reprints.

The Fe/MoS2(0001) interface has been studied by high-resolution photoelectron spectroscopy using synchrotron radiation. The evolution of the Mo 3d, Fe 3p, and S 2p core levels and of the valence band spectra (hv = 152 eV) during growth of vapor-deposited Fe films (1-10 A) indicates the production of sulfur vacancy defects in the MoS2(0001) surface. Several sulfur species were formed, including an interfacial Fe-S species and sulfur adsorbed on the Fe surface. The MoS2 surface was found to be completely covered for Fe film thickness of about 10 A. Annealing of 10 A film to 600 K resulted in the Fe film beginning to agglomerate, while annealing to 700 to 900K resulted in further agglomeration of the Fe film in addition to possible diffusion into the MoS2 or desorption. The results indicate that the Fe/MoS2(0001) system exhibits complex interfacial chemistry but does not form bulk compounds such as FeS or FeS2. The results have been compared to those of previous studies of the Fe/MoS2(0001) system.

200,349
PB93-125409 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
Flash Photolysis Resonance Fluorescence Investigation of the Reactions of Oxygen O((3)P) Atoms with Aliphatic Ethers and Diethers in the Gas Phase.
Final rept.
R. Liu, P. Dagaut, R. E. Huie, and M. J. Kurylo. 1990, 7p
See also PB92-159292.
Pub. in International Jnl. of Chemical Kinetics 22, n7 p711-717 1990.

Keywords: *Oxygen atoms, *Reaction kinetics, *Ethers, Vapor phases, Atomic energy levels, Flashing, Photolysis, Fluorescence, Error analysis, Arrhenius equation, Tetrahydrofuran, Dioxane, Chemical reactions, Reprints, Ether/methyl-amyl, Ether/ethyl-butyl, Methane/diethoxy.

Rate constants for the gas phase reactions of O((sup 3)P) atoms with a series of symmetric aliphatic ethers have been determined using the flash photolysis resonance fluorescence technique over the temperature range 240-400 K. The Arrhenius parameters were derived from these data (in units of cu cm/molecule/s). The error limits are two standard deviations derived from the least-squares fit. Rate constants for several other ethers were determined only at 298 K. The values obtained were (in units of 10 to the 14th power cu cm/molecule/s): tetrahydrofuran (37.5 + or - 1.1); 1,4-dioxane (6.81 + or - 0.46); diethoxymethane (40.4 + or - 1.8); ethyl-t-butylether (37.0 + or - 1.3); and methyl-t-amylether (57.3 + or - 2.3).

200,350
PB93-125417 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
Rate Constants for the Reactions of the OH Radical with some Hydrochlorofluoro-carbons Over the Temperature Range 270 to 400 K.
Final rept.
R. Liu, R. E. Huie, and M. J. Kurylo. 1990, 3p
Pub. in Jnl. of Physical Chemistry 94, n8 p3247-3249 1990.

Keywords: *Reaction kinetics, *Hydroxyl radicals, *Fluorohydrocarbons, Chlorohydrocarbons, Freons, Atmospheric chemistry, Flashing, Fluorescence, Photolysis, Temperature, Arrhenius equation, Chemical reactions, Reprints.

Absolute rate constants were measured in the gas phase for the reactions of the hydroxyl radical with a series of hydrochlorofluorocarbons and hydrofluorocarbons by the flash photolysis-resonance fluorescence technique. Kinetic data were taken over the temperature range 270 to 400K and were used to derive the Arrhenius expressions (in units of cu cm/molecule/s). The results are compared to other measurements of the rate constants for these and similar compounds and are discussed in terms of their predicted atmospheric lifetimes.

200,351
PB93-125425 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
Gas Phase Reactions of Hydroxyl Radicals with a Series of Nitroalkanes Over the Temperature Range 240-400 K.
Final rept.
R. Liu, R. E. Huie, M. J. Kurylo, and O. J. Nielsen. 1990, 5p
Pub. in Chemical Physics Letters 167, n6 p519-523 1990.

Keywords: *Reaction kinetics, *Hydroxyl radicals, *Nitrogen organic compounds, Chemical reactions, Alkanes, Vapor phases, Photolysis, Flashing, Fluorescence, Temperature, Experimental design, Arrhenius equation, Reprints, Methane/nitro, Ethane/nitro, Propane/nitro, 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 with nitromethane and nitromethane-d3 at 296 K yielded rate constants of 1.58 and 0.9 x 10 to the 14th power cu cm/molecule/s, respectively. Data from experiments 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 (CSTL), Gaithersburg, MD. Thermophysics Div.
Comparison of Rotational Relaxation Rate Laws to Characterize the Raman Q-Branch Spectrum of CO at 295 K.
Final rept.
J. P. Looney, W. S. Hurst, J. W. Hahn, L. A. Rahn, and G. J. Rosasco. 1989, 7p
Pub. in Chemical Physics Letters 161, n3 p232-238 1989.

Keywords: *Carbon monoxide, *Raman spectra, Line broadening, Room temperature, Scaling laws, Line 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 characterize line broadening and line interference in the CO Q-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 CO:CO line broadening. From 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:CO system.

200,353
PB93-125557 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Thermophysics Div.
Modelling Macromolecular Diffusion Through a Porous Medium.
Final rept.
R. A. MacDonald. 1992, 14p
Pub. in Jnl. of Membrane Science 68, p93-106 1992.

Keywords: *Porous materials, *Diffusion, *Membranes, *Computerized simulation, *Molecules, Performance evaluation, Mathematical models, Random walk, Porosity, Tortuosity, Porous walls, Molecular interactions, Reprints.

The diffusion of large spherical molecules through a porous medium is studied by means of a two-dimensional computer model developed previously. For two well-characterized, bimodal, pore size distributions, a random walk procedure is used to determine the diffusivity 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 on the random walk. The unbiased case is also studied. Pore sizes are chosen either at random from each distribution or from one distribution at a time to form a layered structure. 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 (NEL), Gaithersburg, MD. Thermophysics Div.
Binary Gas-Liquid Systems Classification.
Final rept.
P. H. E. Meijer. 1988, 6p
Pub. in Proceedings of International Symposium on Supercritical Fluids, Nice, France, October 17-18, 1988, p239-244.

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

Phase separation may be understood by following the critical lines in the fluid-gas diagram. Only in exceptionally simple cases do these lines connect the critical points of the pure solvent with the critical point of the pure solute. The actual behaviors are much more complicated, even if the presence of the solid phase is ignored. The observed diagrams are usually grouped into six topologically different classes, following Scott and van Konynenburg. The author showed in previous work that 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 Laar for the van der Waals 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 Laar point.

200,355
PB93-126050 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Quantum Physics Div.
Characterization of Triplet States in Doubly Charged Positive Ions: Assignment of the (3)Pi(sub g) - (3)Sigma(sub u) + Electronic Transition in N2(2+).
Final rept.
D. M. Szaflarski, A. S. Mullin, K. Yokoyama, M. N. R. Ashfold, and W. C. Lineberger. 1991, 3p
Pub. in Jnl. of Physical Chemistry 95, n6 p2122-2124 1991.

Keywords: *Nitrogen ions, Electron transitions, Positive ions, Excited states, Rotational spectra, Photodissociation, Triplets, Lifetime, Reprints, Molecular dications.

The first direct spectroscopic evidence and characterization of triplet states in a molecular dication is reported. The triplet Pi(sub g) <- triplet Sigma(sub mu, sup +) electronic absorption between excited states of N2(2+) is recorded by ion-laser coaxial beam photofragmentation spectroscopy. Over 300 rotational lines are resolved, and 13 parameters characterizing the upper and lower electronic states are determined. The results are compared with calculated potential energy curves. Dissociation lifetimes of the upper rotational levels are measured, and possible mechanisms of dissociation are discussed.

200,356
PB93-129229 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Chemical Kinetics and Thermodynamics Div.
Ion Chemistry at High Temperatures. 1. The Thermochemistry of the Ammonium Ion from Variable-Temperature Equilibrium Measurements. Proton Transfer, Association, and Decomposition Reactions in Ammonia, Isobutene, and t-Butylamine.
Final rept.
M. Meot-Ner, and L. W. Sieck. 1990, 4p
Pub. in Jnl. of Physical Chemistry 94, n19 p7731-7734 1990.

Keywords: *Proton transport, *Ammonia, *Organic ions, *High temperature, *Thermochemistry, Chemical reactions, Pyrolysis, Enthalpy, Entropy, Thermodynamics, Temperature dependence, Reaction kinetics, Alkene hydrocarbons, Reprints, *Ammonium ion.

At 580-680K, the proton transfer reaction t-C4H9(1+) + NH3 <-> NH4(1+) + i-C4H8 is in equilibrium in mixtures containing ammonia and isobutene. In the same mixtures t-C4H9NH3(1+) is also formed reversibly and kinetic experiments identify the addition/thermal decomposition equilibrium NH4(1+) + i-C4H8 + M <-> t-C4H9NH3(1+) + M. The decomposition of t-C4H9NH3(1+) is at the low pressure limit with rate constants of ((1-14)x10 to the -14th power)cc/s and activation energy 29.1kcal/mol. The thermally activated addition of NH4(1+) to i-C4H8 shows third order kinetics with rate constants of ((2-6)x10 to the -29th power)cc to the second power/s and a negative temperature coefficient, T to the -10.8th power. Equilibrium studies of the proton transfer reaction yield a standard enthalpy of -12.5kcal/mol and a standard entropy of -6.1cal/mol K. For the addition reaction, the equilibrium studies yield a standard enthalpy and entropy of -34.9kcal/mol and -39.2cal/mol K.

200,357
PB93-129260 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Thermophysics Div.
J. D. van der Waals: On the Continuity of the Gaseous and Liquid States.
Final rept.
J. M. H. Levelt Sengers. 1988, 2p
Pub. in Studies in Statistical Mechanics XIV, p86-87 1988.

Keywords: *Statistical mechanics, Molecular theory, Binary mixtures, Historical aspects, Liquids, Gases, Theses, Reprints, Van der Waals J D, Book reviews, Translations.

This is a review of Rowlinson's edition of the English Translation of van der Waals' thesis and his article on the molecular theory of binary mixtures. Rowlinson's introductory essay is a valuable part of this book since it traces the history of the theory of fluids from van der Waals' days to the present.

200,358
PB93-129476 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Process Measurements Div.
Voltammetry of Covalently Immobilized Cytochrome c on Self-Assembled Monolayer Electrodes.
Final rept.
M. Collinson, E. F. Bowden, and M. J. Tarlov. 1992, 4p
Grant NSF-CHE88-20832
Sponsored by National Science Foundation, Washington, DC.
Pub. in Langmuir 8, n5 p1247-1250 1992.

Keywords: *Cytochrome c, *Monomolecular films, *Gold, *Adsorption, Electrodes, Surface properties, Voltammetry, Electron transfer, Kinetics, Reprints.

Cytochrome c was covalently immobilized on carboxylic acid terminated self-assembled monolayer gold electrodes via electrostatically guided carbodiimide coupling. Covalently immobilized cytochrome c was found to be stable, electroactive, and functional. Cyclic voltammetry revealed an electroactive coverage corresponding to ca. one-third monolayer and a surface formal potential slightly negative of the value obtained for electrostatically adsorbed cytochrome c. Electron transfer kinetic results suggest that covalently immobilized and electrostatically adsorbed cytochrome c are similarly oriented at the electrode surface.

200,359
PB93-129484 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Process Measurements Div.

Static Secondary Ion Mass Spectrometry of Self-Assembled Alkanethiol Monolayers on Gold.
Final rept.
M. J. Tarlov, and J. G. Newman. 1992, 8p
Pub. in Langmuir 8, n6 p1398-1405 1992.

Keywords: *Thiols, *Adsorption, *Gold, *Surface chemistry, Monomolecular films, Mass spectroscopy, Spectrum analysis, Molecular ions, Reprints, *Alkane thiols.

We report a static secondary ion mass spectrometry (SSIMS) study of self-assembled monolayers (SAMs) of alkanethiols (CH3(CH2)nSH, where n = 7, 9, 11, 15, 17) adsorbed on Au. A rich variety of molecular secondary ions are observed in the negative SSIMS spectra including (M-H)(1-), (AuM)(1-), (AuSM)(1-), and (Au2(M-H))(1-) and a relatively strong (Au(M-H)2)(1-) where M is the complete alkanethiol molecule. Sulfonates and alkanesulfonates are observed in SSIMS spectra of SAMs that have been atmosphere exposed for prolonged periods; however, sulfonate species are not detected from samples that are analyzed immediately after withdrawal from thiol-ethanol solutions. SSIMS results indicate that sulfonates formed by air oxidation can be displaced by reimmersion of samples in thiol adsorbate solution. Molecular secondary ions are not observed for perfluoromercaptan and carboxylic acid-terminated SAMs, although spectra distinct from those of the alkanethiol SAMs were obtained. Damage profiles indicate that the emission of molecular secondary ions is very sensitive to extremely low primary ion beam doses. In addition, the relative intensities of Au substrate and molecular ions are strongly influenced by the energy of the primary ion beam suggesting a beam penetration depth effect.

200,360
PB93-129534 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Physics Div.
Infrared Spectrum of Thallium Chloride at 450C.
Final rept.
A. G. Maki. 1989, 7p
Pub. in Jnl. of Molecular Spectroscopy 137, n1 p147-153 1989.

Keywords: *Thallium halides, *Vibrational spectra, *Spectrum analysis, Molecular spectroscopy, Isotope effect, Potential energy, Born approximation, Reprints, *Thallium chloride.

The high resolution spectrum of the 283/cm fundamental band of thallium chloride has been measured in the gas phase at a temperature of 450 C. The first vibrational level transitions of (205)Tl(35)Cl have been identified for transitions coming from the six lowest vibrational states. Many transitions also have been identified for the molecules (203)Tl(35)Cl and (205)Tl(37)Cl. Dunham constants are given for all four isotopic species of thallium chloride. As expected, the Born-Oppenheimer vibrational correction term for the thallium atom is found to be unusually large and negative.

200,361
PB93-129542 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.
Chemical Interaction of Mn with the MoS2(0001) Surface Studied by High-Resolution Photoelectron Spectroscopy.
Final rept.
J. R. Lince, A. Talebibrahimi, T. B. Stewart, J. A. Yarmoff, and P. D. Fleischauer. 1989, 6p
See also AD-A212 811.
Pub. in Jnl. of Vacuum Science and Technology A 7, n3 p2469-2474 1989.

Keywords: *Molybdenum disulfide, *Surface reactions, Photoelectron spectroscopy, Synchrotron radiation, Chemical reactions, Vapor deposition, High resolution, Thin films, Annealing, Interfaces, Reprints, Low energy electron diffraction.

The interface produced by vapor deposition of Mn on the MoS2 (0001) surface has been studied in situ by high-resolution photoelectron spectroscopy (PES) using synchrotron radiation. The evolution of the Mo-3d, Mn-4p, and S-2p core levels and of the valence band spectra during growth of thin films (10-58 A) is consistent with partial conversion of the Mn overlayer to MnS via the overall reaction 2Mn + MoS2 -- > 2MnS + Mo. The persistence of the substrate components of the Mo-3d and S-2p spectra for thickness > 35 A are consistent with the Volmer-Weber growth mode. Annealing a 58 A film to 770 K resulted in an overlayer film consisting mostly of MnS coexisting with some metallic Mn.

200,362
PB93-129609 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Rotational Dynamics and Orientational Melting of C60: A Neutron Scattering Study.
Final rept.
D. A. Neumann, J. R. D. Copley, W. A. Kamitakahara, J. J. Rush, R. L. Cappelletti, N. Coustel, J. E. Fischer, J. P. McCauley, A. B. Smith, K. M. Creegan, and D. M. Cox. 1992, 3p
Pub. in Jnl. of Chemical Physics 96, n11 p8631-8633, 1 Jun 92.

Keywords: *Carbon, *Librations, *Phase transformations, Potential energy, Melting, Neutron scattering, Oscillations, Temperature dependence, Reprints, *Buckminsterfullerene, Orientational order.

Well-defined librational excitations have been observed at energies of 2-3 meV in the low temperature ordered phase of solid C60. These relatively high energies imply a stiff orientational potential below the transition. The sharpness of the peaks indicates that this potential does not depend strongly on the axis of the angular displacement. The modes soften and broaden as the temperature approaches that of the orientational melting transition which occurs when the librational amplitude is a considerable fraction of nearest-neighbor interatomic angles.

200,363
PB93-130292 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Surface and Microanalysis Science Div.
Inelastic Mean Free Paths of Low-Energy Electrons in Solids.
Final rept.
S. Tanuma, C. J. Powell, and D. R. Penn. 1992, 18p
See also PB85-183317.
Pub. in Acta Physica Polonica A 81, n2 p169-186 1992.

Keywords: *Electron scattering, *Mean free path, X ray photoelectron spectroscopy, Auger electron spectroscopy, Inelastic scattering, Inorganic compounds, Chemical elements, EV range 10-100, EV range 100-1000, KeV range 1-10, Sum rules, Solids, Reprints.

We present a summary of recent calculations of the electron inelastic mean free paths (IMFPs) of 50-2000 eV electrons in 27 elements and 15 inorganic compounds. These calculations are based in part on experimental optical data to represent the dependence of the inelastic scattering probability on energy loss and the theoretical Lindhard dielectric function to represent the dependence of the scattering probability on momentum transfer. The calculated IMFPs for the elements were fitted to a modified form of the Bethe equation for inelastic electron scattering in matter and the four parameters in this equation were empirically related to other material parameters. The resulting formula, designated TPP-2, provides a convenient means for predicting IMFPs in other materials.

200,364
PB93-131415
(Order as PB93-131381, PC **A07**)
National Inst. of Standards and Technology, Boulder, CO.
Resistive Liquid-Vapor Surface Sensors for Liquid Nitrogen and Hydrogen.
J. D. Siegwarth, R. O. Voth, and S. M. Snyder. 1992, 15p
Included in Jnl. of Research of the National Institute of Standards and Technology, n97 n5 p563-577 Sep/Oct 92.

Keywords: *Liquid-vapor interfaces, *Liquid nitrogen, *Liquid hydrogen, *Resistance thermometers, Silicon films, Weightlessness, Sensors.

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

200,365
PB93-135473 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Vapor Pressure and Thermodynamics of Lithium Aluminates.
Final rept.
E. R. Plante, and L. P. Cook. 1990, 17p
Pub. in Advances in Ceramics 27, p129-145 1990.

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

Vapor pressure measurements were made using the classical Knudsen effusion method coupled with a modulated beam, quadrupole mass spectrometer. Two solid state reactions were studied: (5/4)LiAlO2(c)=Li(g)+(1/4)O2(g) + (l/4)LiAl5O8(c); LiAl5O8(c)=Li(g)+(1/4)O2(g)+(5/2)Al2O3(c).
Second and Third Law analysis of the data yield results in reasonable agreement with literature values. Literature data for Li5AlO4 are questionable, however, as the reported Li pressures appear to exceed those over pure Li2O.

200,366
PB93-135507 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Neutron Scattering Study of Cs-Ammonia Intercalated Graphite.
Final rept.
P. Depondt, D. A. Neumann, and S. F. Trevino. 1992, 5p
Pub. in Materials Science Forum, v91-93 p271-275 1992.

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

Neutron scattering is an ideal tool for the study of the dynamics of alkali-ammonia graphite intercalation compounds. Previous work on the K-ND3 system has revealed a hybridization of the (in brackets: OOL) longitudinal acoustic phonons with a mode of the 'liquid' intercalate layer at an energy of about 7 meV. To date three different models for this intercalate 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 maximum-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 about the C3 axis at 295 K. This extremely anharmonic rotational excitation could not hybridize with the phonons in the rather harmonic manner observed for K-ND3 intercalated graphite. 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 found which is capable of coupling to the (in brackets: OOL) longitudinal phonons.

200,367
PB93-135606 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Molecular Physics Div.
Parallel Bands of Cyclopropane in the 3.2mum Region.
Final rept.
J. Pliva, D. W. Merdes, and A. S. Pine. 1992, 12p
See also PB91-237016.
Pub. in Jnl. of Molecular Spectroscopy 153, p133-144 1992.

Keywords: *Cyclopropane, *Infrared spectra, Intermediate infrared radiation, High resolution, Band spectra, Perturbation, Reprints, Color center lasers.

The extremely perturbed parallel band system occurring in the infrared spectrum of cyclopropane between about 3060 and 3150/cm has been recorded with effective resolution of less than one-half of the Doppler width using a difference-frequency laser spectrometer and subsequent deconvolution. The region of the strong Q branches near 3101/cm has also been measured with a color center laser and optothermal detection in a molecular beam adiabatically cooled to about 10 K. Three distinct sequences of parallel subbands are observed belonging to the antisymmetric C-

H stretching vibration nu(6) of species A(2)'' in anharmonic plus J(z) type Coriolis resonances 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

200,368
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.
N. Tsutsumi, G. T. Davis, and A. S. DeReggi. 1991, 3p
Pub. in Polymer Communications 32, n4 p113-115 1991.

Keywords: *Dyes, *Spectrum analysis, *Vinyl copolymers, *Proton transfer, Hydrogen fluoride, Ferroelectric materials, Ultraviolet spectroscopy, Visible spectrum, Absorption, Reprints, *Polyvinylidene fluoride, Ethylene/trifluoro, Benzene/amino-nitroazo, Stilbene/dimethylamino-nitro.

The paper presents an investigation of changes in the u.v.-visible spectra of the dyes, 4-dimethylamino-4'-nitrostilbene and 4-amino-4'-nitroazobenzene dissolved in a copolymer of 75 mol% vinylidene fluoride (VDF) and 25 mol% trifluoroethylene (TrFE) 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 that due to the protonated form of the dyes suggesting that poling liberates HF from VDF-TrFE copolymer. Subsequent thermal stability of the protonated dyes is discussed. Pulsed radiation 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.

200,369
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.
W. L. Wu, S. K. Satija, and C. F. Majkrzak. 1991, 4p
Pub. in Polymer Communications 32, n12 p363-366 1991.

Keywords: *Polychlorotrifluoroethylene, *Distribution(Property), *Density(Mass/volume), *Interfaces, *Melts, Silicon, Interfaces, Specular reflection, Crystallization, Reprints, *Neutron reflectivity.

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 polychlorotrifluoroethylene 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 point. 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.

200,370
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. Briber, and B. J. Bauer. 1991, 2p
Pub. in Physics News in 1991, p70-71.

Keywords: *Phase transformations, *Polymers, Reprints.

Recent studies on phase transitions in polymer mixtures are described.

200,371
PB92-154053 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Non-Destructive Evaluation Measurement Technology for Polymer Processing Based on Fluorescence Spectroscopy.
Final rept.
A. J. Bur, R. E. Lowry, F. W. Wang, S. C. Roth, and C. L. Thomas. 1990, 8p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v9 p2009-2016 1990.

Keywords: *Polymers, *Production engineering, Fluorescence, Spectroscopy, Reprints, *Polymer processing, Nondestructive evaluation, Intersegmental mixing.

The authors are employing fluorescence spectroscopy as a tool to monitor polymer processing parameters which are important for understanding process behavior. The measurements involve the detection of fluorescence spectra from fluorescent dyes which have been doped into the processed polymer material. The character of the fluorescence, i.e. its intensity, polarization, and wavelength distribution, yields information about the state of the polymer matrix. They have concentrated on developing concepts and methods to measure molecular orientation, shear stress, shear rate, non-Newtonian viscosity, velocity, residence time distribution, flow instabilities, quality-of-mix of ingredients, and intersegmental mixing. Work on each of the measurement problems is ongoing and in various stages of development. In the paper, the authors describe some recent work on quality-of-mix and intersegmental mixing.

200,372
PB92-154285 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
SANS and SAXS Study of Block Copolymer/Homopolymer Mixtures.
Final rept.
H. Hasegawa, H. Tanka, T. Hashimoto, and C. C. Han. 1991, 7p
Pub. in Jnl. of Applied Crystallography 24, p672-678 1991.

Keywords: *Copolymers, *Molecular structure, Neutron scattering, X-ray diffraction, Reprints, *Polymer blends.

The lateral and vertical components of the radius of gyration for a single block copolymer chain and those of a single homopolymer chain in the lamellar microdomain space formed by a mixture of diblock copolymers and homopolymers were investigated by means of small-angle neutron scattering (SANS) and the microdomain structures by small-angle X-ray scattering (SAXS). The SANS result suggests that the homopolymer chains in the microdomain space as well as the block copolymer chains are more compressed in the direction parallel to the interface and more stretched in the direction perpendicular to the interface than the corresponding unperturbed polymer chains with the same molecular weight. The block copolymer chains were found to undergo an isochoric affine deformation on addition of the homopolymers or with the change of the thickness of the lamellar microdomains.

200,373
PB92-159359 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Glass Temperature of Polymer Blends.
Final rept.
E. A. Di Marzio. 1990, 5p
See also PB87-224465.
Pub. in Polymer 31, n12 p2294-2298 1990.

Keywords: *Glass transition temperature, *Polymers, Entropy, Molecular rotation, Chemical bonds, Blends, Reprints.

The entropy theory of glasses is used to derive the glass temperature, T(sub g) of a polymer blend in terms of the glass temperatures of the two substituents. The formula is T(sub g) = B(sub 1)T(sub g1) + B(sub 2)T(sub g2) where B(sub i) is the fraction of flexible bonds of substituent i. A bond is flexible if rotation about it changes the shape of the molecule. Bonds in side groups as well as the backbone are to be counted. The formula assumes that the free volume, taken here to be the volume fraction of empty lattice sites is the same for each of the three materials. One variation of the more general treatment which expresses the properties of the blend in purely additive terms gives T(sub g) = B(sub 1)T(sub g1) + B(sub 2)T(sub g2) +KB(sup 1)(sub B2)(T(sub g1) - T(sub g2)(V(sub o1) - V(sub o2)) where V(sub oi) are the free volume fractions of the homopolymers at their glass temperatures and K is a universal constant. The added term is usually small. The most general form of the equation requires the energy of interaction between the two unlike molecules which can be estimated by volume measurements on the blend.

200,374
PB92-159367 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Simple Treatment of the Collapse Transition in Star Molecules.
Final rept.
E. A. Di Marzio, and C. M. Guttman. 1989, 6p
Pub. in Jnl. of Physical Chemistry 93, n19 p7004-7009 1989.

Keywords: *Polymers, *Mathematical models, *Molecular structure, *Transition points, Scale(Ratio), Thermodynamic properties, Reprints, *Star molecules, *Collapse transition.

A mean field treatment is given which enables the authors to solve for the dimensions of star molecules in both the expanded and collapsed states as well as all intermediate regimes. The scaling laws of Cotton and Daoud are recovered. For g(sub s) the ratio of the radius of gyration of a star of Farms to that of a linear chain the authors obtain g(sub s) = 1.74 F(-4/5) which is smaller than computer generated data by about 6%.

200,375
PB92-159789 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Phase Behavior of a Polymer Solution Studied by Light Scattering during Steady Shear and Following Cessation of Shear.
Final rept.
A. I. Nakatani, D. A. Waldow, and C. C. Han. 1991, 2p
See also PB92-159797.
Pub. in Polymeric Materials: Science and Engineering 65, p216-217 1991.

Keywords: *Polystyrene, *Shear stress, *Phase transformations, *Solutions, Light scattering, Diffusion coefficient, Mobility, Rheology, Reprints, *Phase separation kinetics.

An apparatus has been constructed for conducting light scattering experiments on polymeric samples under the influence of a well defined simple shear field. A two-dimensional CCD array detector is used for quantitative measurement of anisotropic scattering patterns which commonly develop from sheared samples. The authors describe results obtained from a 3% solution of polystyrene in dioctyl phthalate. The sample has been examined previously by a number of different researchers and has demonstrated shear induced phase separation behavior. The steady shear results obtained are consistent with the previous investigations. They also measure the kinetics of remixing following cessation of a steady shear. The results are analyzed using linearized Cahn-Hilliard-Cook theory to obtain values for the apparent diffusion coefficient and mobility.

200,376
PB92-159797 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Phase Behavior of a Polymer Blend Solution during Steady Shear and Cessation of Shear Studied by Light Scattering.
Final rept.
A. I. Nakatani, D. A. Waldow, and C. C. Han. 1991, 2p
See also PB92-159789.
Pub. in Polymeric Materials: Science and Engineering 65, p266-267 1991.

Keywords: *Polystyrene, *Polybutadiene, *Blends, *Solutions, *Shear stress, Light scattering, Rheology, Reprints, *Phase separation kinetics.

An apparatus has been constructed for conducting light scattering experiments on polymeric samples under the influence of a well defined sample shear field. A two-dimensional CCD array detector is used for quantitative measurement of anisotropic scattering patterns which commonly develop from sheared samples. The authors describe results obtained from an 8% solution of a polystyrene/polybutadiene blend (50:50) in dioctyl phthalate. The sample has been examined previously and has demonstrated shear induced mixing behavior. The steady shear results obtained are consistent with the previous investigations. 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
PB92-159938 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Rigid-Rod Derived Amorphous Polydiacetylenes.
Final rept.
M. A. Schen, K. Kotowski, and J. Cline. 1991, 8p
Pub. in Polymer 32, n10 p1843-1850 1991.

Keywords: *Polymerization, *Polymers, *Amorphous state, *Monomers, Melts, Molecular structure, Liquid crystals, Reprints, *Diacetylene.

During the authors' investigations of diacetylene monomers that exhibit thermotropic liquid-crystal phase behavior, it was discovered that spontaneous and rapid thermal polymerization of the isotropic monomer melt takes place with some of the compounds examined. In the diacetylene monomer series containing symmetrically disubstituted 4-oxybenzylidene-4'-n-octylaniline (OBOA) side-groups attached to a butadiyne core via a polymethylene spacer, monomer liquid crystallinity is seen in the lower members of the series yet facile polymerization in the isotropic monomer melt is observed only in the lowest member of the series. The compound, 1OBOA, is believed to be rod-like in structure. It is the microstructural architecture that is believed to be responsible for imparting this unique combination of polymerization and polymer properties. Traditional molecularly flexible diacetylene monomers and the more flexible homologues 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 rept.
M. A. Schen, and F. I. Mopsik. 1991, 11p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Nonlinear Optical Properties of Organic Materials IV, San Diego, CA., July 24-26, 1992, v1560 p315-325 1991.

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-(N-ethyl, N-hydroxyethylamino)-4'-nitroazobenzene (DR1), at a level of 0.19 mole percent, are reported using time domain dielectric spectrometry. Measurements ranging from 0.0001 to 10,000 Hz have allowed the authors to closely examine sub-Tg dipolar losses that are associated with the dye. It is seen that the frequency range over which dye relaxations occur are similar to those characteristic of the sub-Tgbeta transition of polystyrene though with grossly different dispersion amplitudes. The dye relaxation time activation energies are 131kJ/mol. and 79kJ/mol. for DANS and DR1 respectively. The dye relaxation amplitudes do not follow predicted 1/T behavior. Extremely broad dispersion curves imply a broad distribution of relaxation times. With physical aging, little change in beta amplitude is seen though a narrowing of the relaxation time distribution function seems to occur.

200,379
PB92-165141 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Fluorescence Monitoring of Residence Time and Flow Instabilities during Continuous Processing by Twin Screw Extrusion.
Final rept.
A. J. Bur, C. L. Thomas, S. C. Roth, F. W. Wang, and F. M. Gallant. 1989, 12p
See also PB92-144419.
Pub. in Proceedings of JANAF Propellant Characterization Meeting, Laurel, MD., November 1989, 12p.

Keywords: *Fluorescence, *Polymers, *Flow distribution, *Time response, *Probes, Tracer techniques, Mixing, Propellants, Extrusion, Polybutadiene, Reprints, *Twin screw extrusion, *Fiber optic sensors, Coumarin 30.

An optical fiber probe has been constructed for the purpose of observing fluorescence during processing by twin screw extrusion. The fluorescence signal was obtained from a fluorescent dye, coumarin 30, which was mixed with inert ingredients, polybutadiene and calcium carbonate particulate, at 19 ppm by weight concentration. The measurement probe consists of an optical fiber bundle which was inserted axially into the center of a half-inch sensor bolt. Observations yield information about residence time distribution, mix dispersion, quality-of-mix, and flow instabilities. Although most of the authors' measurements were taken with the sensor positioned close to the exit die, the probe could be placed in any instrumentation port along the extruder line. Observations of residence time and mix dispersion were made by measuring the transit times for the dye to travel from an upstream injection point to the measurement probe, a distance of 62 cm. Flow instabilities, such as mat formation of the solids, were observed by noting the abrupt changes and discontinuities in the fluorescence signal.

200,380
PB92-166248 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Fluorescence Monitoring of Polymer Processing.
Final rept.
F. W. Wang, A. J. Bur, R. E. Lowry, and B. M. Fanconi. 1988, 5p
See also PB91-174482.
Pub. in Polym. Mater. Sci. Eng. 59, p600-604 1988.

Keywords: *Curing, *Polymers, *Chemical industry, *Tracer techniques, Fluorescence, Chemical marking agents, Dyes, Epoxy resins, Mixing, Plastics processing, Polyimide resins, Reprints.

Fluorescence spectroscopy was used to monitor the viscosity and chemical changes during curing processes, and the uniformity of mixing of product ingredients. An epoxy resin was doped at low concentrations with a dye whose fluorescence intensity increases with the increase in the local viscosity of the medium surrounding dye molecules, and a second dye whose fluorescence intensity is insensitive to the local viscosity. The ratio of the fluorescence intensities was measured to monitor the cure of the epoxy resin. The formation of aromatic polyimides from poly(amide acid) precursors is often accompanied by changes in their excitation and emission spectra. These changes were measured to monitor the formation of polyimides. Finally, one of the processing ingredients was doped at a low concentration with a fluorescent dye, and the fluorescence intensity of the dye in the mixture passing a region near the wall of the mixer was measured to monitor the degree of mixing of product ingredients.

200,381
PB92-170620 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Neutron Reflectivity Studies of the Surface-Induced Ordering of Diblock Copolymer Films.
Final rept.
S. H. Anastasiadis, T. P. Russell, S. K. Satija, and C. F. Majkrzak. 1989, 4p
Contract DE-FG03-88ER45375
See also DE90005406. Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review Letters 62, n16 p1852-1855, 17 Apr 89.

Keywords: *Polystyrene, *Polymethyl methacrylate, *Surface properties, Thin films, Copolymers, Reflectivity, Neutron radiography, Reprints, Multilayers.

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

200,382
PB92-170893 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Torsional Dilatometry of Polymer Networks in Equilibrium.
Final rept.
R. S. Duran, and G. B. McKenna. 1989, 1p
Pub. in Abstracts of Papers of the American Chemical Society 198, 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 steps. Measurements were made in the vicinity of the glass transition temperature on samples which had been aged to their equilibrium volume. The specific volume of the networks was found to increase after torsional deformation, then relax back towards equilibrium. The volume change for a given torsional strain was found to increase as the temperature decreased. Volumetric behavior as a function of temperature and deformation is reported.

200,383
PB92-170901 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Structure in Rigid Rod Liquid Crystalline Polymers with Flexible Aliphatic Side Chains.
Final rept.
R. S. Duran, G. Wegner, and J. Rodriguez-Parada. 1989, 1p
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, Polyester resins, Hydroquinones, Polymerization, Optical microscopy, Ththalic acids, Dislocations, Order-disorder transformations, Reprints, Bicyclooctane dicarboxylic acid.

Liquid crystalline structure in several chemically similar rigid rod polymers was determined by X-ray diffraction, DSC, and optical microscopy. A series of polymers of 2,5-dialkoxyhydroquinones and terephthalic acid polymerized by melt condensation and having side chain lengths of sixteen carbons showed a disordered smectic mesophase. Polymers formed from bicyclo(2.2.2)octane-1,4-dicarboxylic acid and 2,5-dialkoxyhydroquinone did not show a mesophase. Polyesters substituted on both the hydroquinone and terephthalic 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 (MSEL), Gaithersburg, MD. Polymers Div.
Development of Characterization Techniques for Polyurethanes I. Characterization of SRM 1480, a Low Molecular Weight Polyurethane for SEC Calibration.
C. M. Guttman, J. R. Maurey, P. H. Verdier, C. C. Han, and F. W. Wang. Apr 92, 28p NISTIR-4788

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 47,000 g/mole. The intrinsic viscosity of SRM 1480 in THF was also measured and found to be 43.8 mL/g. The size exclusion chromatography (SEC) of SRM 1480 in THF as received in the bottle was found to exhibit concentration dependent peak positions, even at low concentrations. The addition of 0.01 moles per liter LiBr to the THF was found to alleviate this problem. This low concentration of LiBr did not change the polystyrene calibration of the SEC columns.

200,385
PB92-175595 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
End-to-End Distance of a Single Self-Interacting Self-Avoiding Polymer Chain: d(-1) Expansion.
Final rept.
A. M. Nemirovsky, K. F. Freed, T. Ishinabe, and J. F. Douglas. 1992, 6p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Physics Letters A 162, p469-474 1992.

Keywords: *Polymers, Random walk, Reprints, Lattice models, Self-avoiding walks.

Exact enumeration data in dimensions d=2-6 is used to evaluate the exact d-dimensional mean-square end-to-end distance R(sup 2, sub n) of a short (n < or = 11) n-bond self-interacting self-avoiding random walk on hypercubic lattices as function of the neighbor contact energy. The exact form is transformed into a large n expansion of R(sup 2, sub n) through fifth order in 1/d but to all orders in the contact energy.

200,386
PB92-197409 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Thermodynamics and Small Angle Neutron Scattering of Crosslinked Polymer Mixtures.
Final rept.
R. M. Briber, and B. J. Bauer. 1992, 2p
Pub. in ACS (American Chemical Society) Polymer Preprints, p344-345 1992.

Keywords: *Polymer chemistry, *Thermodynamics, *Crosslinking, *Small angle scattering, Mixtures, Phase studies, Neutron scattering, Binary mixtures, Graft polymerization, Reprints.

Small angle neutron scattering (SANS) has been used to study the effect of crosslinking on the phase separation behavior of compatible binary polymer blends. The effect of crosslinking is profoundly different depending on whether crossover (grafting) occurs between the two species in the mixture. With the presence of grafting reactions the single phase region of the phase diagram is greatly increased. If only one or both of the components are crosslinked, but there are no junctions between the two species then the miscibility of the system is greatly decreased. Data from SANS experiments will be compared with theory.

200,387
PB92-197417 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Image Analysis of the Late Stages of Phase Separation in Polymer Blends.
Final rept.
R. Briber, E. Gholz, and S. Wu. 1992, 2p
Pub. in ACS (American Chemical Society) Polymer Preprints, p775-776 1992.

Keywords: *Phase studies, *Separation, *Polymer chemistry, *Image processing, Blends, Polystyrene, Extraction, Interfaces, Area, Time dependence, Dynamics, Reprints, Poly(ether/vinyl-methyl), Video microscopy.

Video microscopy combined with image processing has been used to follow the late stage phase separation dynamics in the compatible polymer blend polystyrene (PS)/poly(vinyl methyl ether). Images are recorded in a time lapse mode and then analyzed to extract information on the interface, area fraction and mean separation of the domains as a function of time. The power law dependence of the domain growth is found to obey the classical t(sup -1/3) power law dependence.

200,388
PB92-197508 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
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. Piermarini, and S. Block. 1990, 11p
See also PB85-129195.
Pub. in Polymer 31, n12 p2227-2237 1990.

Keywords: *Crystal structure, *Copolymers, *X ray diffraction, High pressure tests, Fluorine organic compounds, Molecular rotation, Phase transformations, Entropy, Order disorder transformations, Reprints, *Poly(ethylene/tetrafluoro), *Homopolymers, Molecular conformation.

X-ray diffraction measurements are reported for 27 deg C, pressures to 5 GPa and concentrations of CF3 units to 0.05 CF3/CF2. These show both the orthorhombic and the monoclinic structures to exist under high hydrostatic pressure. It is proposed that shear stresses 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 concentrations and pressures, both phases become metrically hexagonal. The volume of transition becomes zero at a concentration near 0.05 CF3/CF2 and no transition is observed to 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.

200,389
PB92-222934 PC **A03**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Determination of the Weight Average Molecular Weight of SRM 1480.
C. M. Guttman, J. R. Maurey, and P. H. Verdier. Jul 92, 27p NISTIR-4837
Sponsored by Food and Drug Administration, Rockville, MD.

Keywords: *Polyurethanes, *Molecular weight, Calibrating, Standards, Chromatographic analysis, Light scattering, Tetrahydrofuran, Viscosity, *Standard reference materials, *SRM 1480.

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. The intrinsic viscosity of SRM 1480 in tetrahydrofuran (THF) was also measured. The Size Exclusion Chromatography (SEC) of SRM 1480 in THF as received in the bottle was found to exhibit concentration dependent peak positions even for low concentrations. The addition of 0.05 moles per liter LiBr to the THF was found to alleviate this problem. This low concentration of LiBr did not change the polystyrene calibration of the SEC columns.

200,390
PB92-236264 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Multiphase Equilibrium Phase Compositions of Heterogeneous Random Copolymers.
Final rept.
B. J. Bauer. 1989, 2p
See also PB86-193737.
Pub. in Polymer Preprints 30, n1 p315-316 1989.

Keywords: *Copolymers, *Polymerization, Chemical equilibrium, Phase diagrams, Polystyrene, Styrene copolymers, acrylonitrile copolymers, Chemical composition, Molecular weight, Heterogeneity, Reprints.

Random copolymers of styrene acrylonitrile have been synthesized with between 0 and 40 wt% acrylonitrile. Mixtures of seven differing compositions were dissolved in varying amounts of methylethylketone up to 15 wt%. The layers were allowed to settle out with the aid of a centrifuge, and each phase was characterized as to volume, polymer concentration, copolymer composition, and molecular weight. The solutions separated into between one to six phases depending on concentration. Phase diagrams are constructed showing the variations of volume, composition, and molecular weight as a function of overall polymer concentration.

200,391
PB92-236306 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Static Scattering from Multicomponent Polymer and Copolymer Systems.
Final rept.
H. Benoit, M. Benmouna, and W. L. Wu. 1990, 7p
Pub. in Macromolecules 23, n5 p1511-1517 1990.

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.

200,392
PB93-135580 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Deviation from Mean-Field Behavior in a Low Molecular Weight Critical Polymer Blend.
Final rept.
D. W. Hair, E. K. Hobbie, A. I. Nakatani, and C. C. Han. 1992, 5p
Pub. in Jnl. of Chemical Physics 96, n12 p9133-9137, 15 Jun 92.

Keywords: *Polymers, Correlations, Neutron scattering, Temperature dependence, Critical temperature, Reprints, *Polymer blends, *Mean field behavior, Static susceptibility, Correlation length.

A deviation from standard mean-field behavior is observed in the static susceptibility and correlation length measured with small angle neutron scattering as a function of temperature near the phase boundary of a low molecular weight critical polymer mixture. The possibility of a fluctuation influenced crossover from mean-field to nonmean-field behavior is considered.

200,393
PB93-135598 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Investigation of the Morphology of Amorphous/Semicrystalline Nylon Blends Using Small Angle X-ray Scattering.
Final rept.
M. E. Myers, A. M. Wims, T. S. Ellis, and J. D. Barnes. 1990, 8p
Pub. in Macromolecules 23, n10 p2807-2814 1990.

Keywords: *Nylon 6, *Nylon 66, *Morphology, Polyamide resins, X ray analysis, Phase transformations, Glass transition temperature, Crystallization, Reprints, *Polymer blends.

Blends of nylon 6 and nylon 66, each containing a miscible non-crystallizable polymer (denoted as nylon 3Me6T), have been investigated using small angle x-ray scattering. The relative constancy of the long period, irrespective of blend composition, is interpreted as being a result of rejection of nylon 3Me6T from the interlamellar regions. This observation appears to correlate with unusual specific heat changes associated with the glass transition, Tg, of the crystallized blends and is indicative of heterogeneous amorphous regions. Measurements of the diffuse boundary thickness indicate a dependence on blend composition, from which we deduce that the diffuse boundary region consists mainly of nylon 6 or nylon 66. There is very little substative difference in the behavior of blends containing either nylon 6 or nylon 66 as the crystallizable component, suggesting that blends of both polymers with nylon 3Me6T crystallize in essentially the same habit over an equivalent time scale.

General

200,394
PB92-149764 PC **A04**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.

NIST Standard Reference Data Products 1992 Catalog.
Special pub.
M. W. Chase, and J. C. Sauerwein. Feb 92, 71p
NIST/SP-782-ED-1992
Also available from Supt. of Docs. as SN003-003-03138-1. Supersedes PB91-167312.

Keywords: *Catalogs(Publications), *Databases, Biotechnology, Chemical analysis, Reaction kinetics, Atomic physics, Molecular structure, Molecular spectroscopy, Thermochemistry, Thermodynamics, Thermophysical properties, Materials, Fluids, Numerical data, Standard Reference Data Program, US NIST.

The National Institute of Standards and Technology's (NIST) Standard Reference Data Program provides reliable, well-documented data to scientists and engineers for use in technical problem-solving, research, and development. The catalog lists published data compilations, and current databases in the Standard Reference Database Series. The edition of the catalog contains many new databases and updates current ones. These data compilations have been subdivided into eight categories. Data bases are discussed in the areas of analytical chemistry, atomic physics, biotechnology, chemical kinetics, materials properties, molecular structure and spectroscopy, thermodynamics and thermochemistry, thermophysical properties of fluids, and NIST special databases. Prices and ordering information are located at the back of the document.

200,395
PB92-181163 PC **A08**/MF **A02**
National Inst. of Standards and Technology (TS), Gaithersburg, MD. Standard Reference Materials Program.
NIST Standard Reference Materials Catalog 1992-93.
Special pub. (Final).
N. M. Trahey. Feb 92, 169p NIST/SP-260
Also available from Supt. of Docs. as SN003-003-03461-1. Supersedes PB90-183310.

Keywords: *Catalogs(Publications), *Standards, Calibrating, Chemical analysis, Chemical composition, Calibration standards, Quality assurance, Quality control, Standardization, Concentration(Composition), *Standard reference materials, *Reference materials, Certified reference materials.

The catalog provides technical and general ordering information for the Standard Reference Materials (SRMs) and Reference Materials (RMs) currently available from the National Institute of Standards and Technology (NIST) Standard Reference Materials Program (SRMP). The materials are arranged according to technical category and classified as follows: Standard Reference Materials for Chemical Composition; Standard Reference Materials for Physical Properties; and Standard Reference Materials for Engineering Materials. Technical descriptions are given for all materials and may include certified values. However, these values may be incomplete as they appear in the catalog and therefore cannot be referenced for actual measurement purposes. The certificates issued by SRMP are the only legitimate sources of certified information for NIST reference materials.

CIVIL ENGINEERING

Construction Equipment, Materials, & Supplies

200,396
PB92-144245 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Building Materials Div.
Simulation Studies of the Effects of Mineral Admixtures on the Cement Paste-Aggregate Interfacial Zone.
Final rept.
D. P. Bentz, and E. J. Garboczi. 1991, 12p
Sponsored by National Science Foundation, Washington, DC.
Pub. in ACI Materials Jnl. 88, n5 p518-529 Sep/Oct 91.

Keywords: *Cements, *Admixtures, *Aggregates, *Interfacial tension, Fly ash, Computerized simulation, Microstructure, Construction materials, Water cement ratio, Mechanical properties, Silicon dioxide, Cement aggregate reactions, Silicate cements, Pozzolans, Reprints.

In concrete, the interfacial zone between cement paste and aggregate plays a critical role in determining mechanical performance. In recent years, high-performance concretes have been produced based on a low water-cement ratio cement paste containing a superplasticizer and silica fume. One of the key benefits of silica fume is its ability to improve the integrity of the interfacial zone in concrete. The paper presents a three-dimensional microstructural model for simulating the interfacial zone in concrete, including the incorporation of inert and pozzolanic mineral admixtures. The model is used to obtain the cementitious-material phase distributions as a function of distance from the aggregate surface to quantitatively characterize the interfacial zone. Pozzolanic admixtures, such as silica fume and fly ash, are found to increase the homogeneity of the interfacial region, with the most important enhancement proposed to be the improved homogeneity of the calcium-silicate-hydrate phase. The effects of mineral admixture particle size and reactivity are also computed via simulations. Simulation results are compared to conventional experimental measurements, such as compressive strength, and scanning electron micrographic investigations of the microstructure of actual cement-based materials.

200,397
PB92-148253 PC **A05**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Guide to Using HYDRA3D: A Three-Dimensional Digital-Image-Based Cement Microstructural Model.
D. P. Bentz, and E. J. Garboczi. Jan 92, 96p NISTIR-4746
See also PB91-240804.

Keywords: *Cements, *Hydration, *Microstructure, *Computerized simulation, Computer applications, Mathematical models, Three dimensional models, Interfacial tension, Percolation, Electrical resistivity, Diffusivity, Computer programs, HYDRA3D computer program, Tricalcium silicate, C programming language, Fortran programming language.

A computer program, HYDRA3D, to simulate cement microstructural development and quantify microstructural characteristics has been developed. HYDRA3D is a menu drive program available in either Fortran or C which allows a user to create a starting microstructure, execute hydration, measure phase fractions, and assess phase connectivity. The manual outlines the conceptual model on which HYDRA3D is based, describes the programs in detail, and provides examples of program usage. A system calling diagram, source code listings, guidelines for modifying the programs, and system requirements are provided in the Appendices.

200,398
PB92-154046 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Smoke Emission and Burning Rates for Urban Structures.
Final rept.
N. P. Bryner, and G. W. Mulholland. 1991, 10p
Sponsored by Defense Nuclear Agency, Washington, DC.
Pub. in Atmospheric Environment 25A, n11 p2553-2562 1991.

Keywords: *Buildings, *Fire tests, *Nuclear explosion effects, Smoke, Gypsum, Cribs, Soot, Plastics, Ventilation, Reprints.

Cribs, ordered arrays of sticks, were burned to mimic post-nuclear building fires. As the packing density of the cribs was increased to simulate blast damage, the smoke yield increased and the smoke changed from strongly light absorbing to whitish in color. A ventilation parameter proportional to the ratio of the crib vent area to the total fuel surface area correlated the burning rate and smoke yield data for both large (3.81 cm stick thickness) and small (0.64 cm stick thickness) scale cribs. The globally averaged smoke optical depth inferred from the burning of the wood cribs is in the low range of Penner's (1986, Nature 324, 222-226) estimate. The smoke yield for freely burning cribs containing wood, gypsum, and plastic can be accounted for based on the high sooting yield of the plastic by itself.

200,399
PB92-183664 PC **A03**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
X-ray Powder Diffraction Analysis of Three Portland Cement Reference Material Clinkers.
P. E. Stutzman. Apr 92, 26p NISTIR-4785
See also PB91-147397.

Keywords: *Portland cements, *Clinker, X ray diffraction, Scanning electron microscopy, Quantitative analysis, Particle size distribution, Chemical composition, *Reference materials, Phase abundance.

Three portland cement clinker Reference Materials (RMs) are now available from the National Institute of Standards and Technology (NIST). They are intended for use in testing and developing methods for quantitative phase abundance analysis and have been selected as representative of the range of compositions and textures of North American clinkers. Quantitative X-ray powder diffraction analysis was used to determine the phase abundance composition and compositional variability of eight randomly selected samples from each RM. In addition, each sample was split for duplicate analyses for evaluation of intra-sample phase abundance variability. The Reference Intensity Ratio method was used for powder diffraction calibrations and quantitative analysis. Both pure-phase standards and subsamples of the RM clinkers, which were point counted using the scanning electron microscope, were used for calibrations. Phase abundance values generally agree with those reported in earlier studies and the inter-sample standard deviation values were generally less than or equal to the intra-sample standard deviation values.

200,400
PB92-198084 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Materials Div.
Cement Clinker Characterization by Scanning Electron Microscopy.
Final rept.
P. E. Stutzman. 1991, 6p
Pub. in Cement, Concrete, and Aggregates 13, n2 p109-114 1991.

Keywords: *Portland cements, *Scanning electron microscopy, Construction materials, Clinker, Image analysis, Microstructure, Nondestructive tests, Topography, X ray analysis, Fractures(Materials), Concretes, Reprints.

The scanning electron microscope (SEM) is becoming increasingly recognized as an important instrument for the study of portland cement clinker, cement, and concrete. Images of clinker surface topography are used to study particle size and shape, as well as fracture surface features. Microstructural features such as phase distribution and abundance are obtained by imaging polished surfaces. X-ray microanalysis provides qualitative and quantitative elemental composition and images of element distribution. Computer-based image analysis systems are used to process microscope images to enhance details (such as the separation of individual phases) and image analysis for the measurement of features (such as phase abundance). The linking of the SEM with X-ray microanalysis and image analysis under computer control will provide automated, quantitative, and consistent analysis of portland cement clinker.

200,401
PB92-222751 PC **A04**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Nondestructive Evaluation of the In-Place Compressive Strength of Concrete Based upon Limited Destructive Testing.
K. A. Snyder, J. R. Clifton, and N. J. Carino. Jul 92, 67p NISTIR-4874
Prepared in cooperation with Oak Ridge National Lab., TN. Sponsored by Nuclear Regulatory Commission, Washington, DC.

Keywords: *Compressive strength, *Nondestructive tests, *Concretes, Mechanical properties, Concrete durability, Mechanical tests, Regression analysis, 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: rebound hammer, probe penetration, pulse velocity, pullout, and break-off. Regression analysis accounted for the error in both the nondestructive and the compressive strength data and their constant coefficient of variation. Data for each nondestructive test were grouped by coarse aggregate type and aggregate mass fraction. The results of the regression analysis are given, along with the parameters required to estimate compressive strength from subsequent 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, Gaithersburg, MD.
Development of a Technique for In situ Measurement of Water at the Asphalt/Model Siliceous Aggregate Interface.
Final rept.
T. Nguyen, W. E. Byrd, D. Bentz, and J. Seiler. Jun 92, 66p NISTIR-4783, SHRP-ID/UFR-92-611
Sponsored by Strategic Highway Research Program, Washington, DC.

Keywords: *Aggregates, *Pavement tests, *Interfaces, *Moisture content, *Spectroscopy, Asphalts, Fourier transformation, Asphalt pavements, Transport properties, Diffusion, Spectrum analysis, Highway maintenance, Absorptance, Test methods, Road materials, Fourier transform infrared spectroscopy, Multiple 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 required the coating of an asphalt layer of a known thickness 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 rept.
G. S. Cheok, and W. C. Stone. 1990, 9p
See also PB87-152245. Sponsored by National Science Foundation, Washington, DC., Federal Highway Administration, Washington, DC., and California State Dept. of Transportation, Sacramento, CA.
Pub. in ACI Structural Jnl. 87, n6 p630-638 1990.

Keywords: *Columns(Supports), *Bridges(Structures), *Cyclic loads, *Reinforced concrete, *Model tests, Elastic properties, Ready mixed concrete, Loads(Forces), Displacement, Gravel, Aggregates, Bridge design, Structural design, Mechanical properties, Mathematical models, Reprints.

Circular, spirally reinforced concrete bridge columns were subjected to cyclic inelastic lateral 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 axial load, and the 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 presented 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 rept.
E. Escalante, and S. Ito. 1990, 17p
See also PB80-170848. Sponsored by Federal Highway Administration, McLean, VA.
Pub. in Corrosion Rates of Steel in Concrete, ASTM STP 1065, p86-102 1990.

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

A study on the relationship of pH, chloride concentration, and oxygen concentration shows that a drying cycle, which locally concentrates chloride and oxygen, initiates the corrosion of steel in concrete. Once corrosion is initiated, the pH at the anodic areas decreases allowing corrosion to proceed more easily. Oxygen controls the rate of corrosion, but chloride affects the number of sites where corrosion initiates. Using a small portable computer system that applied the technique of polarization resistance with current interruption for elimination of iR error, the voltage measurement error generated when current flows through a resistive media, the corrosion of steel in concrete was measured in the laboratory. The portable system was then used to perform preliminary rate of corrosion measurements on reinforcing steel in three bridge decks in Frederick County, Maryland.

200,405
PB92-191865 PC **A03**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
Expert/Knowledge-Based Systems for Cement and Concrete: State-of-the-Art Report.
Working paper.
L. J. Kaetzel, and J. R. Clifton. Oct 91, 40p SHRP-C/UWP-91-527
Sponsored by Strategic Highway Research Program, Washington, DC.

Keywords: *Expert systems, *Concrete pavements, *Concrete structures, *Highway maintenance, *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/knowledge-based systems applications and development methods related to concrete pavements and structures. It is the initial step in the development of expert systems for the SHRP C-206 (Task 3) project. The report addresses the following subjects: (1) the potential for the application of expert systems for concrete mixture design and diagnostics, repair, and rehabilitation; (2) a description of inference procedures that are best suited 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 (BFRL), Gaithersburg, MD.
Application of Inelastic Damage Analysis to Double-Deck Highway Structures.
J. L. Gross, and S. K. Kunnath. Aug 92, 80p NISTIR-4857
Contract USGS-9900-0247
Prepared in cooperation with University of Central Florida, Orlando. Sponsored by Geological Survey, Reston, VA.

Keywords: *Earthquake damage, *Elastic properties, *Damage assessment, *Concrete structures, *Viaducts, Finite element analysis, Dynamic structural analysis, Earthquake engineering, Displacement, Cyclic loads, Computerized simulation, Seismic waves, Dynamic response, Structural members, 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 (Interstate 880). A study was undertaken by NIST to identify, using computer-based analysis methods, causes of structural failure of elevated highway structures resulting from the Loma Prieta earthquake and thereby reveal the potential for damage or collapse of similar structures nationwide. 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 addition, a smeared-crack approach finite element analysis was employed to determine the lateral load-deformation relationship of the pedestal regions. The model of the Cypress Viaduct was subjected to the Oakland Outer Harbor Wharf ground acceleration record in the plane of the bent. The analytical model was calibrated using static lateral load tests, ambient and forced vibration tests, and observed performance.

COMBUSTION, ENGINES, & PROPELLANTS

Combustion & Ignition

200,407
AD-A244 496/6 PC **A03**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
Spectroscopy of Reaction Intermediates in Nitramine Decomposition and Combustion.
Final rept. 20 Apr 88-19 Apr 91.
M. E. Jacox. 20 Jun 91, 25p ARO-25664-CH
Contracts MIPR-126-88, MIPR-117-89
MIPR-120-90.

Keywords: *Free radicals, Carbon, Chemistry, Combustion, Decomposition, Dimers, Environments, High energy, Infrared detection, Infrared spectra, Ionosphere, Ions, Isolation, Low pressure, Materials, Matrix theory, Models, Molecular ions, Molecules, Near infrared radiation, Neon, Nitramines, Nitrites, Photodecomposition, Response, Sampling, Solids, Spectroscopy, Vapor pressure, *Dimer ions, *Infrared spectrum, *Nitramine decomposition, Matrix isolation, Monomethylnitramine, 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 molecular ion studies resulted in the first infrared spectral detection of dimer ions in a non-interactive 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 studies 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 designed for matrix isolation sampling of low vapor pressure materials. Supporting evidence was obtained for a mechanism recently proposed by Melius for water-catalyzed nitramine decomposition. The photodecomposition of matrix-isolated MMN was studied. Evidence was obtained supporting initial detachment of NO2 and cage recombination to form the nitrite 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-atomized spray flame.
C. Presser, A. K. Gupta, and H. G. Semerjian. 1990, 26p CONF-900704-15
Contract AI01-86CE90213
International symposium on combustion (23rd), Orleans (France), 22-27 Jul 1990. Sponsored by Department of Energy, Washington, DC.

Keywords: *Flames, *Liquid Fuels, *Atomization, *Sprays, Air, Combustion, Flame Propagation, Laser Spectroscopy, Turbulent Flow, Meetings, EDB/400800, EDB/100400, EDB/330100.

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 techniques. Axial and radial velocity distributions have been obtained in a pressure-atomized kerosene spray under nonburning 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 flame stability. Combustion leads to significantly increased droplet velocities, while the droplet number densities are much reduced, especially near the spray centerline and outside the spray boundary. The reduction in the number densities makes the LV measurements sensitive to the data acquisition rate, especially near the spray boundary. The combustion air swirl is also found to lead to bimodal velocity distributions near the spray boundary, where recirculated droplets and droplets arriving directly from the nozzle coexist. Interpretation of droplet transport processes is found to require 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 (BFRL), Gaithersburg, MD.
Computing Radiative Heat Transfer Occurring in a Zone Fire Model.
G. P. Forney. Nov 91, 50p NISTIR-4709
See also PB89-218366.

Keywords: *Mathematical models, *Computerized simulation, *Fires, Differential equations, FORTRAN, Subroutines, Heat transfer, *Radiative heat exchange.

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 room gases. 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 model can also easily dominate the work required to calculate other physical submodels in a zone fire model. The report presents algorithms for efficiently computing 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, after the appropriate transformation is taken, to be diagonally dominant. Iterative methods may then be used to solve the linear equations more efficiently than direct methods such as Gaussian elimination. The radiation exchange algorithms are implemented as FORTRAN subroutines named RAD2, RAD4, and RAD10. These subroutines along with a test driver are available from the author.

200,410
PB92-159011 Not available NTIS
National Inst. of Standards and Technology (NEL), 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
Contract AFOSR-ISSA089-0025
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Proceedings of International Symposium on Combustion (23rd), Orleans, France, July 22-27, 1990, p715-722.

Keywords: *Combustible flow, *Eddies, *Turbulent flow, *Diffusion flames, Mixing, Chemical reactions, Mathematical models, Unsteady flow, Heat transfer, Reprints.

A mathematical model of a local transient diffusion flame generated by mixing in a turbulent eddy is presented. It is intended ultimately as a computational 'molecule' to be imbedded in numerical simulations of large scale reacting flows. The specific objective of the present analysis is to account explicitly for the modification of the local velocity field induced by the heat generation process. An 'idealized' single step irreversible 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 analyzed using the experimental observation that specific volume is a piecewise linear function of mixture fraction. A Cole-Hopf transformation is used to reduce this equation to an incompressible form in terms of a new 'pseudo mixture fraction' which can be related to all scalar properties using measured or idealized 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 (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Numerical/Experimental Study of a Buoyant Jet Diffusion Flame.
Final rept.
L. D. Chen, J. G. Lee, S. H. Wu, R. W. Davis, E. F. Moore, V. Vilimpoc, L. P. Gross, and W. M. Roquemore. 1990, 4p
Pub. in Chem. Phys. Processes Combust., p123/1-123/4 1990.

Keywords: *Diffusion flames, *Jet flow, *Combustible flow, Buoyancy, Vortices, Combustion, Laminar flow, Propane, Flow visualization, Navier-Stokes equations, Nitrogen, Reprints.

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 with a laminar flame sheet 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 disappear 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.

200,412
PB92-159334 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Preliminary Results of a Numerical-Experimental Study of the Dynamic Structure of a Buoyant Jet Diffusion Flame.
Final rept.
R. W. Davis, E. F. Moore, W. M. Roquemore, L. D. Chen, V. Vilimpoc, and L. P. Gross. 1991, 8p
Pub. in Combust. Flame 83, n3-4 p263-270 1991.

Keywords: *Jet flow, *Diffusion flames, *Combustible flow, Combustion physics, Combustion, Flame propagation, Propane, Nitrogen, Navier-Stokes equations, Vortices, Bouyancy, Reprints.

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 with a laminar flame sheet 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 disappear 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 instantatneous radial profiles of temperature at five axial locations in the flame. The experimental and numerical results are compared near two of the locations.

200,413
PB92-159912 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Enclosed Buoyant Convection in a Two-Layer Stratified Fluid.
Final rept.
R. G. Rehm, D. W. Lozier, H. R. Baum, and L. Y. Cooper. 1988, 4p
Pub. in Proceedings of Fall Technical Meeting Chemical and Physical Processes in Combustion, Clearwater Beach, FL., December 5-7, 1988, p35-1-35-4.

Keywords: *Convection, Computational fluid dynamics, Finite difference theory, Stratification, Combustion, Computation, Fires, Reprints, *Buoyant flow, Stratified media.

No abstract available.

200,414
PB92-165752 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Flammability of Plastics. 1. Ignition Temperatures.
Final rept.
T. Kashiwagi. 1988, 2p
Pub. in Fire Mater. 12, n3 p141-142 1988.

Keywords: *Plastics, *Ignition, Flux(Rate), Emission spectra, Surface temperature, Thermal radiation, Reprints.

This is a Letter-To-The-Editor regarding the published work by H. E. Thomson and D. D. Drysdale in 'Fire and Material' (11, p. 163, 1987). The effects of external radiant flux and its emission spectrum on ignition surface temperature of plastics are discussed.

200,415
PB92-165760 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Effects of Polymer Characteristics on Flammability Properties.
Final rept.
T. Kashiwagi. 1989, 14p
Pub. in Abstracts of Papers of the American Chemical Society 197, 14p Apr 89.

Keywords: *Molecular weight, *Thermal stability, *Flame propagation, *Polystyrene, *Polymethyl methacrylate, Ignition, Flammability, Thermal degradation, Reprints.

The effects of initial molecular weight and thermal stability of polymer samples on piloted ignition, 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 show significant effects of thermal stability on piloted ignition, heat release rate, and possibly on flame spreading rate. The sample with high initial molecular weight does not form molten polymer near the flame front and the flame spreads steadily. However, the sample with low initial molecular weight forms molten polymer and the opposed slow fluid motion of molten polymer along the inclined degrading surface against the traveling flame significantly affects flame spreading behavior and its rate.

200,416
PB92-170976 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Measurement and Research Div.

COMBUSTION, ENGINES, & PROPELLANTS

Combustion & Ignition

Smoke Plumes from Crude Oil Burns.
Final rept.
D. Evans, H. Baum, G. Mulholland, N. Bryner, and G. Forney. 1989, 22p
Sponsored by Department of the Interior, Washington, DC.
Pub. in Proceedings of Arctic and Marine Oil Spill Program Technical Seminar (12th), Calgary, Alberta, Canada, June 7-9, 1989, p1-22.

Keywords: *Smoke trails, *Fires, *Crude oil, *Plumes, Environmental transport, Combustion products, Optical properties, Agglomerations, Light transmission, Particles, Oil spills, Numerical analysis, Reprints.

Measurements of optical properties and particle agglomeration of smoke from Alberta Sweet Blend Mix crude oil fires were made using a one cubic meter aging/dilution chamber. Measurements were made at ambient temperature simulating conditions in dilute smoke plumes away from the fire and at 100 C which simulates temperature conditions within several flame heights above the burning crude oil. Measurements of light transmission at three different wavelengths through the smoke collected in the chamber proved that the specific extinction coefficient of the carbonaceous agglomerate particles in the smoke is independent of the agglomerate size. These data are used as input to a calculation of smoke particle settling from the fire plume and deposition remote from the fire site. The process of smoke particulate settling from the plume is considered in detail by tracking representative smoke particles in the calculation. Results of example calculations are presented that demonstrate important features of the method.

200,417
PB92-171008 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Science and Engineering Div.
Investigation of Radial Effects on the Burning Rate in Liquid Pool Fires.
Final rept.
S. J. Fischer, and T. Kashiwagi. 1989, 4p
Pub. in Chem. Phys. Processes Combust., p51/1-51/4 1989.

Keywords: *Burning rate, *Combustion, Heat flux, Mass flow, Heptane, Fuels, Emissivity, Reprints, *Liquid pool fires, *Radial effects.

A summary of the work done to date on a mass burning rate study of a 38 cm diameter heptane pool fire is given. The pool fire pan is made up of 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. Infrared transmission measurements along the radius have also been taken. So far, measurements for heights of 19 and 38 cm above the pool surface have been taken and these results are discussed. Based on data taken so far the thermal output of the fire is estimated to be 220 kW with a maximum mass flux of 0.047 kg/sq m-s and maximum incident heat flux on the surface of the pool of 22.7 kW/sq m occurring for the inner ring of the fire.

200,418
PB92-172006 PC **A03**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
Finite-Rate Diffusion-Controlled Reaction in a Vortex: A Report.
R. R. Rehm, H. R. Baum, H. C. Tang, and D. W. Lozier. Feb 92, 31p NISTIR-4768
See also PB89-176622 and PB87-210266.

Keywords: *Combustion, *Fires, Mathematical models, Turbulent diffusion, Reaction kinetics, Asymptotic series, Navier-Stokes equations, Chemical reactions, Convection, Flames, Reynolds number, Vortices.

A two-dimensional model of a constant-density diffusion-controlled reaction with finite reaction-rate chemistry occurring between unmixed species initially occupying adjacent half-spaces is formulated and analyzed. The chemical reaction term is taken to be appropriate for an isothermal, bimolecular reaction for simplicity. An axisymmetric viscous vortex field satisfying the Navier-Stokes equations winds up the interface between the species as they diffuse together and react. The diffusion rates for the two species are assumed contant and equal so that mixture fraction or Shvab-Zeldovich variable can be used. The resulting equation for the mixture fraction is linear and can be solved by noting that a Lagrangian coordinate system removes the convection and that the equation permits 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 reaction region and the competing influences of reaction, diffusion and convection.

200,419
PB92-172790 PC **A03**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Analyzing and Exploiting Numerical Characteristics of Zone Fire Models.
G. P. Forney, and W. F. Moss. Mar 92, 45p NISTIR-4763
See also PB88-175559, PB89-218366 and DE85008493. Prepared in cooperation with Clemson Univ., SC. Dept. of Mathematical Sciences.

Keywords: *Mathematical models, *Numerical analysis, *Fires, Algorithms, Differential equations, Compartment analysis, Smoke, Thermodynamic properties, Stiffness.

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 differential equations for zone fire modeling can be derived using the conservation of mass and energy. A comparison between various possible formulations is made in terms of numerical properties. One property that many formulations possess is the presence of multiple time scales. Pressures equilibrate much faster than other quantities such as density and temperature. 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 Flows.
Final rept.
R. G. Joklik. 1992, 4p
Pub. in Proceedings of Biennial DOD Fiber Optics Conference (3rd), McLean, VA., March 24-27, 1992, p189-192.

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 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 probe volume to 25 micro J, which resulted in a 3sigma uncertainty of + or - 75 K (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.
Final rept.
R. G. Rehm, H. R. Baum, D. W. Lozier, H. Tang, and J. Sims. 1991, 11p
Pub. in Proceedings of International Symposium on Fire Safety Science (3rd), Edinburgh, Scotland, July 8-12, 1991, p313-323.

Keywords: *Fires, *Convective flow, *Enclosures, Boussinesq approximation, Buoyancy, Finite difference method, Algorithms, 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 arbitrary direction relative to the enclosure so that the enclosure is 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 model when the viscosity and thermal conductivity 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 flow in a corridor, and a stairwell (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.
Doctoral thesis.
B. T. Amos. Mar 92, 149p NIST/GCR-92/604
Grant NANB7D737
See also COM-75-50574 and DE91000261. Sponsored by National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.

Keywords: *Flame 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 the combustion process over 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 radiation absorption by the fuel vapor. The surface is assumed to be either in a zero gravity, initially stagnant air environment or in a stagnation point flow field. 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 fuel and air mix above the fuel surface. After ignition occurs, there is a period of weak chemical reaction, which is followed by a period of 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 combustion and radiation processes are shown to have a large effect on the flow field in the stagnation point flow 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 fast enough that the expanding 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 incoming flow again dominates and a boundary layer reappears.

200,423
PB92-191253 PC **A04**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Analyzing Strategies for Eliminating Flame Blow-Down Occurring in the Navy's 19F4 Fire Fighting Trainer.
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, Computerized simulation, Temperature distribution, Computer programs, Three dimensional flow, Mathematical models, *19F4 Fire Fighting Trainer.

The purpose of the report is to document a series of numerical experiments performed to analyze strategies for eliminating flame blow-down occurring in the Navy's 19F4 fire fighting trainer. The first strategy involves the use of a fence in the way fences are used as tennis court wind breaks. The second strategy involves the use of fans to pressurize the space below the propane burners. Numerical simulations were performed for various fence heights, fence distances from 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

National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Fire Measurement and Research Div.
Effect of Oxygen Concentration on CO and Smoke Produced by Flames.
Final rept.
G. Mulholland, S. Yusa, M. Janssens, W. Twilley, and V. Babrauskas. 1991, 10p
Pub. in Proceedings of International Symposium on Fire Safety Science (3rd), Edinburgh, Scotland, July 8-12, 1991, p585-594.

Keywords: *Fire tests, *Combustion products, *Calorimeters, Carbon monoxide, Methane, Propane, Smoke, Douglas fir wood, Reprints.

A modified cone calorimeter with an enclosure has been developed for measuring the yield of combustion products including CO and smoke under vitiated conditions. The CO yields of methane, propane, PMMA, ABS, polyethylene, and Douglas fir are found to increase by at least a factor of two as the oxygen concentration is decreased from 21% to 14%, while the smoke yields are found to be insensitive to vitiation for the solid materials (less than 30% change). Results for air vitiated separately by nitrogen and by carbon dioxide suggest that the CO yield for a given fuel in a free burn is mainly controlled by the flame temperature. 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.

200,425
PB92-213396 PC **A03**/MF **A01**
Massachusetts Inst. of Tech., Cambridge.
Soot Formation in the Buoyancy-Dominated Ethene Diffusion Flame.
Master's thesis.
H. Subramaniasivam. Mar 92, 47p NIST/GCR-92/609
Grants NANB9D0975, NANB1D1110
Prepared in cooperation with Brown Univ., Providence, RI. Div. of Engineering. Sponsored by National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.

Keywords: *Diffusion flames, *Ethene, *Soot, Combustion products, Buoyancy, Sampling, Oxidation, Theses, Flames, Combustion, Pyrolysis.

A sampling technique, based on the phenomenon of thermophoresis is used here, in order to study the soot morphology within a buoyancy-dominated ethene diffusion flame. The buoyancy-dominated flame has a fuel flow rate of 50 cc/s and a co-annular air flow of 107 cc/s. Soot morphologies at each sampling location are obtained on carbon-coated grids through a fast probe drive mechanism, and they are analyzed under a transmission electron microscope. These observations, coupled with temperature measurements at various heights of the buoyancy-dominated flame, leads to a basic understanding of particle inception region, surface growth, aggregate formation, oxidation process, aggregate size and primary particle size within the flame. Change in soot morphology is studied both in the vertical and radial axes of the flame. The intense particle inception region, characterized by a large concentration of liquid-like microdroplets, is contained within the low part of the flame. These microdroplets form on the fuel side of the flame front where the temperature is the highest. Since there is very little evidence of oxidation taking place within the buoyancy-dominated flame, it is concluded that most of the soot formed in the flame is released into the surroundings. Observations being made here have been compared to similar soot morphology studies previously made on laminar ethene diffusion flames, both nonsooting and sooting, and laser diagnostic tests.

200,426
PB92-222736 PC **A05**/MF **A01**
Mission Research Corp., Santa Barbara, CA.
User's Guide for the Fire Demand Model; A Physically Based Computer Simulation of the Suppression of Post-Flashover Compartment Fires.
Final rept.
L. M. Pietrzak, and J. J. Dale. Jul 92, 76p MRC-R-1364, NIST/GCR-92/612
Grant NANB0D1050
Sponsored by National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.

Keywords: *Fire tests, *Computerized simulation, Software, Flashover, Charring, Spraying, Sprinklers, User manuals, *Fire demand model.

The Swedish Fire Research Board and the U.S. Federal Emergency Management Agency, with the cooperation of the U.S. National Institute of Science and Technology, supported the development of a computerized Fire Demand Model (FDM). The FDM simulates the suppression of post-flashover charring and non-charring solid fuel fires in compartments using water sprays from portable hose-nozzle equipment used by fire departments. The output of the FDM shows the extinguishing effects of water sprays at various flow rates and droplet sizes. The calculations are based on a heat and mass balance accounting for gas and surface cooling, steam-induced smothering, direct extinguishment of the fuel and water spray induced air inflow and venting of heat and products of combustion. The document provides instruction on how to execute the FDM on a Personal Computer (PC). This includes a description of the required input parameters and instructions for producing three different types of graphical plots: (1) time-temperature histories, (2) volume-medium-drop-size verses water application rate defining combinations where fire control is and is not possible, and (3) cross plots to facilitate comparison between different cases. (Copyright (c) 1992 by Mission Research Corporation.)

200,427
PB92-236249 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Toxic Hazard from Fires: A Simple Assessment Method.
Final rept.
V. Babrauskas. 1988, 10p
Pub. in Proceedings of International Conference on Fire: Control the Heat, Reduce the Hazard, London, UK, October 24-25, 1988, p16.1-16.10.

Keywords: *Fire hazards, *Assessments, *Combustion products, *Toxicity, Fire tests, Combustion, Smoke, Fires, Fire safety, Numerical analysis, Reprints.

Detailed mathematical methods have recently become available for performing a complete fire hazard analysis. Because of their complexity, they are used primarily for research purposes. For many design and evaluation 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.

200,428
PB93-113678 PC **A03**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
New Heater and Flux Gauge for the NBS Smoke Box.
R. L. Smith. Sep 92, 31p NISTIR-4917
Contract DTFA03-91-A-002
Sponsored by Federal Aviation Administration, Washington, DC.

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 obtained and evaluated. This report covers various aspects of analysis and gives details on the heater that may provide a more uniform radiation field on the target specimen. The use of a smaller gauge, similar to the one used in the OSU calorimeter, in the smoke box for measuring the heat flux is discussed. Finally, a method that 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.

Fuel & Propellant Tanks

200,429
PB92-149723 PC **A09**/MF **A03**
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Review of Cryogenic Mechanical and Thermal Properties of Al-Li Alloys and Alloy 2219.
N. J. Simon, E. S. Drexler, and R. P. Reed. Dec 91, 196p NISTIR-3971, B91-0236
See also AD-A242 956. Sponsored by Astronautics Lab. (AFSC), Edwards AFB, CA.

Keywords: *Low temperature alloys, *Aluminum alloys, *Lithium alloys, *Cryogenics, *Tensile properties, *Fuel tanks, Yield strength, Mechanical properties, Fracture(Mechanics), Thermal conductivity, Specific heat, Toughness, Ultimate strength, Deformation, Cracking(Fracturing), Elongation, *Alloy 2219.

The review of cryogenic mechanical and thermal properties presented here is part of a broader National Institute of Standards and Technology (NIST) program to assess new high-strength Al-Li alloys for use in the cryogenic tankage of the Advanced Launch System (ALS). The purpose of the NIST program has been to assess the relative suitability of high-strength Al-Li alloys and alloy 2219 for use in ALS cryogenic tanks. In the report, the cryogenic data on Al-Li alloys 8090, 2090, WL049, and Al alloy 2219 have been summarized. Properties covered in the survey are tensile strength, yield strength, elongation, fracture toughness, elastic constants, specific heat, thermal conductivity, and thermal expansion.

Rocket Engines & Motors

200,430
PB92-159961 Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.
Vortex Shedding Flowmeters for Space Shuttle Main Engines.
Final rept.
J. D. Siegwarth. 1988, 13p
Sponsored by National Aeronautics and Space Administration, Huntsville, AL. George C. Marshall Space Flight Center.
Pub. in Proceedings of Conference on Advanced Earth-to-Orbit Propulsion Technology, Huntsville, AL., May 10-12, 1988, v2 p429-441.

Keywords: *Space shuttle main engine, *Flowmeters, Vortex shedding, Gas flow, Performance, Tests, Reprints.

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 inserted into ducts through a pair of standard instrument ports 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 tested a flowmeter with liquid nitrogen. 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 find a more ideal vortex detector, optical and inductive position sensors have been successfully used. Available positions sensors require modifications to meet requirements for service in high pressure LOX environment.

200,431
PB93-129237 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. Siegwarth, L. L. Sparks, and D. Chaudhuri. 1990, 11p
Sponsored by National Aeronautics and Space Administration, Huntsville, AL. George C. Marshall Space Flight Center.
Pub. in NASA Conference Publication 3092, v1 p123-134 1990.

Keywords: *Rocket engines, *Turbine pumps, *Sliding friction, *Temperature dependence, Wear, Bearings, Tribology, Steels, Loads, Oxidation, Space shuttles, Reprints.

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 (HPOTP) of the Space Shuttle Main Engine (SSME). Measurements of the coefficient of friction of 440C 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 (0.915 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 662 F (-140 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 PC$9.00
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 Continent price $7.00; all others write for quote.

Keywords: *Telecommunication, *Modems, Standards, Coding, Modulation, Communication equipment, *Duplex 600 and 1200 bit/second modems, Analog transmission channels, Federal Information Processing Standards.

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 International Telegraph and Telephone Consultative Committee (CCITT) Recommendation V.22, which in turn was based upon the Western Electric Company model 212 modem. In addition to operation at 1,200 bits/s, an optional 600 bit/s capability is described. The standard supersedes FIPS PUB 136 (former Federal Standard 1008) in its entirety.

200,433
FIPS PUB 163 PC$9.00
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 133. 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 Continent price $7.00; all others write for quote.

Keywords: *Telecommunications, *Modems, *Requirements, Federal information processing standards, Telephones, Circuits, Models, Bandwidth, Coding and modulation, Demodulation, Digital data, Communications equipment, Federal standard 1005A, 1, 200 bits/second.

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 International Telegraph and Telephone Consultative Committee (CCITT) Recommendation V.22 bis. Interworking is provided with modems operating at 1,200 bits/s. The standard and FIPS PUB 164 supersede FIPS PUB 133 (former Federal Standard 1005A) in its entirety.

200,434
FIPS PUB 164 PC$9.00
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
2,400 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 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 Continent price $7.00; all others write for quote.

Keywords: *Telecommunications, *Modems, *Requirements, Federal information processing standards, Telephones, Circuits, Demodulation, Digital data, Communication equipment, Analog 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 International Telegraph and Telephone Consultative Committee (CCITT) Recommendations V.26 (four-wire duplex) and V.26 bis (two-wire half-duplex). The standard and FIPS PUB 163 supersede FIPS PUB 133 (former Federal Standard 1005A) in its entirety.

200,435
FIPS PUB 165 PC$9.00
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
4,800 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 134-1. See also FIPS PUB 166. Prepared in cooperation with National Communications System, Arlington, VA. Office of Technology and Standards.
Three ring vinyl binder also available; North American Continent price $7.00; all others write for quote.

Keywords: *Telecommunications, *Standards, *Modems, Federal information processing standards, Telephones, 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 International Telegraph and Telephone Consultative Committee (CCITT) Recommendations V.27 bis and V.27 ter. The standard and FIPS PUB 166 supersede FIPS PUB 134-1 (former Federal Standard 1006A) in its entirety.

200,436
FIPS PUB 166 PC$9.00
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.
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.
Final rept.
S. M. Radack. 2 Apr 92, 6p
Supersedes FIPS PUB 134-1. See also FIPS PUB 165. Prepared in cooperation with National Communications System, Arlington, VA. Office of Technology and Standards.
Three ring vinyl binder also available; North American Continent price $7.00; all others write for quote.

Keywords: *Telecommunications, *Modems, *Standards, Federal information processing standards, Telephones, Circuits, Communication equipment, Coding, 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 International Telegraph and Telephone Consultative Committee (CCITT) Recommendation V.32. The standard and FIPS PUB 165 supersede FIPS PUB 134-1 (former Federal Standard 1006A) in its entirety.

200,437
FIPS PUB 167 PC$9.00
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 Continent price $7.00; all others write for quote.

Keywords: *Telecommunication, *Modems, Coding, Standards, Communication equipment, Modulation, *Duplex 9600 bit/second modems, Analog transmission channels, Federal Information Processing Standards.

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 International Telegraph and Telephone Consultative Committee (CCITT) Recommendation V.29. The standard supersedes FIPS PUB 135 (former Federal Standard 1007) in its entirety.

200,438
FIPS PUB 168 PC$9.00
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
Prepared in cooperation with National Communications System, Arlington, VA. Office of Technology and Standards.
Three ring vinyl binder also available; North American Continent price $7.00; all others write for quote.

Keywords: *Telephone circuits, Modems, Demodulation, Data transmission, Digital data, *Federal Standard 168, *Data communications, 12000 and 14400 Bits Per Second Four-Wire Duplex Modems, Federal Information Processing Standards Publication 168, Telecommunications Standards.

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 International Telegraph and Telephone Consultative Committee (CCITT) Recommendation V.33.

200,439
FIPS PUB 169 PC$9.00
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
Error Correction in Modems Employing Asynchronous-to-Synchronous Conversion; Category: Telecommunications Standard; Subcategory: Modems.
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 Continent price $7.00; all others write for quote.

Keywords: *Telephone circuits, Modems, Digital data, Demodulation, Data transmission, *Federal Standard 169, *Modem Error Correction, *Asynchronous-to-Synchronous Conversion, *Data communications, Federal Information Processing Standards Publication 169, Telecommunications Standards.

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 method of error correction described in the standard is error correction by retransmission. The modem error correction techniques described by the standard are based upon International Telegraph and Telephone Consultative Committee (CCITT) Recommendation V.42.

200,440
FIPS PUB 170 PC$9.00
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
Data Compression in Modems Employing CCITT Recommendation V.42 Error Correction; Category: Telecommunications Standard; Subcategory: Modems.
Final rept.
S. M. Radack. 2 Apr 92, 7p
Prepared in cooperation with National Communications System, Arlington, VA. Office of Technology and Standards.
Three ring vinyl binder also available; North American Continent price $7.00; all others write for quote.

Keywords: *Telephone circuits, Modems, Digital data, Demodulation, Data transmission, *Federal Standard 170, *Modem data compression, *CCITT Recommendation v 42 Error Correction, *Data communications, Federal Information Processing Standards Publication 170, Telecommunications Standards.

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. Data compression is obtained by substituting strings of characters by reduced length codes at a transmitting modem and replacing the transmitted codes by the original strings of characters at a receiving modem. The modem data compression techniques described by the standard are based upon International Telegraph and Telephone Consultative Committee(CCITT) Recommendation V.42 bis.

200,441
PB92-145036 Not available NTIS
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Advanced Systems Div.
Architectures for BISDN Networks: A Performance Study.
Final rept.
X. Qian, S. Wakid, D. Vaman, and D. Cypher. 1991, 15p
See also N91-12336.
Pub. in International Jnl. of Satellite Communications 9, n5 p313-327 1991.

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-accredited Committee T1's T1S1.5 baseline document. The standard currently defines procedures for the median access control (MAC) layer and interfaces for some 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 behavior of these signalling protocols 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 P802.6 as a backbone for concatenated Local Area Networks (LANs).

200,442
PB92-165398 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
High-Frequency Optical FM Noise Reduction Employing a Fiber-Insertable Feedforward Compensation Technique.
Final rept.
R. D. Esman, and K. Iwashita. 1992, 2p
Pub. in Proceedings of OFC '92 Technical Digest, Optical Fiber Communication Conference, San Jose, CA., February 2-7, 1992, p72-73.

Keywords: *Optical communication, *Noise reduction, Frequency modulation, High frequency, Integrated optics, Line width, Reprints, Phase noise.

High frequency (approx. 1 GHz) optical phase noise, as sampled by a Mach-Zehnder frequency discriminator with an integrating receiver, is fedforward (out-of-phase) to a subsequent phase modulator. The canceling technique results in linewidth and phase noise reduction.

200,443
PB92-165653 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.
Time Tracking Error in Direct-Sequence Spread-Spectrum Networks Due to Coherence Among Signals.
Final rept.
D. A. Howe. 1990, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Communications 38, n12 p2103-2105 Dec 90.

Keywords: *Communication networks, Synchronization(Electronics), Frequency stability, Spread spectrum, Code division multiple access, Uncertainty, Errors, Reprints.

High data rate communications networks, navigation, and some types of time synchronization networks which use spread-spectrum modulation in a CDMA (code-division multiple-access) mode are subject to a time tracking (or time synchronization) error related to the degree of signal frequency agreement or coherence among involved communicators. As reference oscillator stabilities improve and various frequency offsets decrease in networks involving several interfering spread-spectrum signals, the degree of carrier and code coherence increases. In the paper, data are presented showing more than a twenty-fold increase in the time synchronization uncertainty (from 0.3 to 7 ns) due to interference of two spread-spectrum signals having a high degree of signal coherence.

200,444
PB92-181015 PC **A03**/MF **A01**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Advanced Systems Div.
Overview of Integrated Services Digital Network Conformance Testing.
Special pub. (Final).
L. A. Collica, K. M. Roberts, and D. Su. Mar 92, 21p
NIST/SP-823/1
Also available from Supt. of Docs. as SN003-003-03142-9. See also PB92-102201 and PB92-102219.

Keywords: *Protocols, *Tests, Specifications, Testing, Standards, Communication networks, Computer networks, Translators, *ISDN(Integrated Services Digital Network), PICS(Protocol Implementation Conformance Statement), PIXIT(Protocol Implementation Extra Information for Testing), BRI(Basic Rate Interface), PRI(Primary Rate Interface), TTCN(Tree and Tabular Combined Notation).

The document introduces a series of documents which focus on the conformance test specifications for the various Integrated Services Digital Network (ISDN) Protocols. An overview of the current status of ISDN Conformance Testing, and the issues involved are also provided.

200,445
PB92-181114 PC **A05**/MF **A02**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Advanced Systems Div.
Integrated Services Digital Network Conformance Testing. Layer 1, Physical Layer. Part 2, Basic Rate U Interface, User Side.
Special pub. (Final).
D. P. Stokesberry, and K. M. Roberts. Mar 92, 97p
NIST/SP-823/2
Also available from Supt. of Docs. as SN003-003-03143-7.

Keywords: *Tests, *Specifications, Testing, Standards, Test equipment, Data transmission, Characteristics, Computer software, Communication networks, Computer networks, Tables(Data), *ISDN(Integrated Services Digital Network), NT(Network Termination), BRI(Basic Rate Interface).

The American National Standard for Telecommunications (ANS) T1.601-1988 specifies the minimal set of requirements to provide for satisfactory transmission between the network and the Network Termination (NT). It describes both the physical interface and the electrical characteristics of the signals appearing at the network side of the NT, commonly called the U interface point, or U reference point. Equipment designed to operate on the North American Integrated Services Digital Network (ISDN) Basic Access U Interface must conform with the set of minimal requirements. The document describes a set of conformance test specifications for all NTs connected to the Basic Rate ISDN user-network interface. These tests were developed and approved by members of the North American ISDN Users' Forum.

200,446
PB92-197938 Not available NTIS
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Systems and Network Architecture Div.
Conformance Evaluation Methodology and Protocol Testing.
Final rept.
R. J. Linn. 1989, 16p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Jnl. on Selected Areas in Communications 7, n7 p1143-1158 Sep 89.

Keywords: *Computer communications, *Protocols, Tests, Methodology, Reprints, *Conformance evaluation, TTCN(Tree and Tabular Combined Notation).

The past decade has been a period of intense growth and development in data communications protocols. Accompanying this growth and development have been significant research and development in methodology for specification, validation, and testing data communications protocols. A survey of recent developments in conformance evaluation methodology is presented, including test architectures and a test language which are destined to become international standards, test generation methodology, and application of formal description techniques to several facets of testing. Gaps between theory and current practice are noted. Unresolved problems and some opportunities for additional research are identified.

200,447
PB92-236751 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Overview of Photonic Primary Standards Development.
Final rept.
D. L. Franzen. 1992, 2p
Pub. in Proceedings of Biennial Department of Defense Fiber Optics Conference (3rd), McLean, VA., March 24-27, 1992, p357-358.

Keywords: *Primary standards, *Photonics, *Standards, Optical communication, Optical fibers, Power measurement, Wavelengths, Geometry, Fiber optics, Reprints.

The National Institute of Standards and Technology (NIST) is working on primary standards to support lightwave communications. Primary standards are being developed to support the following measurements: absolute optical power, optical fiber geometry, and wavelength.

200,448
PB92-236827 Not available NTIS
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Systems and Network Architecture Div.
Analysis of Transport Measurements Over a Local Area Network.
Final rept.
S. Heatley, and D. Stokesberry. 1989, 7p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Communications Magazine 27, n6 p16-22 Jun 89.

Keywords: *Local area networks, *Computer communications, *Protocols, Throughput, Data transmission, Measurement, Reprints, OSI(Open System Interconnection).

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 and throughput measurements are reported for the Intel 310 microcomputer system running the iNA960 implementation of OSI Transport over an IEE 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 increase in delay associated with increased protocol services. The maximum throughput for the transport Class 4 service is reported and the effect of the main factors affecting maximum throughput is captured in a set of equations that are applicable to many implementations of Transport protocols.

Graphics

200,449
PB92-149756 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Synthesis of Non-Ionic and Ionic Resins for BEP Intaglio Inks Curing by Electron Beam Radiation.
Annual rept.
B. J. Bauer, and B. Dickens. Jan 92, 29p NISTIR-4752
See also PB91-144345 and PB91-194456. Sponsored by Bureau of Engraving and Printing, Washington, DC.

Keywords: *Radiation curing, *Resins, *Electron beams, *Polymerization, *Printing inks, Chemical radiation effects, Crosslinking, Air pollution abatement, Viscosity, Free radicals, Polymethyl methacrylate, Copolymers, Urethanes, Polyoxyethylene, Polyacrylates, Chemical stability, *Intaglio inks, Bureau of Engraving and Printing.

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 formulation of intaglio inks for the printing of postage stamps and security documents. The inks are to be cured by exposure to an electron beam. The uncured inks are cleaned from the roller and wiping blade by washing the wiping blade with neutral water or with caustic water. Laboratory scale work on the urethane/polyethylene oxide/methacrylate resins has now been concluded and 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, MD. Polymers Div.
FY 91 Syntheses of Liquid Prototype Air Dry Resins for Use in BEP Intaglio Inks.
Annual rept.
B. Dickens, B. J. Bauer, W. R. Blair, and R. E. Lowry. Jan 92, 57p NISTIR-4754
See also PB90-112343. Sponsored by Bureau of Engraving and Printing, Washington, DC.

Keywords: *Printing inks, *Alkyd resins, *Polymerization, *Curing, Oxidation, Air pollution abatement, Drying, Viscosity, Fatty acids, Performance evaluation, Amines, Solvents, Molecular structure, Tung oil, Linseed oil, *Intaglio inks, Bureau of Engraving and Printing.

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-wipe inks to be used in printing currency at 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 cure 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 alkyd resins. Linseed oil fatty acid-containing alkyd resins which passed laboratory tests for washing (ability to emulsify in Dalmar solution) and chemical resistance were successfully designed and synthesized. The key was to increase the average molecular size of the alkyd resin molecules. At least three of the resins produced inks which are promising candidates for production intaglio inks. Because of acid numbers of the resins are designed to be about 100 (mg KOH per gram resin), no solubilizing amines 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.

Policies, Regulations, & Studies

200,451
PB92-165026 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.
Time and Frequency Metrology: Current Status and Future Considerations.
Final rept.
D. W. Allan. 1991, 9p
Pub. in Proceedings of European Frequency and Time Forum (5th), Besancon, France, March 12-14, 1991, p1-9.

Keywords: *Frequency measurement, *Time measurement, *Atomic clocks, Frequency standards, Time standards, Metrology, Reviews, Reprints, Frequency domain.

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.

200,452
PB92-165315 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.
Improving GPS Time Transfer Accuracy with the NIST Ionospheric Measurement System.
Final rept.
D. Davis, M. A. Weiss, K. Davies, and G. Petit. 1991, 16p
Pub. in Proceedings of Institute of Navigation (ION) Global Positioning Systems (GPS) 1991: ION Satellite Division's International Technical Meeting (4th), Albuquerque, NM., September 11, 1991, p253-268.

Keywords: *Global positioning system, Ionosphere, Time delay, Improvement, Accuracy, Reprints, *Time transfer, NIMS System, Ionospheric delay.

The NIST Ionospheric Measurement System (NIMS) uses the GPS P-codes 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 GOES-2 satellite and by computing a time closure around the world with GPS data corrected with ionospheric measurements. The stability of the measurements is about 1 ns at 15 s, and they integrate as white phase noise to about 16 min.

200,453
PB92-165851 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.
Laboratory Automation: The Design Philosophy of the NIST Frequency Measurement Service.
Final rept.
M. Lombardi. 1991, 11p
See also PB87-122537.
Pub. in Proceedings of National Conference of Standards Laboratories Workshop and Symposium, Albuquerque, NM., August 1991, p277-287.

Keywords: *Frequency measurement, Time interval counters, Computer applications, Oscillators, Calibration, Reprints, *Laboratory automation, Computer software, US NIST.

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 themself, and make these products easier to use. This concept now extends to the calibration laboratory, with the advent of the automated calibration system. These systems have many benefits. They are easier to use and learn, and increase the lab's productivity. In keeping with this trend, NIST has offered an automatic frequency measurement system to the public since 1984. Since that time, NIST has redesigned and improved the system, in a continuing effort to make frequency calibrations easier to perform and understand. The paper discusses the design philosophy behind the system, what it does, how it works, and some ways the system can be enhanced in the future.

200,454
PB92-170810 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.
Codeless Ionospheric Calibrator for Time Transfer Applications.
Final rept.
D. D. Davis, M. A. Weiss, and M. Vidmar. 1989, 5p
Sponsored by Air Force Geophysics Lab., Hanscom AFB, MA.
Pub. in Proceedings of Institute of Navigation Conference, p455-459 1989.

Keywords: Global positioning system, Time delay, Computer applications, Signal processing, Receivers, Reprints, *Time transfer, Ionospheric delay.

With solar activity near maximum, the single largest error in the use of GPS for 'common-view' time transfer is correction for ionospheric delay. The paper describes the hardware and software development of a 'codeless' ionospheric calibration receiver that recovers the 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 volute antennas on a choke ring ground plane, 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 100Hz bandwidth. Signals are processed as 8 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.

200,455
PB92-175017 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.
Remote Time and Frequency Comparisons Now and in the Future.
Final rept.
D. W. Allan. 1990, 11p
Pub. in Proceedings of European Frequency and Time Forum (4th), Neuchatel, Switzerland, March 13-15, 1990, p619-629.

Keywords: *Atomic clocks, Global positioning system, Frequency standards, Frequency stability, Time standards, Synchronism, Metrology, Comparison, Accuracy, Reprints, Time transfer, Syntonization.

Time metrology has moved from milliseconds to picoseconds in the last four decades, and frequency metrology has moved from nine significant digits to sixteen. The ability to synchronize remote clocks has improved dramatically as well. With the implementation of GPS (Global Positioning System), the full long-term frequency stability, as well as the frequency accuracy of the best atomic clocks, can now be transferred to remote sites. In the future, GPS's selective availability, an intentional degradation of system performance, will adversely affect the usefulness of GPS time and frequency transfer for the average civilian user. The paper discusses various alternatives for clock synchronization and syntonization, and makes some comparisons between various techniques used in synchronizing and syntonizing clocks. In the process, it reviews concepts of time stability and accuracy, and frequency stability and accuracy. The future of comparison systems is considered. An Appendix of definitions is provided to support the concepts developed.

200,456
PB92-175223 Not available NTIS

National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.
Optically Pumped Primary Frequency Standards.
Final rept.
R. E. Drullinger. 1990, 6p
See also PB90-261025.
Pub. in Proceedings of Annual Symposium on Frequency Control (44th), Baltimore, MD., May 23-25, 1990, p76-81.

Keywords: *Frequency standards, *Optical pumping, Technology, Reviews, Reprints.

The use of optical state preparation and detection in atomic beam 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.
R. E. Drullinger, J. H. Shirley, D. J. Glaze, J. Lowe, H. Lee, and A. S. Zibrov. 1991, 3p
Pub. in Proceedings of European Frequency and Time Forum (5th), Besancon, France, March 12-14, 1991, p412-414.

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 used the system to demonstrate a solution to the problem of coherence trapping of population that could otherwise limit clock performance. The authors also report spectra taken on 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.
GPS Time Closure Around the World Using Precise Ephemerides, Ionospheric Measurements and Accurate Antenna Coordinates.
Final rept.
W. Lewandowski, G. Petit, C. Thomas, and M. A. Weiss. 1991, 6p
Pub. in Proceedings of European Frequency and Time Forum (5th), Besancon, France, March 12-14, 1991, p215-220.

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, USA) 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 BIPM (France). The GPS antenna coordinates of OP, NIST and CRL are now unified in IERS Terrestrial Frame. In the paper, the authors realize for the first time the closure 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.

200,459
PB92-175736 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.
Characterization of Frequency Stability in Precision Frequency Sources.
Final rept.
J. Rutman, and F. L. Walls. 1991, 9p
Pub. in Proceedings of the IEEE (Institute of Electrical and Electronics Engineers) 79, n6 p952-960 Jun 91.

Keywords: *Frequency standards, *Frequency stability, Frequency modulation, Frequency domain, Time domain, Random noise, Reviews, Reprints.

The paper presents a short review of the progress that has occurred over the past 25-30 years in both the theoretical and practical characterization of frequency stability of precision frequency sources. The emphasis is on the evolution of ideas and concepts for the characterization of random noise processes in such standards in the time domain and the Fourier frequency domain, rather than a rigorous mathematical treatment of the problem. Numerous references to the mathematical treatments are made.

200,460
PB92-189547 PC **A10**/MF **A03**
National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.
Trapped Ions and Laser Cooling III: Selected Publications of the Ion Storage Group of the Time and Frequency Division, NIST, Boulder, CO.
Technical note.
J. C. Bergquist, J. J. Bollinger, W. M. Itano, and D. J. Wineland. Apr 92, 203p NIST/TN-1353
Also available from Supt. of Docs. as SN003-003-03153-4. See also PB89-153878. Sponsored by Office of Naval Research, Arlington, VA., and Air Force Office of Scientific Research, Bolling AFB, DC.

Keywords: *Ion storage, *Frequency standards, *Atomic spectroscopy, Atomic clocks, High resolution, Quantum mechanics, Quantum optics, Beryllium ions, Reports, Laser cooling, Ion traps, Quantum zeno effect.

The collection of papers represents the work of the Ion Storage Group, Time and Frequency Division, National Institute of Standards and Technology from October, 1988 to February, 1992. It follows the collections of papers contained in NBS Technical Note 1086 'Trapped Ions and Laser Cooling' (June 1985) and NIST Technical Note 1324 'Trapped Ions and Laser Cooling II' (September 1988). Although the primary goal of the work has been the development of techniques necessary for achieving high resolution spectroscopy, the authors have also been able to investigate related areas of research.

200,461
PB92-190453 PC **A03**/MF **A01**
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
EMC Standards and Regulations: A Brief Review.
M. T. Ma. May 92, 35p NISTIR-3989
See also PB88-211149.

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 of measurement 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. Concurrently, the EMC measurement capability at the National Institute of Standards and Technology is evaluated and appraised for the purpose of planning new metrology activities or programs responsive to the needs of U.S. industry.

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, 8p
See also PB90-117367.
Pub. in Proceedings of Symposium on Frequency Standards and Metrology (4th), Ancona, Italy, September 5-9, 1988, p29-36 1989.

Keywords: *Clocks, *Metrology, *Atomic clocks, Time standards, Frequency standards, Time measurement, Optimization, Algorithms, Reprints.

Because of the increased need for better clock performance than is currently available, the paper addresses some fundamental questions regarding clock metrology. Heretofore, most work has focused on improving the clocks to meet the increased need. Though this is fundamental, it shows that significant gains are also available through the algorithms (computational methods for optimally combining the information) which process the readings of the clocks and through international comparisons now available via satellite. Proper algorithms for processing seem to be more important than the proportionate attention generally given them. In fact, to date, 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.

200,463
PB93-129203 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.
Design of Kalman Smoothers for Global Positioning Data.
Final rept.
M. A. Weiss. 1988, 2p
Pub. in CPEM '88 Digest, Proceedings of Conference on Precision Electromagnetic Measurements, Tsukuba, Japan, June 7-10, 1988, p109-110.

Keywords: *Global positioning system, *Time measurement, Diurnal variations, Time standards, Clocks, Reprints, Kalman smoothing.

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 Measures (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.

200,464
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.
M. A. Weiss, D. W. Allan, and T. K. Peppler. 1988, 2p
See also PB89-174072.
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 scale algorithm.

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 around the world. We are able to study long term stability of the order of years, and short term stability of the order of days. We now have estimated fractional frequency stabilities for averaging times out to a year of about 1 x 10(sup -14). This paper studies the behavior of the algorithm from a theoretical point of view, characterizing its performance.

200,465
PB93-129617 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.

COMMUNICATION

Policies, Regulations, & Studies

Frequency and Time Stability of GPS and GLONASS Clocks.
Final rept.
P. Daly, I. D. Kitching, D. W. Allan, and T. K. Peppler. 1991, 12p
See also PB91-202937.
Pub. in International Jnl. of Satellite Communications 9, p11-22 1991.

Keywords: *Global positioning system, *Frequency stability, Satellite navigation systems, Frequency standards, Atomic clocks, Comparison, Reprints, *GLONASS system, Allan variance, Time transfer.

The frequency stability and reliability of the clocks are critical to the success of the GPS and GLONASS programs. We will show some of the similarities and differences between the clocks involved in these two systems. Because both systems plan to be operational in the next few years, the data leading up to this operational stage is of significant interest. On-board clocks and the stability of the master control clocks for these systems are analyzed. We will discuss the attributes of these two systems as time and frequency references. Their relationship to UTC will also be illustrated. More data over a longer period of time was available for the authors from GPS than from GLONASS. Even so it is obvious that both systems have matured. Though the GLONASS system was developed later, its overall clock performance has improved more rapidly. Some of the more recent GLONASS clock performance is at about the same level as that of the GPS clocks. The analysis has yielded some very interesting contrasts, comparisons and changes in these systems that should be of great interest for time and frequency users, as well as for clock vendors and receiver vendors.

Radio & Television Equipment

200,466
PB93-135499 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.
Direct Sequence Spread-Spectrum Modem Design for Time Transfers via Geostationary Satellites.
Final rept.
D. A. Howe, and D. D. Davis. 1991, 7p
Pub. in Proceedings of the European Frequency and Time Forum (5th), Besancon, France, March 12-14, 1991, p89-95.

Keywords: *Modems, Synchronous satellites, Spread spectrum, Atomic clocks, Coding, Reprints, Time transfer.

The National Institute of Standards and Technology (NIST) is engaged in the development of a direct sequence spread spectrum (DSSS) modem. This development is part of a program to do various time transfer experiments using geostationary satellites. The purpose of the program is to exploit low-cost present and future commercial satellite resources in order to achieve timing accuracy of a few nanoseconds or better in a two-way time transfer scheme. The modem's technical specifications will be presented. The modem has the capability for variable PN sequence chip rate from 102.3 kcps to 2.5 Mcps. This is because many aspects of time transfer experiments are affected by the DSSS chip rate, for example, occupied bandwidth and power (hence, satellite transponder cost), resolution, accuracy, processing gain, and time to acquire lock. Two types of codes can be selected: (1) Gold code of length 1023 bits, and (2) truncated linear maximal sequence (LMS) of length 10,000 bits. Functionally the modem operates with a PC-AT type of computer.

Verbal

200,467
PB92-171206 Not available NTIS
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Advanced Systems Div.
Use of CD-ROM for Speech Database Storage and Exchange.
Final rept.
J. S. Garofolo, and D. S. Pallett. 1989, 4p
Pub. in Proceedings of European Conference on Speech Communication and Technology - Eurospeech 89, Paris, France, September 26-28, 1989, v2 p309-312.

Keywords: *Speech, *Databases, Database management, Standards, Optical disks, Magnetic tape transports, Magnetic storage devices, Prototypes, Format, Reprints, *CD-ROM.

Speech databases have become important resources for the speech research community. The use of CD-ROM media for speech database storage and exchange is attractive for a number of reasons. The National Institute of Standards and Technology (NIST) has produced a prototype CD-ROM version of the DARPA TIMIT Acoustic-Phonetic Speech Database. The paper discusses issues involved in producing the disc and future CD-ROMs, including CD-ROM standards and portability, directory and filename organization, speech file headers, and speech data formats.

200,468
PB92-502087 CD-ROM $250.00
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Automated Speech Recognition Group.
NTIMIT Telephone Network Acoustic-Phonetic Continuous Speech Corpus (on CD-ROM).
Data file.
Aug 92, 2 CD-ROM NIST/DF/VD-92/005
Paper copy user instructions included. Microsoft Extensions, version 2.1. See also PB91-505065 and PB93-173938 (documentation booklet for PB91-505065). Includes user instructions.
The datafile is on two 4.72 inch CD-ROM discs. Data format: ISO 9660.

Keywords: *Data file, *Speech recognition, *Telephone systems, Voice communication, Communication networks, Phonology, Phonetics, Acoustics, Algorithms, Calibrating, CD-ROM, Speech corpus.

NTIMIT (Network TIMIT) is a multi-speaker, telephone bandwidth, continuous speech corpus. The NTIMIT corpus was developed by transmitting the utterances in the TIMIT corpus over various channels in the NYNEX telephone network. Speech transmission was achieved by creating a 'loopback' telephone path to a large number of central offices. The central offices were geographically distributed to simulate different telephone network conditions. As with TIMIT, the NTIMIT corpus contains a carefully selected diversity of American Speech dialects and extensive breadth and depth of phonetic coverage. The NTIMIT data is time-aligned with the TIMIT data so that the TIMIT time-aligned phonetic and word-boundary transcriptions can be used. NTIMIT may be used for acoustic analysis of telephone bandwidth speech, development of telephone bandwidth speech recognition algorithms, and retraining current wideband algorithms for telephone speech. Disc 1 contains the NTIMIT speech corpora and original TIMIT transcriptions. Disc 2 contains the calibration tones.

200,469
PB93-135135 Not available NTIS
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Advanced Systems Div.
Benchmark Tests for DARPA Resource Management Database Performance Evaluations.
Final rept.
D. S. Pallet. 1992, 4p
Pub. in Proceedings of International Conference on Acoustics, Speech and Signal Processing, Glaskow, United Kingdom, May 23-26, 1989, IEEE Cat. No. 89CH2673-2, p536-539.

Keywords: *Speech recognition, *Automation, *Data bases, Performance evaluation, Resource management, Tests, Algorithms, Reprints, National Institute of Standards and Technology.

A nominally 1000-word Resource Management Database for Continuous Speech Recognition was developed for use in the DARPA Speech Research Program. This database has now been used at several sites for Benchmark Tests, and the database is expected to be made available to a wider community within the near future. The paper documents the structure of the Benchmark Tests, including selection of test material and details of studies of scoring algorithms at the National Institute of Standards and Technology (NIST).

COMPUTERS, CONTROL & INFORMATION THEORY

Computer Hardware

200,470
DE92019011 PC **A03**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
Computer Assisted Audit Techniques for UNIX (UNIX-CAATS).
B. K. Hsiao, and W. T. Polk. 1991, 12p CONF-9105126
Contract AI01-83IG00049
Proceedings of the U.S. Department of Energy (DOE) Computer Security Group Conference (14th), Concord, CA (United States), 7-9 May 1991. Sponsored by Department of Energy, Washington, DC.

Keywords: *Audits, *Computer Architecture, Computer Networks, Computer-Aided Instruction, Control, Executive Codes, Security, *UNIX(Operating system), EDB/990200.

Federal and DOE regulations impose specific requirements for internal controls of computer systems. These controls include adequate separation of duties and sufficient controls for access of system and data. The DOE Inspector General's Office has the responsibility to examine internal controls, as well as efficient use of computer system resources. As a result, DOE supported NIST development of computer assisted audit techniques to examine BSD UNIX computers (UNIX-CAATS). These systems were selected due to the increasing number of UNIX workstations in use within DOE. This paper describes the design and development of these techniques, as well as the results of testing at NIST and the first audit at a DOE site. UNIX-CAATS consists of tools which examine security of passwords, file systems, and network access. In addition, a tool was developed to examine efficiency of disk utilization. Test results at NIST indicated inadequate password management, as well as weak network resource controls. File system security was considered adequate. Audit results at a DOE site indicated weak password management and inefficient disk utilization. During the audit, we also found improvements to UNIX-CAATS were needed when applied to large systems. NIST plans to enhance the techniques developed for DOE/IG in future work. This future work would leverage currently available tools, along with needed enhancements. These enhancements would enable DOE/IG to audit large systems, such as supercomputers.

200,471
PB92-137538 PC **A05**/MF **A02**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Advanced Systems Div.
Development of a Testing Methodology to Predict Optical Disk Life Expectancy Values.
Special pub. (Final).
F. L. Podio. Dec 91, 99p NIST/SP-500/200
Also available from Supt. of Docs. as SN003-003-03134-8. See also PB89-151815 and PB92-116409. Sponsored by National Archives and Records Administration, Washington, DC.

Keywords: *Optical disks, Aging tests(Materials), Accelerated tests, Stress testing, Life(Durability), Test methods, Predictions, Arrhenius model, Byte error rate, US NIST.

There are no standards for longevity of optical disks that can assist managers in the Federal government to select the right media for the storage of permanent records, and to know how long the information may be safely stored on those disks. The report focuses on research undertaken at the National Institute of Standards 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 between aging cycles. The 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.

200,472
PB92-144682 Not available NTIS
National Inst. of Standards and Technology (ICST), Gaithersburg, MD. Advanced Systems Div.
Role of the NIU-Forum in Realizing Interoperable ISDN.
Final rept.
T. Holman, S. Wakid, and T. DeWitt. 1989, 7p
Pub. in Computer Networks and ISDN Systems 18, n1 p65-71, 24 Nov 89.

Keywords: *Computer networks, *Standardization, Communication networks, Protocols, Tests, Conformity, Reprints, *ISDN, Interoperability.

The paper seeks to place the North American ISDN Users' Forum (NIU-FORUM) in context and adopts 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.

200,473
PB92-144948 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Tunneling Stabilized, Magnetic Force Microscopy with a Gold-Coated, Nickel-Film Tip.
Final rept.
J. Moreland, and P. Rice. 1991, 3p
See also PB91-203653.
Pub. in Jnl. of Applied Physics 70, n1 p520-522, 1 Jul 91.

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 (TSMFM) is done with a scanning tunneling microscope having a flexible magnetic tip. TSMFM can be used to generate maps of magnetic records with submicrometer resolution. The authors found that Au-coated, Ni-film tips made from a free-standing 0.5 micrometer-thick Ni film can be used as a 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.

200,474
PB92-145044 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Tunneling-Stabilized Magnetic Force Microscopy of Bit Tracks on a Hard Disk.
Final rept.
P. Rice, and J. Moreland. 1991, 3p
See also PB91-134486.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics 27, n3 p3452-3454 May 91.

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 force measurements on thin-film longitudinal magnetic storage media has been adapted. The usual rigid Ptir tip of the STM was replaced by a flexible Fe film tip. Images of a hard disk showing bit tracks written by a ferrite head in a computer disk drive are presented. The images shown are comparable to images of the bit tracks on textured surfaces using either ferrofluid decoration or other magnetic force microscopy (MFM) imaging techniques. The sensitivity of the Fe film tip was such that the influence on the image due to magnetic forces was larger than the influence due to sample surface topography.

200,475
PB92-172709 PC **A05**/MF **A01**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
Computer Systems Laboratory Annual Report, 1991.
E. Lennon, S. Radack, and R. Roach. Dec 91, 86p NISTIR-4759
See also report for 1990, PB91-201822.

Keywords: *Computers, *Computer software, Information systems, Systems engineering, Computer security, Technology transfer, Computer networks, Computer architecture, Telecommunication, 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 overview of the Laboratory is presented, including a current CSL Organization Chart and selected staff accomplishments. Overviews of CSL's five technical divisions are featured next, followed by a section on Technology Transfer which details the vehicles CSL uses to disseminate research and information to the public and technical communities. A list of Federal Information Processing Standards (FIPS) and FIPS order information conclude the annual report.

200,476
PB92-175553 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Imaging Magnetic Bit Patterns Using a Scanning Tunneling Microscope with a Flexible Tip.
Final rept.
J. Moreland, and P. Rice. 1991, 6p
Pub. in Proceedings of Materials Research Society Symposium Magnetic Materials: Microstructure and Properties, Anaheim, CA., April 30-May 3, 1991, v232 p141-146.

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 (TSMFM) 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 capacitive detection of cantilever deflection due to magnetic forces. Instead, the position of the flexible tunneling tip depends on both topography and magnetic forces acting on the end of the tip. The z-motion of the piezoelectric translator flexes the tip to balance the magnetic force so that the end of the tip remains a fixed tunneling distance from the sample surface. The authors present a review of some TSMFM images showing the recorded bit patterns on hard disk, floppy disk, and tape surfaces. The images were taken in air using STM tips made from free-standing Fe and Ni films about 1 micrometer thick. The image resolution of TSMFM is routinely submicrometer. The authors conclude that the simple modification of STM will be a valuable diagnostic tool in the magnetic recording industry.

200,477
PB92-181064 PC **A03**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD. Technology Administration.
FAUST: A Vision-Based Neural Network Multi-Map Pattern Recognition Architecture.
C. L. Wilson. Mar 92, 19p NISTIR-4805
See also AD-A198 236 and AD-A217 032.

Keywords: *Computer architecture, *Pattern recognition, *Massively 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 88% recognition on multiple-writer hand print with a 2.3% substitutional error rate.

200,478
PB92-181072 PC **A03**/MF **A01**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
Operating Principles of MULTIKRON Performance Instrumentation for MIMD Computers.
A. Mink, and R. J. Carpenter. Mar 92, 29p NISTIR-4737
See also PB91-159319 and PB92-171529. Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.

Keywords: *Computer systems performance, *Chips(Electronics), Very large scale integration, Computer systems hardware, Multiprocessors, Computer software, Computer networks, 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 and processor identification, and sixteen counters for resource utilization measurements. The initial implementation uses a 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.

200,479
PB92-226281 PC **A04**/MF **A01**
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Advanced Systems Div.
Calibration of NIST Standard Reference Material 3202 for 18-Track, Parallel, and 36-Track, Parallel Serpentine, 12.65 mm (0.5 in), 1491 cpmm (37871 cpi), Magnetic Tape Cartridge.
Special pub. (Final).
M. P. Williamson. Jul 92, 55p NIST/SP-260/118
Also available from Supt. of Docs. as SN003-003-03162-3. Sponsored by Computer and Business Equipment Manufacturers Association, Washington, DC.

Keywords: *Magnetic tapes, *Calibration, Test methods, Resolution, *Standard reference materials, *Standard reference tapes.

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 18-track, parallel, and 36-track, parallel serpentine, 12.65 (0.5 in), 1491 cpmm (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 on the basis of a comparison to a known and accepted 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.

COMPUTERS, CONTROL & INFORMATION THEORY

Computer Software

Ada Compiler Validation Summary Report: Certificate Number: 910918S1.11217, NEC Corporation, NEC Ada Compiler System for EWS-UX/V to V70/RX-UX832, Version 1.0 EWS 4800/60 => MV4000.
1991, 93p

Keywords: Standardization, Test and evaluation, *Compilers, *ADA Programming language, *Validation summary reports, 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 this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-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. All 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 tests, the ACVC, as inputs to an Ada compiler and evaluating the results.

200,481
AD-A252 405/6 PC **A08**/MF **A02**
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Software Standards Validation Group.
Ada Compiler Validation Summary Report: Alenia: Certificate Number: 920509S1.11259 Alenia Aeritalia and Selenia S.p.A DACS VAX/VMS to 80x86 PM MARA Ada Cross Compiler, Version 4.6 Microvax 4000/200 => MARA.
Final rept.
1992, 155p

Keywords: *Compilers, *Ada programming language, Test and evaluation, *Validation summary reports, Standardization, 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 this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-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. All 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 tests, the ACVC, as inputs to an Ada compiler and evaluating the results.

200,482
FIPS PUB 153 PC **E99**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
Computer Graphics: Programmer's Hierarchical Interactive Graphics System (PHIGS) (Part 1. Functional Description). Category: Software Standard. Subcategory: Graphics.
Final rept.
D. R. Benigni. c1989, 394p
See also Part 2, FIPS PUB 153-A. Also pub. as American National Standards Inst., New York rept. no. ANSI/ISO-9592.1-1989. Prepared in cooperation with American National Standards Inst., New York.
Three ring vinyl binder also available; North American Continent price $7.00; all others write for quote.

Keywords: *Computer graphics, *Standards, Software, *Federal Information Processing Standards, Programmers Hierarchical Interactive Graphics System, PHIGS system, Interactive graphics.

The standard is a redesignation of ANSI X3.144-1988. It announces the adoption of the American National Standard Programmer's 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 toolbox package) for the definition, display and modification of two-dimensional (2D) or three-dimensional (3D) graphical data. In addition, the standard supports highly 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 application programs between different installations. The standard is for use by implementors as 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.

200,483
FIPS PUB 153-A PC **E14**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
Computer Graphics: Programmer's Hierarchical Interactive Graphics System (PHIGS) (Part 2. Archive File Format). Category: Software Standard. Subcategory: Graphics.
Final rept.
D. R. Benigni. c1989, 20p
See also Part 1, FIPS PUB 153 and Part 3, FIPS PUB 153-B. Also pub. as American National Standards Inst., New York rept. no. ANSI/ISO-9592.2-1989. Prepared in cooperation with American National Standards Inst., New York.
Three ring vinyl binder also available; North American Continent price $7.00; all others write for quote.

Keywords: *Computer graphics, *Standards, Software, *Federal Information Processing Standards, Programmers Hierarchical Interactive Graphics System, PHIGS system, Interactive graphics.

The standard is a redesignation of ANSI X3.144-1988. It announces the adoption of the American National Standard Programmer's 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 toolbox package) for the definition, display and modification of two-dimensional (2D) or three-dimensional (3D) graphical data. In addition, the standard supports highly 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 application programs between different installations. The standard is for use by implementors as 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.

200,484
FIPS PUB 153-B PC **E07**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
Computer Graphics: Programmer's Hierarchical Interactive Graphics System (PHIGS) (Part 3. Clear-Text Encoding of Archive File). Category: Software Standard. Subcategory: Graphics.
Final rept.
D. R. Benigni. c1989, 46p
See also FIPS PUB 153-A and FIPS PUB 153-C. Also pub. as American National Standards Inst., New York rept. no. ANSI/ISO-9592.3-1989. Prepared in cooperation with American National Standards Inst., New York.
Three ring vinyl binder also available; North American price $7.00; all others write for quote.

Keywords: *Software, *Interactive graphics, *Standards, Computer aided design, Computer animation, Programming languages, Display devices, *Federal information processing standards, Archive file, American National Standards Institute.

The standard is a redesignation of ANSI X3.144-1988. It announces the adoption of the American National Standard Programmer's 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 toolbox package) for the definition, display and modification of two-dimensional (2D) or three-dimensional (3D) graphical data. In addition, the standard supports highly 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 application programs between different installations. The standard is for use by implementors as 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.

200,485
FIPS PUB 153-C PC **E99**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
Computer Graphics: Programmer's Hierarchical Interactive Graphics System (PHIGS). Language Bindings (Part 3. Ada). Category: Software Standard. Subcategory: Graphics.
Final rept.
D. R. Benigni. c1990, 300p
See also FIPS PUB 153-B and FIPS PUB 153-D. Also pub. as American National Standards Inst., New York rept. no. ANSI/ISO-9593.3-1990. Prepared in cooperation with American National Standards Inst., New York.
Three ring vinyl binder also available; North American Continent price $7.00; all others write for quote.

Keywords: *Software, *Interactive system, *Standards, Specifications, Computer aided design, Computer animation, Programming languages, Error correcting codes, *Federal information processing standards, *American National Standards Institute, Archive file, Language binding.

The standard is a revision and redesignation of ANSI X3.144.3. It announces the adoption of the American National Standard Programmer's 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 toolbox package) for the definition, display and modification of two-dimensional (2D) or three-dimensional (3D) graphical data. In addition, the standard supports highly 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 application programs between different installations. The standard is for use by implementors as 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.

200,486
FIPS PUB 153-D PC **E99**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
Computer Graphics: Programmer's Hierarchical Interactive Graphics System (PHIGS) Language Bindings. Part 1. FORTRAN. Category: Software Standard. Subcategory: Graphics.
Final rept.
D. R. Benigni. c1990, 266p
See also FIPS PUB 153-C. Also pub. as American National Standards Inst., New York rept. no. ISO/IEC-9593.1-1990. Prepared in cooperation with American National Standards Inst., New York.
Three ring vinyl binder also available; North American Continent price $7.00; all others write for quote.

Keywords: *Computer graphics, *Standards, Software, Programmers Hierarchical Interactive Graphics

Systems, Federal Information Processing Standards, PHIGS system, Interactive graphics.

The standard is a redesignation of ANSI X3.1433.3. It announces the adoption of the American National Standard Programmer's 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 toolbox package) for the definition, display and modification of two-dimensional (2D) or three-dimensional (3D) graphical data. In addition, the standard supports highly 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 application programs between different installations. The standard is for use by implementors as 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.

200,487
PB92-144351 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Guide to Available Mathematical Software Advisory System.
Final rept.
R. F. Boisvert. 1990, 11p
See also PB90-123654.
Pub. in Intelligent Mathematical Software Systems, p167-177 1990.

Keywords: *Data bases, *Expert systems, On line systems, Information systems, Interactive systems, Indexes(Documentation), Reprints, *Mathematical software, NIST(National Institute of Standards and Technology).

The primary goal of the Guide to Available Mathematical Software (GAMS) project is to provide convenient access to information about mathematical and statistical software which is available to computer users at the National Institute for Standards and Technology. The principal vehicle through which this information is disseminated is an on-line advisory system called the GAMS Interactive Consultant. The paper describes the current status of the GAMS project. It then enumerates some of the weaknesses of the system and suggests knowledge engineering techniques which may alleviate them.

200,488
PB92-144369 Not available NTIS
National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Statistical Engineering Div.
Guide to Available Mathematical Software Problem Classification System.
Final rept.
R. F. Boisvert, S. E. Howe, and D. K. Kahaner. 1991, 32p
See also PB91-132175.
Pub. in Communications in Statistics 20, n4 p811-842 1991.

Keywords: *Classifications, *Computer calculations, *Computer software, Classifying, Problem solving, Reprints, *Mathematical software, Reusable software.

A vast collection of reusable mathematical and statistical software is now available for use by scientists and engineers in their modeling efforts. The software represents a significant source of mathematical expertise, created and maintained at considerable expense. Unfortunately, the collection is so heterogeneous that it is a tedious and error-prone task simply to determine what software is available to solve a given problem. In mathematical problem-solving environments of the future such questions will be fielded by expert software advisory systems. One way for such systems to systematically associate available software with the problems they solve is to use a problem classification system. The paper describes a detailed tree-structured problem-oriented classification system appropriate for such use.

200,489
PB92-153956 Not available NTIS
National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Applied and Computational Mathematics Div.
Parallelizing Computational Geometry: First Steps.
Final rept.
I. Beichl, and F. Sullivan. 1991, 4p
Pub. in Siam News 24, n6, 1, p14-16 1991.

Keywords: *Parallel processing, *Algorithms, Triangulation, SIMD(Computers), Reprints, *Computational geometry.

Great progress has been made in devising parallel algorithms for classes of problems in which the core computation is a convergent iterative method. However, methods for the problems that combine numeric and combinatoric features are less well developed. An especially important and interesting sub-area in this class is computational geometry, and in particular, geometric methods that will work on real machines and real problems. The questions themselves are often deceptively simple to describe. However, the numeric problems are different, some would say much harder, because there is no guarantee of convergence as there is in Newton's method, for example. Instead, one is given a finite number of coordinates and needs to determine things like interior and exterior, where there is no real notion of an approximate answer. The paper outlines a new algorithm for triangulation that exploits the parallelism of Single Instruction Multiple Data Stream (SIMD) machines.

200,490
PB92-158328 PC **A06**/MF **A02**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
Reference Model for Frameworks of Software Engineering Environments. (Technical Report ECMA TR/55, 2nd Edition).
Special pub. (Final).
Dec 91, 108p NIST/SP-500/201
Also available from Supt. of Docs. as SN003-003-03135-6. See also AD-A236 494 and AD-A236 697.

Keywords: *Software engineering, *Computer applications, *Models, Computer communications, Man computer interface, Software tools, Computer security, Computer program integrity, Reference models, SEE(Software Engineering Environments).

The document describes a Reference Model (RM) for Software Engineering Environment (SEE) Frameworks. A Software Engineering Environment deals with information about: (1) the software under development (e.g., specifications, design data, source code, test data, project plans); (2) project resources (e.g., costs, computer resources, and policy, standards and guidelines on the production of software. A SEE frameworks reference model is a conceptual basis for describing and comparing existing SEEs of SEE components. Its main purposes are to describe existing SEEs using the common reference terms and structures provided by the RM and to provide a basis for determining interfaces between environment components in order to create consistent interface standards.

200,491
PB92-159268 Not available NTIS
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Information Systems Engineering Div.
Integrating a Knowledge-Based Component into a Physical Database Design System.
Final rept.
C. E. Dabrowski, D. K. Jefferson, J. V. Carlis, and S. T. March. 1989, 16p
See also PB89-228993 and PB89-229033.
Pub. in Information and Management 17, p71-86 1989.

Keywords: *Data bases, *Knowledge bases(Artificial intelligence), *Systems engineering, Performance evaluation, Algorithms, Systems design, Reprints.

Physical database design is a difficult and complex process. Algorithmic approaches are appropriate for design subproblems, such as record segmentation and access path selection, but are infeasible for global design. A major problem with algorithmic approaches is that, for realistic databases, the number of alternative schema possibilities that must be evaluated to generate an optimal design is extremely large. The design system addresses this problem by combining a knowledge-based component with an algorithmic component. The knowledge-based component reduces the solution space to a reasonable size by producing a small number of efficient schema alternatives. The algorithmic component develops a low cost design for each alternative. An example of the application of the Knowledge-Based System (KBS) component of the design system is presented.

200,492
PB92-159805 Not available NTIS
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Information Systems Engineering Div.
Developing and Applying Data Entity Naming Conventions.
Final rept.
J. J. Newton. 1991, 6p
See also PB92-175455.
Pub. in Data Resource Management 2, n4 p63-68 1991.

Keywords: *Terminology, *Data management, Data structures, Standards, Reprints, Information Resource Directory System, IRDS System, Data dictionaries.

Increasing use of such tools as the data dictionary has facilitated the control and management of data across organizational boundaries and has reduced the confusion arising from the proliferation of ill-defined terms. To manage data and to optimize conditions for sharing it, organizations must set a policy for establishing unique entity names. The article suggests one approach to standardization of data terminology through use of an Information Resource Directory System (IRDS).

200,493
PB92-170794 Not available NTIS
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Information Systems Engineering Div.
Interactive Conformance Testing for PHIGS.
Final rept.
J. V. Cugini. 1991, 14p
See also PB90-264094.
Pub. in Proceedings of Conference Eurographics '91, Vienna, Austria, September 2-6, 1991, p353-366.

Keywords: *Interactive graphics, *Standards, Computer program verification, Human factors engineering, Interactive systems, Main computer interface, Databases, Tests, Reprints, *Conformance testing, Programmer's Hierarchical Interactive Graphics System, PHIGS standard.

Conformance testing for the Programmer's Hierarchical Interactive Graphics System (PHIGS) standard presents certain novel difficulties, especially the indirect effect of many functions, and the inaccessibility to the program of visual effects. The PHIGS Validation Tests (PVT) incorporate several innovative design features in order to address these difficulties. The model of deductive inference suggests ways to organize a system as logically complex as the PVT. The complexity makes the use of certain database concepts quite valuable in allowing users to navigate within the system. The problem of inaccessible effects can be addressed by careful design of the user interface, so as to minimize the subjectivity and operational difficulty inherent in testing such features. Subjectivity is minimized by posing short simple questions to the operator, in which the expected answer is randomized. Several design features enhance ease of use, including a customizable interface, self-explanatory displays, and automatic capture of results.

200,494
PB92-171131 Not available NTIS
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Information Systems Engineering Div.
Increasing the Power of Hypertext Search with Relational Queries.
Final rept.
L. Gallagher, R. Furuta, and P. D. Stotts. 1990, 14p
Pub. in Hypermedia 2, n1 p1-14 1990.

Keywords: *Database management systems, *Relational databases, Query languages, Searching, Search structuring, Prototypes, Reprints, *HyperCard, Hypertext systems.

The report describes an SQL relational database schema for representing the objects in HyperCard, along with a technique for automatically populating the schema from a HyperCard stack using the facilities in HyperTalk with calls to the database manager. The standard relational database query language SQL can then be used to perform more general hypertext searches than are possible with the string search feature found in most hypertext browsing environments. Semiautomatic updates of the content of a hypertext 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.

200,495
PB92-172493 PC **A03**/MF **A01**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Advanced Systems Div.
User's Manual for the NIST TTCN Translator, Version 3.0.
D. H. Su. 31 Aug 91, 41p NISTIR-4655

Keywords: *Computer communications, *Tests, *Translators, Protocols, Standards, Input output processing, UNIX(operating system), Computer programs, *TTCN(Tree and Tabular Combined Notation), C programming language, NIST, National Institute of Standards and Technology.

Standard conformance testing is the first step in ensuring the interoperability of communications products. There has been increased interest in the development of Abstract Conformance Test Suites (ATS) in the standards community. A standard test script language called Tree and Tabular Combined Notation (TTCN) has increasingly been used to specify test suites. The National Institute of Standards and Technology (NIST) has developed a TTCN to C language translator to help the industry in speeding up implementation of ATSs into executable test suites (ETS). The manual describes processes involved in implementing an ETS, how the translator is to be used, and the design of the translator itself.

200,496
PB92-191212 PC **A08**/MF **A02**
National Inst. of Standards and Technology, Gaithersburg, MD.
Managing Data: From Vision to Reality. Proceedings of the Annual DAMA Symposium (4th). Held in Gaithersburg, Maryland on May 14-15, 1991.
J. J. Newton, M. L. Melley, and H. Higgins. May 92, 165p NISTIR-4843
See also PB90-204512. Sponsored by Data Administration Management Association, Washington, DC. National Capital Region.

Keywords: *Meetings, *Data management, Software engineering, Computer applications, Data base administrators, Information processing, Data bases, Standards, Models, Systems engineering, CASE(Computer-Aided Software Engineering).

Contents:
- Achieving the data management reality;
- The road map for CASE implementation;
- The impact of implementing a new information architecture;
- Data planning--what good is it anyhow;
- Data modeling:
- the data administrator perspective vs. the traditional application development point of view;
- Data management and information proficiency:
- a vision for the future;
- Information reengineering;
- Managing information across multiple CASE tools;
- The atomic database:
- Building the perfect beast;
- Data management and customer satisfaction;
- Data administration, the IBM repository, and CASE technology at Depository Trust Company;
- Status and application of standards for data administration;
- Future vision:
- an essential prerequisite for a data management program.

200,497
PB92-197656 Not available NTIS
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Systems and Software Technology Div.
Computer Assurance: Security, Safety, and Economics.
Final rept.
A. L. Hankinson. 1989, 7p
Pub. in Proceedings of Annual Conference on Computer Assurance (4th): Systems Integrity, Software Safety and Process Security, p1-7 1989.

Keywords: *Computer security, *Computer program reliability, *Safety engineering, Computer software, Risk assessment, Configuration management, Quality assurance, Computer program verification, Data integrity, Reprints.

Concerns of software product assurance, computer security, and computer system safety are part of the same problem of assuring the confidentiality, integrity and availability of information. Increasingly, software product assurance will focus on computer security and computer system safety. The paper identifies some common objectives and activities, key issues of the problems of system assurance, security, safety, and integrity, and approaches to dealing with them.

200,498
PB92-213271 PC **A09**/MF **A02**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
Network Management Support for OSI Systems (NeMaSOS), Version 2.0. Programmer's Reference Manual.
K. G. Brady, J. F. Fox, and R. Aronoff. Jul 92, 181p NISTIR-4866

Keywords: *Computer networks, *Applications programs(Computers), Programming manuals, UNIX(Operating system), *OSI(Open Systems Interconnection), *Network management, ISO(International Organization for Standardization), CMIS/CMIP(Common Management Information Services and Protocol), ROSE(Remote Operations Service Element), ACSE(Association Control Service Element).

The National Institute of Standards and Technology (NIST) Network Management Support for Open Systems (NeMaSOS) project developed a prototype network manager conforming strictly to the Common Management Information Services and Protocol (CMIS/CMIP) Information System (IS) version 1, and the Open Systems Interconnection (OSI) Workshop Implementors Agreements of December 1991. The document describes libraries of functions implemented to provide the services of CMIS/P, Association Control Service Element (ACSE), and Remote Operations Service Element (ROSE). The service interface for UNIX systems using ISO Development Environment (ISODE) is also described.

200,499
PB92-229178 PC **A06**/MF **A02**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
Conformance Test Specifications for COBOL Intrinsic Function Module.
Special pub. (Final).
C. Montanez-Rivera, and L. A. Johnson. Jul 92, 113p NIST/SP-500/203
Also available from Supt. of Docs. as SN003-003-03172-1.

Keywords: *Tests, *Specifications, Federal information processing standards, Computer program verification, Requirements, Compilers, Functions(Mathematics), *Cobal programming language, National Institute of Standards and Technology.

The document contains test specifications for the COBOL Intrinsic Functions Module of the Federal Information Processing Standard (FIPS) Programming Language COBOL, FIPS PUB 21-3 (ANSI X3.23-1985, and Addendum ANSI X3.23A-1989). The document serves as a reference manual and as a user's guide for the COBOL Intrinsic Function Module Tests in the 1985 COBOL Compiler Validation System (CCVS).

200,500
PB92-237080 Not available NTIS
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Systems and Software Technology Div.
Effective Use of Software Standards in Systems Integration.
Final rept.
D. R. Kuhn. 1990, 7p
Pub. in Proceedings of International Conference on Systems Integration (1st), Morristown, NJ., April 23-26, 1990, p455-461.

Keywords: *Computer software, *Standards, Computer program portability, Interfaces, Software engineering, Systems engineering, Reprints, Systems integration.

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 others. While intelligent use of standards can solve many integration problems, the architecture of applications can significantly affect the degree of success in systems integration. The paper explains an approach to application development that helps use software standards to the best advantage in systems integration.

200,501
PB92-237403 Not available NTIS
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Information Systems Engineering Div.
Gauging the Validity of Graphics Standards.
Final rept.
M. W. Skall. 1989, 3p
Pub. in Government Graphics Systems, p25-27 Feb 89.

Keywords: *Computer graphics, *Standards, Computer program verification, Tests, Reprints.

The paper discusses the history and status of current graphics standards. It emphasizes the importance of developing techniques to verify that implementations of these standards have correctly implemented the entire standard.

200,502
PB93-124261
(Order as PB93-124246, PC **A06**/MF **A02**)
National Inst. of Standards and Technology, Gaithersburg, MD.
Symmetric Level Index Arithmetic in Simulation and Modeling.
D. W. Lozier, and P. R. Turner. 1992, 14p
Included in Jnl. of Research of the National Institute of Standards and Technology, v97 n4 p471-485 Jul/Aug 92. Prepared in cooperation with Naval Academy, Annapolis, MD.

Keywords: *Computer graphics, Binomial density functions, Least squares method, Exponential functions, Logarithm functions, Curve fitting, Computerized simulation, Parallel processing, Polynomials, Computation, Combustion, Algorithms, Symmetric level index arithmetic.

The paper begins with a general introduction to the symmetric level-index, SLI, system of number representation and arithmetic. The system provides a robust framework in which experimental computation can be performed without the risk of failure due to overflow/underflow or to poor scaling of the original problem. There follows a brief summary of some existing computational experience with the system to illustrate its strengths in numerical, graphical and parallel computational settings. An example of the use of SLI arithmetic to overcome graphics failure in the modeling of a turbulent combustion problem is presented. The main thrust of the paper is to introduce the idea of SLI-linear least squares data fitting. The use of generalized logarithm and exponential functions is seen to offer significant improvement over the more conventional linear regression tools for fitting data from a compound exponential decay such as the decay of radioactive materials.

200,503
PB93-125078 PC **A03**/MF **A01**
National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Statistical Engineering Div.
PC-OMNITAB: An Interactive System for Statistical and Numerical Data Analysis.
S. T. Peavy, and R. N. Varner. Oct 92, 14p NISTIR-4957
See also PB91-507954.

Keywords: *Statistical analysis, *Data analysis, *Computer software, Computer calculations, Matrices(Mathematics), Bessel functions, Interactive systems, Least squares method, Numerical analysis, Personal computers, Plotting, Probability density functions, Thermodynamic properties, PC-OMNITAB system, OMNITAB 80 system.

PC-OMNITAB, an interactive system for statistical and numerical data analysis, is an extension of OMNITAB 80. The system can be implemented on a 386/486 personal computer which has a math coprocessor and at least 4 MBytes of random access memory (RAM).

PC-OMNITAB responds to simple instructions to obtain accurate results since reliable, varied and sophisticated algorithms for data analysis and manipulation are referenced.

200,504
PB93-126365 PC **A07**/MF **A02**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
User's Guide for the PHIGS Validation Tests (Version 2).
J. V. Cugini, M. T. Gunn, and L. S. Rosenthal. Oct 92, 131p NISTIR-4953
Supersedes PB90-265216.

Keywords: *Computer graphics, *Standards, *Computer program verification, Tests, Interactive graphics, User manuals(Computer programs), *PHIGS(Programmers Hierarchical Interactive Graphics System), Conformance testing.

The Programmer's Hierarchical Interactive Graphics System (PHIGS) Validation Tests (PVT), developed by the National Institute of Standards and Technology (NIST), consist of a large set of Fortran programs which may be used to test how well implementations of PHIGS conform to the standard. The tests are organized into a hierarchical structure of modules which corresponds to the conceptual overview of the standard. The tests are associated with the standard via a set of semantic requirements which are derived directly from the standard. Cross-reference tables allow the user to find tests relating to specific PHIGS functions and data structures. Directions for installation and operation of the tests are included.

200,505
PB93-129575 Not available NTIS
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Systems and Software Technology Div.
Standards Test for Portability.
Final rept.
R. J. Martin. 1989, 3p
Pub. in Datamation, p38-40, 15 May 89.

Keywords: *Computer program portability, *Standards, Federal information processing standards, Computer program transferability, Computer program verification, Applications programs(Computers), Reprints.

There have been significant changes in computing over the past five years which have affected both users and vendors and have had a profound impact on the requirements for the management of software. Rapid changes in technology and the increasing sophistication of user needs and expectations has resulted in a marketplace where no single vendor can supply all the needs of a specific user.

Information Processing Standards

200,506
FIPS-PUB-171 PC **E16**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
Financial Institution Key Management (Wholesale). X9.17.
Final rept.
E. B. Barker. c27 Apr 92, 182p
Also pub. as American National Standards Inst., New York. rept. no. ANSI-X9.17-1985. Prepared in cooperation with American National Standards Inst., New York, Accredited Standards Committee on Financial Services-X9, and American Bankers Association, Washington, 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 Algorithm(DEA).

The standard specifies a particular selection of options for the automated distribution of keying 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 materials 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 selected options specified in the standard will allow the development of cost effective systems which will, in addition, increase the likelihood of interoperability.

200,507
FIPS PUB 19-2 PC **A04**/MF **A01**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
Catalog of Widely Used Code Sets; Category: Data Standards and Guidelines; Subcategory: Representations and Codes.
Final rept.
H. Tom, E. Lennon, and J. Wilson. 1 Jul 92, 64p
Supersedes FIPS PUB 19-1.
Three ring vinyl binder also available: North American Continent price $7.00; all others write for quote.

Keywords: *Data processing, *Standards, *Coding, *Catalogs(Publications), Directories, *Federal Information Processing Standards, Data elements.

The catalog lists and briefly describes code sets that are in wide use in the United States and that might be useful to Federal data systems. The purpose of the catalog is to assist Federal agencies and other organizations 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 characteristics, maintenance agency, source document, and other pertinent data. The revision supersedes FIPS PUB 19-1 in its entirety.

200,508
PB92-149830 PC **A03**/MF **A01**
National Inst. of Standards and Technology (NCTL), Gaithersburg, MD. Office Systems Engineering Group.
Interchangeability of SGML and ODA.
C. K. Nicholas, and L. A. Welsch. Jan 92, 23p NISTIR-4681
See also DE85000986 and FIPS PUB 152.

Keywords: *Standards, *Documents, Translator routines, Conversion, *SGML(Standard Generalized Markup Language), *ODA(Office Document Architecture), *Interchange, ODL(Office Document Language), Electronic documents.

The Standard Generalized Markup Language (SGML) and the Office Document Architecture (ODA) are international standards for the markup and interchange of electronic documents. These standards are incompatible, in the sense that in general a document encoded using SGML cannot be used directly in an ODA-based system, and vice versa. The authors first describe the two standards, and suggest criteria under which a bridge between the two standards could be evaluated. They then evaluate the Office Document Language (ODL), an SGML application specifically designed for ODA documents, with respect to these criteria. They then describe a translation program that converts SGML documents to ODA and back.

200,509
PB92-149871 PC **A04**/MF **A01**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
Government Network Management Profile (GNMP): Public Review Version of Proposed FIPS, May 31, 1991.
R. Aronoff, K. Brady, M. Chernick, J. Fox, and K. Hsing. Jan 92, 73p NISTIR-4651
See also PB91-120113 and PB91-171967.

Keywords: *Federal information processing standards, Protocols, Syntax, Semantics, Computer networks, Communication networks, Computer security, Access control, Testing, Specifications, *GNMP(Government Network Management Profile).

The Government Network Management Profile (GNMP) is the standard reference for all Federal Government agencies to use when acquiring Network Management (NM) functions and services for computer and communications systems and networks. The GNMP is being developed in phases. The document specifies the initial proposed version of the GNMP. The proposed version 1 GNMP specifies the common management information exchange protocol and services, specific management functions and services, and the syntax and semantics of the management information required to support monitoring and control of network and system components and their resources. Version 1 GNMP also includes optional methods of authentication. These optional authentication methods are provided for interim use in the absence of standard approaches to network management security.

200,510
PB92-154038 Not available NTIS
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Systems and Network Architecture Div.
Toward a Unified Theory of Managing Large Networks.
Final rept.
P. Brusil, and D. Stokesberry. 1989, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Spectrum 26, n4 p39-42 Apr 89.

Keywords: *Computer networks, *Standards, Computer viruses, Integrated systems, Protocols, Computer communications, Reprints, *Network management.

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, protocol, 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.
Stable Implementation Agreements for Open Systems Interconnection Protocols. Version 5, Edition 1, December 1991. Based on the Proceedings of the OSI Implementors' Workshop. Held in Gaithersburg, Maryland.
Special pub. (Final).
T. Boland. Mar 92, 986p NIST/SP-500/202
Also available from Supt. of Docs. as SN903-015-00000-4. 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 Networks).

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 (CSL), Gaithersburg, MD. Database and Graphics Group.
Guide for Specifying and Building CITIS with Data Management Standards.
L. J. Gallagher, J. M. Sullivan, and J. C. Collica. Feb 92, 50p NISTIR-4780
See also PB92-163856.

Keywords: *Data management systems, *Standards, Specifications, Relational data bases, Federal information processing standards, Data dictionaries, Data base management systems, Computer networks, Data access, Data integrity, Distributed data bases, Testing, Procurement, *CITIS(Contractor 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 (CITIS) when that service is to be provided in an environment that supports other federal standards for 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 data dictionary systems, specifically Database Language SQL, Remote Database Access (RDA), and Information Resource Dictionary System (IRDS). It addresses the CITIS specification in terms of these data management standards and indicates how these standards may be specified or used to meet the requirements for various levels of service and functional requirements of CITIS. It concludes by identifying the benefits of data management standards in the CITIS architecture. The Appendices describe the general content of each data management standard and discuss its applicability and availability. Where appropriate, they also address the availability of conformance test suites and future plans for enhancements and follow-on standardization efforts.

200,513
PB92-190479 PC **A08**/MF **A02**
National Inst. of Standards and Technology, Gaithersburg, MD.
Supplement to Stable Implementation Agreements for Open Systems Interconnection Protocols. Change Pages to Version 5, Edition 1. Output from the March 1992 Workshop.
8 Jun 92, 163p NIST/SP-500/202
Also available from Supt. of Docs. as SN903-015-00000-4. Supersedes PB92-164508.

Keywords: *Protocols, *Changes, Computer networks, Message processing, File management systems, Computer security, Data processing security, Data bases, Access, Testing, Health care, *OSI(Open Systems Interconnection), Virtual terminals.

The document records, in replacement page format, all changes to stable material for Open Systems Interconnection (OSI) protocols which was current as of the end of December 1991. By following the instructions, and replacing or inserting the indicated pages, text will be created which reflects the current status of relevant stable material as of March 13, 1992.

200,514
PB92-197953 Not available NTIS
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Systems and Software Technology Div.
Government Procurements Stress Applications Portability.
Final rept.
R. J. Martin. 1989, 3p
Pub. in CommUNIXations IX, n2 p11-13 Mar/Apr 89.

Keywords: *Computer program portability, *Government procurement, *Specifications, Federal information processing standards, Applications programs(Computers), Computer program transferability, Reprints, APP(Applications Portability Profile).

The National Institute of Standards and Technology (NIST) Applications Portability Profile (APP) identifies the functional areas which must be addressed to promote applications portability. The paper presents an overview of the APP and how the APP specifications are expected to be used in government procurement specifications.

200,515
PB92-236405 Not available NTIS
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Advanced Systems Div.
Overview of FDDI.
Final rept.
W. E. Burr, and L. Zuqiu. 1988, 7p
See also PB91-148254.
Pub. in Proceedings of European Fibre Optic Communications and Local Area Networks Exposition (6th), Amsterdam, Netherlands, June 29-July 1, 1988, p287-293.

Keywords: *Local area networks, *Standards, Fiber optics, Protocols, Access control, Reprints, *FDDI(Fiber Distributed Data Interface), Token rings, ANSI(American National Standards Institute), ISO(International Organization for Standardization).

The Fiber Distributed Data Interface (FDDI) is a 100 Mbit/s fiber optic token ring Local Area Network (LAN) standard. The four sublayers of the FDDI standard, Station Management (SMT), Medium Access Control (MAC), Physical Protocol (PHY), and Physical Medium Dependent (PMD) are described and the current status of these standards in ANSI and ISO is reviewed. The probable effects of FDDI on both the computer and fiber optics network are reviewed.

200,516
PB92-236637 Not available NTIS
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Systems and Software Technology Div.
ODA and Document Interchange.
Final rept.
F. Dawson, and F. Nielsen. 1990, 7p
Pub. in Unix Review 8, n3 p50-56 Mar 90.

Keywords: *Documents, *Data processing, *Standards, Data transfer(Computers), Reprints, *Compound documents, ODA(Office Document Architecture).

The compound document is the medium for conveying information in the electronic office. The recently published Office Document Architecture (ODA) International Standard is intended as the solution for interchanging compound documents between different document processing products and throughout the office network. The standard is described in the article.

200,517
PB93-129666 Not available NTIS
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Systems and Network Architecture Div.
U.S. GOSIP: The Challenges Ahead.
Final rept.
K. L. Mills. 1990, 5p
See also PB92-110105.
Pub. in Computer Standards and Interfaces 10, n3 p219-223 1990.

Keywords: *Standards, *Computer networks, Federal information processing standards, Protocols, Computer program verification, Tests, Federal agencies, Routing, Message processing, Computer security, Reprints, *GOSIP(Government Open Systems Interconnection Profile).

The paper looks beyond the existing United States Government Open Systems Interconnection Profile (GOSIP) toward several important challenges to be met in the years ahead. The first challenge is creating effective, economical, and technically credible test policies and procedures for GOSIP. The second challenge is stimulating the strategic and tactical planning within Federal Agencies necessary to implement the provisions of GOSIP. The third challenge is adding functions to later versions of GOSIP to provide directory services, dynamic routing, security, transaction processing, and electronic data interchange. The fourth challenge is fostering and successfully pursuing international collaboration in functional standards, procurement profiles, and testing. Beyond these four challenges lies the next horizon -- integrated, interoperable network management.

200,518
PB93-135275 Not available NTIS
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Systems and Network Architecture Div.
TCP/IP versus OSI, or How I Learned to Stop Translating and Love Standards.
Final rept.
K. L. Mills. 1992, 14p
Pub. in Federal Computer Week, v6 n11 p32-45 1992.

Keywords: *Computer networks, *Computer architecture, *Standards, Protocols, Computer communications, Reprints, OSI(Open Systems Interconnection), TCP/IP, SNA.

The need to interconnect computers, and to communicate without regard to make or model, is clear. More confusing is the means of meeting the need. Should one use a proprietary solution such as SNA. Should one use a de facto standard such as TCP/IP. Or, should one use a de jure standard such as OSI. The author addresses these questions and provides his own recommendations for a pragmatic course of action that should enable one to steer through the current confusion.

Pattern Recognition & Image Processing

200,519
PB92-133008 PC **A03**/MF **A01**
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Kinematic Calibration of an Active Camera System.
G. S. Young, T. H. Hong, M. Herman, and J. C. S. Yang. Nov 91, 37p NISTIR-4715
Prepared in cooperation with Maryland Univ., College Park. Dept. of Mechanical Engineering, and American Univ., Washington, DC. Dept. of Computer Science and Information Systems.

Keywords: Robot arms, Manipulators, Kinematics, Calibration, *Robot vision, *Computer vision, *Active camera systems.

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 designated tasks in perceptual activity, an active camera system is often used. An active camera system is also usually used for vision-based guidance. In order to position the camera sytem accurately and to obtain the relation between the camera and the manipulator, the active camera system must be calibrated. In the paper, the authors introduce a modified Denavit-Hartenburg kinematic model and develop a new technique to calibrate an active camera system. The manipulator, camera-to-manipulator, camera, and base-to-world calibrations are all included. The method employs four ideas: (1) The camera poses, joint poses, and link frames calibrated are all related to the world frame, therefore the camera-to-manipulator and base-to-world calibration is very straightforward; (2) The joint poses are calibrated separately; (3) The manipulator motion is obtained from the camera poses; (4) Once the joint poses are obtained, the link frames can be defined for any kinematic model. In consequence, the whole procedure is simple, flexible, accurate, and efficient. Two experiments are performed to verify the accuracy of the new technique.

200,520
PB92-149863 PC **A03**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD. Technology Administration.
Massively Parallel Implementation of Character Recognition Systems.
M. D. Garris, C. L. Wilson, J. L. Blue, G. T. Candela, and P. Grother. Jan 92, 16p NISTIR-4750
Presented at SPIE's Conference on Machine Vision Applications in Character Recognition and Industrial Inspection, San Jose, CA., 1992.

Keywords: *Character recognition, *Massively parallel processors, Neural nets, Image processing, Feature extraction, Image reconstruction, Documents, Data processing, Handwriting, Computer architecture, Software engineering, Data bases.

A massively parallel character recognition system has been implemented. The system is designed to study the feasibility of the recognition of handprinted 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 data, use 94% of the system time. The segmentation time is 15 ms/character and segmentation accuracy is 89% for handprinted digits and alphas. Character recognition accuracy for medium quality machine print is 99.8%. On the handprinted digits, the recognition accuracy is 96% and recognition speeds of 10,100 character/second can be realized. The limiting factor in the recognition portion of the system 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.

200,521
PB92-158302 PC **A03**/MF **A01**
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Unmanned Systems Group.
Computing Depth from Temporal Cross-Correlation: A Comparison of Two Methods of Computation.
J. A. Horst. Feb 92, 14p NISTIR-4764

Keywords: *Range finding, Cross correlation, Depth finding, Comparison, *Machine vision, Reichardt model, Robot vision.

An important problem in machine vision is to determine the distance from camera to feature by appropriately interpreting a two dimensional image or sequence of images of that feature. Calculating the distance from camera to feature point by temporal cross-correlation of pixels in a flat image plane is better done using simple geometric relations than using time differentials. Both methods of computation will be presented and contrasted. The effect of measurement error and other inaccuracies on the determination of range will also be covered.

200,522
PB92-171990 PC **A03**/MF **A01**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Advanced Systems Div.
Training Feed Forward Neural Networks Using Conjugate Gradients.
P. J. Grother, and J. L. Blue. Feb 92, 24p NISTIR-4776

Keywords: *Optical character recognition, *Neural nets, *Conjugate gradient method, Iteration, Training, Pixels, Handwriting, Workstations, Serial processors, Massively parallel processors, Tests, Self organizing systems.

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 hand-written digit segmented from the National Institute of Standards and Technology (NIST) Handwriting Image Data Base. 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 runs on a serial scientific workstation and a highly parallel computer. Typical training on a network with 32 inputs, 32 hidden nodes, and 10 output nodes gives a 98% to 99% recognition for the training set and 95% for the test set. Training with conjugate gradients requires fewer than 200 iterations; times are about 20 to 40 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 scientific workstation and on the highly parallel computer respectively. These results suggest that commercial hand-written character recognition systems with great economic potential are feasible.

200,523
PB92-172741 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Robot Systems Div.
Flat Surfaces: A Visual Invariant.
D. Raviv. Mar 92, 14p NISTIR-4794
See also PB90-228008, PB91-112805, PB92-133016 and PB92-148287. Prepared in cooperation with Florida Atlantic Univ., Boca Raton.

Keywords: *Computer vision, *Flatness, *Surfaces, Motion, Surface properties, Mobility, Visual perception, Image processing.

The paper deals with machine perception of flat surfaces. For an observer that undergoes only translational motion in parallel to a planar surface, it shows that a nonlinear function of optical flow produces the same value for all points on the surface, i.e., there is an optical-flow based invariant for all points that lie on a flat surface. It discusses some potential uses of the invariant.

200,524
PB92-183649 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Robot Systems Div.
Logarithmic Retinae.
D. Raviv, D. J. Orser, and J. S. Albus. Apr 92, 44p NISTIR-4807
See also PB92-133016. Prepared in cooperation with Florida Atlantic Univ., Boca Raton.

Keywords: *Computer vision, *Motion, Image processing, Three dimensional bodies, Computerized simulation, Logarithmic retinae, Optical flow.

The paper suggests several iconic image 'warpings', or remappings, which facilitate computationally inexpensive measurements of moving 3-D points relative to a camera. Assuming translational motion of the camera, where the optical axis coincides with the direction of motion, and a stationary scene, points in 3-D space 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 there is one 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, looming and clearance. For each invariant a camera-retina imaging model utilizing spherical projection and foveal peripheral resolution is described for analyzing optical flow. Computer simulation demonstrates how the new suggested retinae normalize the optical flow with respect to each one of the parameterizations.

200,525
PB92-187111 PC **A03**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
Karhunen Loeve Feature Extraction for Neural Handwritten Character Recognition.
P. J. Grother. Apr 92, 16p NISTIR-4824
See also PB92-171990.

Keywords: *Feature extraction, *Character recognition, Handwriting, Neural nets, Machine learning, Image processing, Algorithms, Conjugate gradient method, Massively parallel processors, *Karhunen Loeve transform.

The optimality of the Karhunen Loeve (KL) transform is well known. Since its basis is the eigenvector set of the covariance matrix, a statistical, not functional, representation of the variance in pattern ensembles is generated. By using the KL transform coefficients as a natural feature representation of a character image, the eigenvector set can be regarded as an unsupervised biological feature extractor for a (neural) classifier. The covariance matrix and its eigenvectors are obtained from 76753 handwritten digits. The operation is a unique expense; once the basis set is calculated, it forms a linear first layer of a three weight layer feed forward network. The subsequent nonlinear perceptron layers are trained using a scaled conjugate gradient algorithm that typically affords an order of magnitude reduction in computation over the ubiquitous back-propagation algorithm. In conjunction with a massively parallel computer, training is expedited such that tens of initially different random weight sets are trained and evaluated. Increase in training set size (up to 76755 patterns) gives less accurate learning but improved generalization on the fixed disjoint test set. A neural classifier is realized that recognizes 96.1% of 15000 handwritten digits from 944 different writers. The recognition is attributed to KL transform energy compaction optimality.

200,526
PB92-197524 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Analysis of Frame Interpolation in Video Compression and Standards Conversion.
Final rept.
C. Fenimore, and B. Field. 1992, 1p
Pub. in Proceedings of Data Compression Conference, Snowbird, UT., March 25-27, 1992, p381.

Keywords: *Video data, *Data compression, Frames(Data processing), Image processing, Interpolation, Standards, Errors, Reprints.

The interpolation 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 considered the metrics which are used for assessing the quality of an interpolation scheme. Recently, it has been suggested that the L sup 1 norm is a preferred metric in the comparison of images. The authors applied both the time-averaged L sup 1 and L sup 2 norms to video, processed according to each of two interpolation schemes. These norms were compared for their ability to detect various levels of interpolation error. The L sup 2-based norm discriminated between low and high levels of interpolation error more effectively than did the L sup 1-based norm. Short sequences of interpolated video were generated and viewed in realtime to provide a comparison. The study was carried out on a realtime video supercomputer, the Princeton Engine.

200,527
PB92-213412 PC **A03**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
Reject Mechanisms for Massively Parallel Neural Network Character Recognition Systems.
M. D. Garris, and C. L. Wilson. Jun 92, 16p NISTIR-4863
See also PB92-149863.

Keywords: *Character recognition, *Massively parallel processors, *Neural nets, Handwriting, Image processing, Accuracy, Classifications, 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 recognition system was designed to study the feasibility of automatically recognizing hand-printed text in a loosely constrained environment. The first method is a simple scalar threshold on the output activation of the winning neurode from the character classifer network. The second method uses an additional neural network trained on 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 nonlinear function of the character classifier network which effectively removes most of the correlation between character accuracy and all activations other than the winning activation. This suggests that any effective rejection network must receive information from the system which has not been filtered through the non-linear classifier.

200,528
PB92-222942 PC **A03**/MF **A01**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Advanced Systems Div.
Topological Separation versus Weight Sharing in Neural Net Optimization.
O. M. Omidvar, and C. L. Wilson. Jul 92, 16p NISTIR-4893

Keywords: *Neural nets, *Optimization, Image processing, Pattern recognition, Topology, Fingerprints, Boltzmann machine.

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 shortcoming of the weight sharing method is attributed to a large number of extraneous weights which play a minimal role in pattern separation and recognition. The authors' experiments have shown that up to 97% of the connections in the network can be eliminated with little or no change in the network performance. Topological separation should be used when the size of the network is large enough to tackle real life problems such as fingerprint classification. Their research has focused on the network topology by changing the number of connections as secondary method of optimization. The findings indicate that for large networks, topological separation yields smaller network size that is more suitable for very large scale integration (VLSI) implementation. Topological separation is based on the error surface and information content of the network. As such, it is an economical way of size reduction which leads to overall optimization. The differential pruning of the connections is based on the weight contents rather than number of connections. The training error may vary with the topological dynamics but the correlation between the error surface and recognition rate decreases to a minimum. Topological separation reduces the size of the network by changing its architecture without degrading its performance.

200,529
PB92-238542 PC **A17**/MF **A03**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Advanced Systems Div.
Census Optical Character Recognition System Conference (1st). Held in Gaithersburg, MD. in May 1992.
R. A. Wilkinson, J. Geist, S. Janet, P. J. Grother, C. J. C. Burges, R. Creecy, B. Hammond, J. J. Hull, N. J. Larsen, T. P. Vogl, and C. L. Wilson. Sep 92, 376p NISTIR-4912
Sponsored by Bureau of the Census, Washington, DC.

Keywords: *Optical character recognition, *Character recognition, *Handwriting, *Meetings, Optical character recognition device, State of the art.

The First Census Optical Character Recognition (OCR) Systems 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. Wilkinson, and M. D. Garris. Sep 92, 14p
NISTIR-4923

Keywords: *Optical character recognition, *Handwriting, Parallel processing, Histograms, Comparison, *Handprinting, Segmentation, Blob coloring.

NIST has developed a massively parallel hand-print recognition system that allows components to be interchanged. 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 histogramming method locates linear spaces, which may be slanted, to segment characters. The hybrid method is an augmented histogramming method that incorporates statistically adaptive rules to decide 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 Single Instruction Multiple Data (SIMD) machine attached to it. The data used in this comparison is 'NIST Special Database 1' which contains 2100 forms from different writers where each form contains 130 digit characters distributed across 28 fields. This gives a potential 273,000 characters to be segmented. Running the massively parallel system across the 2100 forms, blob coloring required 2.1 seconds per form with an accuracy of 97.5%, histogramming required 14.4 seconds with an accuracy of 95.3%, and the hybrid method required 13.2 seconds with an accuracy of 95.4%. The results of this comparison show that the blob coloring method on a SIMD architecture is superior.

200,531
PB93-113587 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MEL), 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 vehicles and the like, can benefit from this information. In this report, the problem is formulated under a least squares minimization framework. Based only upon a set of spatiotemporal disparity measurements from a correlation algorithm, the algorithm in general recovers optimal estimates, in the sense of least squares, of both the instantaneous optical flow field and time-to-contact simultaneously. It does not utilize knowledge of camera translation or any internal camera parameters. Nevertheless, additional information can be recovered if prior information is incorporated into the algorithm. It is shown that if complete translational camera motion as well as some internal camera parameters are known, optimal estimates of absolute depth can directly be inferred from the disparity measurements. Closed-form solutions are obtained in all cases. The algorithm is simple, effective, and easy to implement, which enhances the possibility of hardware realization for real-time applications. Experimental results, both 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 (MEL), Gaithersburg, MD. Robot Systems Div.
Real-Time Smooth Pursuit Tracking for a Moving Binocular Robot.
D. Coombs, and C. Brown. Apr 92, 26p NISTIR-4826
Grants NSF-IRI89-03582, NSF-CDA88-22724
Sponsored in part by contract N000114-82-K-0193. 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, *Robot tracking, Computer vision.

The paper examines the problem of a moving robot tracking a moving object with its cameras, without requiring the ability to recognize the target to distinguish it 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 horopter (surface of zero stereo 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 field of view, so spatially-localized processing helps concentrate on the target. Instead of requiring a way to recognize the target, the system relies on active control of camera movements and binocular fixation segmentation.

200,533
PB93-120707 PC **A04**/MF **A01**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Advanced Systems Div.
NIST Scoring Package User's Guide Release 1.0.
M. D. Garris, and S. A. Janet. Oct 92, 73p NISTIR-4950

Keywords: *Character recognition, *Computer software, *Performance evaluation, Computer applications, Forms(Paper), Documents, Image processing, 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 Handprinted Characters from Image Data Scanned from Forms, which has been submitted to American National Standards Institute (ANSI) X.3A. The document presents the concepts of scoring forms processing systems and character classifiers, discusses the concepts and algorithm used for dynamic string alignment, defines the files and their formats required as input to the Scoring Package, and documents how the Scoring Package software is installed and invoked.

General

200,534
PB92-144138 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Outline for a Theory of Intelligence.
Final rept.
J. S. Albus. 1991, 37p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Systems, Man, and Cybernetics 21, n3 p473-509 May/Jun 91.

Keywords: *Intelligence, *Artificial intelligence, Robotics, Machine vision, Sensors, Feedback control, Behavior, Reprints.

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 research in both natural and artificial systems. The model consists of a hierarchical system architecture wherein: (1) control bandwidth decreases about 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 planning horizons expand in space and time about 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 rept.
D. M. Gilbert, and N. Lynch. Dec 91, 97p NISTIR-4749
See also PB91-107540.

Keywords: *Computer security, *Federal agencies, *United States, National government, Government procurement, Contractors, Project management, Contracted services, Computer privacy, Computer information security, Installing, Training, Awareness, Data processing security, *Statements of work.

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 expertise of staff, and the potential knowledge to be gained by the organization from an 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) describing 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**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Computer Security Div.
Review of U.S. and European Security Evaluation Criteria.
C. R. Dinkel. Mar 92, 29p NISTIR-4774
See also AD-A207 905.

Keywords: *Computer security, *Data processing security, *Computer networks, *Computer performance evaluation, United States, Europe, Criteria, Data base management systems, Specifications, Orange book, Red book, National Institute of Standards and Technology.

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**
Iowa State Univ., Ames. Dept. of Computer Science.
Foundations of a Security Policy for Use of the National Research and Educational Network.
A. E. Oldehoeft. Feb 92, 55p NISTIR-4734
Grant NANB-112737
Sponsored by National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Computer Security Div.

Keywords: *Computer security, *Computer networks, *Policies, Policy making, Computer information security, Federal agencies, Guidelines, Supercomputers, Ethics, Threats, *NREN(National Research and Education Network).

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 context for developing 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 policies, and identifies the need for developing a policy. A security policy is then proposed for the NREN; one that is intended to provide the basis for continuing discussion and further development. The draft policy identifies responsibilities of all major network constituents: end users, local system administrators, management at all levels, vendors, system developers, service providers, and a national council. It is abstractly stated in order to remain independent of current technologies and organization-specific practices.

200,538
PB92-172816 PC **A06**/MF **A02**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Computer Security Div.
Formal Description of the SDNS Security Protocol at Layer 4 (SP4).
W. A. Jansen. Mar 92, 110p NISTIR-4792
See also PB90-198946.

Keywords: *Computer networks, *Computer security, *Protocols, Specifications, Communication networks, Data encryption, Access control, Data integrity, *SDNS(Secure Data Network System), OSI(Open Systems Interconnection), ISO(International Organization for Standardization), SMIB(Security Management Information Base), FDT(Formal Description Technique).

The Secure Data Network System (SDNS) project, initiated by the National Security Agency in 1986, produced a computer network security architecture within the framework of the International Organization for Standardization (ISO) reference model for Open Systems Interconnection (OSI). The report contains a formal description of the SDNS security protocol at layer four (SP4), one component of the overall security architecture. Estelle is the OSI formal description technique (FDT) used for the SP4 specification. Estelle is based on an extended state transition model with language elements from the Pascal language. An Estelle specification describes a hierarchically structured system of modules. The design of the formal description is explained through a top level and subsequent level of module decomposition. A description of the underlying security management information base is also included.

200,539
PB92-183714 PC **A06**/MF **A02**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Computer Security Div.
Computer Security Considerations in Federal Procurements: A Guide for Procurement Initiators, Contracting Officers, and Computer Security Officials.
Special pub. (Final).
B. Guttman. Mar 92, 113p NIST/SP-800/4
Also available from Supt. of Docs. as SN003-003-03147-0. See also PB90-148784 and PB92-148261.

Keywords: *Computer security, *Government procurement, Specifications, Contract administration, Cryptography, Data encryption, Data integrity, Access control, Acquisition, Guidelines, Requirements, Risk, *FIP(Federal Information Processing).

The document provides guidance on including computer security considerations in the acquisition phase of information resources management. It is intended to help agencies select and acquire cost-effective computer security by explaining how to include computer security requirements in federal information processing (FIP) procurements. The guideline has three parts. The first part is an introduction to the two disciplines: computer security (targeted for FIP procurement personnel); and FIP procurement (targeted for computer security personnel). These overviews provide sufficient knowledge to understand the legal, conceptual, and regulatory underpinnings of the document. The second part explains the integration of computer security into the FIP procurement process. The guideline also provides assistance on the selection of computer security features, assurances, and procedures. The third part of the document includes specifications and contract language for specific computer security features, assurances, and procedures that can be included in FIP procurements.

200,540
PB92-205418 PC **A03**/MF **A01**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Advanced Systems Div.
Optimization of Neural Network Topology and Information Content Using Boltzmann Methods.
C. L. Wilson, and O. M. Omidvar. Feb 92, 13p NISTIR-4766
Prepared 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(Charts).

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 heavily rely on weight sharing 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 of the network. The changes in the network topology were achieved by altering the number of weights. The primary optimization was scaled 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. Everhart. 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 implement Public Law 100-235, the Computer Security Act of 1987, which requires training for all employees responsible for the management and use of federal computer systems that process sensitive information. The publication is divided into five audience categories: (1) Executives, (2) Program/Functional Managers, (3) IRM, Security, and Audit Personnel, (4) ADP Management, Operations, and Programming Staff, and (5) End Users. In addition to the five audience categories, there are five training content areas for each audience 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 from general awareness to specific training courses depending on the training objectives established by each agency.

200,542
PB92-236256 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Scientific Computing Div.
Experiences with an Expert System for ODEs.
Final rept.
D. Barnett, and D. Kahaner. 1989, 9p
Pub. in Mathematics and Computers in Simulation 31, n4-5 p315-323 Oct 89.

Keywords: *Expert systems, *Ordinary differential equations, Computer calculations, Computer software, Systems engineering, Reprints, PLOD computer program.

An Expert System can be defined '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 wheel' in order to provide needed capabilities. 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 (CSL), Gaithersburg, MD. Computer Security Div.
Computer Security Bulletin Board System: User's Guide.
M. Skandera, and M. Swanson. Sep 92, 43p NISTIR-4933

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 computer security issues. The NIST Computer Security BBS makes available to federal agencies and the public a wide variety of computer security information and encourages the sharing of information which can help 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 (CSL), Gaithersburg, MD. Computer Security Div.
Threat Assessment of Malicious Code and External Attacks.
L. E. Bassham, and W. T. Polk. Oct 92, 21p NISTIR-4939
Contract AVAL-W43P6Q-EW138
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, such as viruses and worms, to human threats, such as hackers and phone phreaks. These attacks target different characteristics of a system. This leads to the possibility that a particular system is more susceptible to certain kinds of attacks. Malicious code, such as viruses and worms, attack a system in one of two ways, either internally or externally. Traditionally, 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 of systems. Many of these vulnerabilities are simply due to configuration errors. The report provides an assessment of the threats associated with malicious code and external attacks on systems using commercially available hardware and software.

200,545
PB93-120731 PC **A03**/MF **A01**
National Inst. of Standards and Technology (TS), Gaithersburg, MD. Weights and Measures Program.
Protocol Implementation Conformance Statement (PICS) Proforma for the SDNS Security Protocol at Layer 4 (SP4).
W. A. Jansen. Oct 92, 23p NISTIR-4934

Keywords: *Computer networks, *Computer security, Protocols, Algorithms, Error detection codes, Conformity, ISO(International Organization for Standardization), OSI(Open Systems Interconnection), SDNS(Secure DataNetwork System), PICS(Protocol Implementation Conformance Statement).

The Secure Data Network System (SDNS) project, initiated by the National Security Agency in 1986, produced a computer network security architecture within the framework of the International Organization for

Standardization (ISO) reference model for Open Systems Interconnection (OSI). The security protocol at layer 4 (SP4) is one element of the SDNS architecture used to provide security services at the Transport Layer of the OSI reference model. The report specifies the Protocol Implementation Conformance Statement (PICS) proforma for SP4. When the PICS proforma is completed for an SP4 implementation, it provides a clear and concise statement of capabilities, useful in a variety of situations to those involved in the production, testing, supply, procurement, and application of the implementation.

ELECTROTECHNOLOGY

Antennas

200,546

AD-A243 489/2 PC **A07**/MF **A02**

National Inst. of Standards and Technology, Boulder, CO.

Spherical Near-Field Scanning: Experimental and Theoretical Studies.

Final rept.

R. C. Wittmann, and C. F. Stubenrauch. Apr 91, 132p RL-TR-91-56

Contract F30602-88-F-0021

Keywords: Antennas, Computer programs, Experimental data, Test equipment, Theory, *Antenna measurements, Spherical scanning, Near field.

This 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).

200,547

PB92-166016 Not available NTIS

National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.

Time-Domain Method for Measuring the Reflection Coefficient of Microwave Absorbers at Frequencies Below 1 GHz.

Final rept.

A. R. Ondrejka, and M. Kanda. 1991, 4p

Pub. in Proceedings of Digest Antennas and Propagation Society Symposium, London, Ontario, Canada, June 24-28, 1991, v3 p1656-1659.

Keywords: Electrical measurement, Time domain, Reflectometers, Reflectivity, 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 method uses the two antennas in a difference mode to remove the undesired signals and enhance the small reflections being measured. Using this technique, the authors can separate front surface reflections from those which are generated at greater angles. The bandwidth of the pulses is 30 MHz to 1000 MHz, and reflection characteristics are 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 the measurement accuracy.

200,548

PB92-175272 Not available NTIS

National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.

Swept Frequency Gain Measurements from 33 to 50 GHz at the National Institute of Standards and Technology.

Final rept.

M. H. Francis, and R. C. Wittmann. 1991, 4p

Sponsored by Department of Defense, Washington, DC.

Pub. in Proceedings of Antenna Measurement Techniques Association, Boulder, CO., October 7-11, 1991, p1-3-1-6.

Keywords: Extremely high frequency, Millimeter waves, Extrapolation, Reprints, *Antenna gain, Swept frequency measurements, US NIST.

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 a swept frequency gain measurement service for the 33-50 GHz band. The service gives gain values with an accuracy of + or - 0.3 dB. In the paper the authors discuss an example measurement and the associated errors.

200,549

PB92-187020 PC **A07**/MF **A02**

National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.

Standard Spherical Dipole Source.

Technical note.

G. Koepke, L. D. Driver, K. Cavcey, K. Masterson, R. Johnk, and M. Kanda. Dec 91, 133p NIST/TN-1351

Also available from Supt. of Docs. as SN003-003-03149-6. See also PB89-193890.

Keywords: *Dipole antennas, *Spherical antennas, *Antenna radiation patterns, *Antenna design, *Standards, Electromagnetic fields, 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 signal generator. The signal and all 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.

200,550

PB92-192111

(Order as PB92-192079, PC **A05**)

National Inst. of Standards and Technology, Boulder, CO.

Probe-Position Error Correction in Planar Near Field Measurements at 60 GHz: Experimental Verification.

L. A. Muth. 1992, 25p

Included in Jnl. of Research of the National Institute of Standards and Technology, v97 n2 p273-297 Mar/Apr 92.

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.

200,551

PB92-197995 Not available NTIS

National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.

Analytic Correction for Probe-Position Errors in Spherical Near-Field Measurements.

Final rept.

L. A. Muth. 1991, 4p

Pub. in Proceedings of International Conference on Antennas and Propagation (7th), York, England, April 15-18, 1991, p762-765.

Keywords: Probes(Electromagnetic), Spherical configuration, Error functions, Near field, Reprints, *Antenna measurements, Error correction.

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 method has been used 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 obtained using a state-of-the-art 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 FFTs, and in spherical geometry 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.

200,552

PB92-198001 Not available NTIS

National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.

Experimental and Theoretical Probe Position Error Correction in Near-Field Antenna Measurements.

Final rept.

L. A. Muth, A. C. Newell, R. L. Lewis, S. Canales, and D. P. Kremer. 1991, 4p

Pub. in Proceedings of Annual Meeting and Symposium Antenna Measurement Techniques Association (12th), Philadelphia, PA., October 7-13, 1991, p13-27-13-30.

Keywords: Probes(Electromagnetic), Extremely high frequency, Computerized simulation, Error functions, Near field, Correction, 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. The position errors can be further removed by a theoretical procedure, which requires only the error-contaminated near field and the probe position errors at the points of measurements. All necessary computations can be efficiently performed using FFTs. An explicit nth-order approximation to the ideal near field of the antenna can be shown to converge to the error-free near field. Computer simulations with periodic error functions show that the error-correction technique is highly successful even if the errors are as large as 0.2(lambda), thereby making near-field measurements at frequencies well above 60 GHz more practicable.

200,553

PB92-213305 PC **A03**/MF **A01**

National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.

Certification Plan for a Planar Near-Field Range Used for High-Performance Phased-Array Testing.

M. H. Francis, A. G. Repjar, and D. P. Kremer. Jul 92, 27p NISTIR-3991

See also PB89-153886.

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 the antenna under test, rf crosstalk, probe position errors, rf 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 authors discuss the important aspects of a certification plan specifically written for the measurement of high-performance phased-array antennas. Further, they show how the requirements of each aspect depend on the measurement accuracies needed to verify the performance of the array under test.

200,554
PB93-113629 PC A04/MF A01
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Simulation of the Merged Spectrum Technique for Aligning Planar Phased-Array Antennas. Part 1.
R. C. Wittmann, A. C. Newell, C. F. Stubenrauch, K. MacReynolds, and M. H. Francis. Oct 92, 51p
NISTIR-3981

Keywords: *Antenna arrays, Phased arrays, Computerized simulation, Near field, Alignment, Graphs(Charts), Antenna measurements, Merged spectrum technique.

The report describes the initial phase of a NIST study of the merged-spectrum technique for determining the element excitations from planar scanning near-field 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 ultimately directed to quantify the effect of these errors, to more fully understand the merged-spectrum technique, and to recommend possible improvements. The present report covers theory developed to support evaluation of the merged-spectrum technique and gives simulation examples illustrating calculation of near fields from array factor and element patterns.

Circuits

200,555
PB92-144575 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Isolated Ramping Current Sources for a Cryogenic Current Comparator Bridge.
Final rept.
R. E. Elmquist, and R. F. Dziuba. 1991, 4p
Pub. in Review of Scientific Instruments 62, n10 p2457-2460 Oct 91.

Keywords: *Comparator circuits, *Resistance bridges, *SQUID devices, Cryogenic equipment, Direct current, Feedback control, Resistors, Standards, Comparison, Reprints, *Current sources.

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 programmed 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.

200,556
PB92-144823 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Multiline Method of Network Analyzer Calibration.
Final rept.
R. B. Marks. 1991, 11p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques 39, n7 p1205-1215 Jul 91.

Keywords: *Network analyzers, *Calibration, Redundant components, Error analysis, Standards, Accuracy, 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 minimize 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 here, is useful in the assessment of calibration accuracy. It also yields new results relevant to the choice of standards.

200,557
PB92-145028 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
High-Frequency, High-Speed Phase-Angle Measurements and Standards.
Final rept.
N. M. Oldham, and P. S. Hetrick. 1991, 6p
Pub. in Proceedings of National Conference of Standards Laboratories Workshop and Symposium, Albuquerque, NM., August 18-22, 1991, p251-256.

Keywords: *Phase meters, *Phase angle, Time interval analyzers, Phase measurement, High frequency, Calibration, Time interval counters, Reprints, Heterodyne interferometry, Phase standards.

Counter-timers capable of measuring the delay between two signals at frequencies up to 20 MHz have been evaluated as phase angle meters with applications in heterodyne interferometry. A scheme for calibrating these instruments both statically and dynamically (with the phase angle changing as fast as 10 deg./microsec is described.

200,558
PB92-159904 Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Automated Finite-Element Mesh Generation for Surface Mount Technology Solder Joints.
Final rept.
D. T. Read, and G. K. Lucey. 1991, 8p
Sponsored by Harry Diamond Labs., Adelphi, MD.
Pub. in Jnl. of Electronic Packaging 113, p178-185 Jun 91.

Keywords: *Computational grids, *Soldered joints, *Electronic circuits, *Finite element method, Reliability, Inspection, 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) solder joints, by relating them to field performance and reliability. The fitness-for-purpose approach can be applied to SMT solder joints by relating specific characteristics or flaw indications in individual solder joints to their likelihood of failure, through finite element analysis. An effort is underway to automate the finite element modeling of actual solder joints by generating meshes from optical and X-ray inspection data in the form of thousands of surface points. Computer programs have been written to convert these surface points to finite element meshes. Two trial data sets have been meshed, one from an X-ray laminography system and one from a machine vision system.

200,559
PB92-165075 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Coherent Emission from Two-Dimensional Josephson Junction Arrays.
Final rept.
S. P. Benz, and C. J. Burroughs. 1991, 3p
Pub. in Applied Physics Letters 58, n19 p2162-2164, 13 May 91.

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 detector junction 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 0.4 microW, based on simulations of the detector circuit. Possible mechanisms for coherent emission from two-dimensional arrays are discussed.

200,560
PB92-165414 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Time and Frequency Div.
Superimposing Low-Phase-Noise, Low-Drift Instrumentation Techniques on RF Design.
Final rept.
C. M. Felton. 1990, 8p
Pub. in Proceedings of Annual Frequency Control Symposium (44th), Baltimore, MD., May 23-25, 1990, p622-629.

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 ratio (CMRR) and power supply rejection ratio (PSRR)) from interfering noise and line harmonics. Concerns with operating point stability at the microvolt level lead to awareness of dielectric quality, thermal stability, and bias balance requirements. The focus of the paper is integrating these considerations into basic designs. A radio frequency (RF) isolation amplifier will be used to illustrate the concepts. The author will discuss component selection and circuit details of the completed device and show how these affect both AM and phase noise (PM) performance.

200,561
PB92-165422 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
International Comparison of Low Audio Frequency Power Meter Calibrations Conducted in 1989.
Final rept.
P. S. Filipski, E. So, W. J. M. Moore, R. B. D. Knight, P. Martin, N. M. Oldham, and B. C. Waltrip. 1991, 4p
See also PB91-101204.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement 40, n2 p399-402 Apr 91.

Keywords: *Power meters, *Calibration, Interlaboratory comparisons, Audio frequencies, Electrical measurement, Very low frequency, Ultralow frequency, 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, was used as the transfer standard. The measurements were made at 120 V, 5 A, power factors of 1, 0 lead, and 0 lag and at frequencies up to 5 kHz. Agreement between 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 50-4800 Hz range.

200,562
PB92-165554 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Margins and Yield in Single Flux Quantum Logic.
Final rept.
C. A. Hamilton, and K. C. Gilbert. 1991, 7p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Applied Superconductivity 1, n4 p157-163 Dec 91.

Keywords: *Gates(Circuits), *Logic circuits, Superconducting devices, Medium scale integration, Large scale integration, Monte Carlo method, Josephson junctions, Logic design, Adding circuits, Reprints.

Simulations are used to optimize the design of simple rapid single flux quantum (RSFQ) 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 single gate simulations, the results show that 1-sigma parameter spreads of less than about + or - 5% will be required to make medium or large scale integrated RSFQ logic circuits. Finally, a single-bit full adder using five RSFQ gates and a local self-timing network is simulated with discrete components. The full adder used 2000 A/sq cm junctions with a specific capacitance of 0.04 pF/sq micrometer and had a logic delay of 87 ps and a worst-case margin of + or - 19%. A small margin reduction results from loading which is not present in the individual gate simulations.

200,563
PB92-165901 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Performance Criteria for Power-System Compatibility.
Final rept.
F. Martzloff. 1992, 6p
Pub. in Proceedings of Annual Applied Power Electronics Conference and Exposition (7th), Boston, MA., February 23-27, 1991, p287-292.

Keywords: *Electromagnetic compatibility, Reliability(Electronics), Power supplies, Electric power, Performance, Reprints.

Power electronics create an opportunity for better use of electric energy, but can become a source of problems if the electromagnetic characteristics (immunity and emissions limits) of the equipment are not compatible with the characteristics (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 (EEEL), Boulder, CO. Electromagnetic Fields Div.
Application of Radiometry to the Accurate Measurement of Amplifier Noise.
Final rept.
D. F. Wait, and G. F. Engen. 1991, 5p
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 matrix, 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 context. The application of the (highly developed) NIST radiometers to the measurement problem is then outlined, and a preliminary assessment of the probable accuracy is given.

200,565
PB92-169119 PC A03/MF A01
National Inst. of Standards and Technology (NEL), 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. Dognanksoy. 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, Confidence 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 specimen 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
PB92-171164 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
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement 39, n6 p952-957 1990.

Keywords: *Oscilloscopes, *Calibration, Transfer functions, Standards, Pulses, Reprints, *Waveform recorders, Deconvolution.

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 properly and completely at present. The second is that, in most cases, the tools are now available to perform these complete and proper 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
PB92-171719 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Linear Error Modeling of Analog and Mixed-Signal Devices.
Final rept.
G. N. Stenbakken, and T. M. Souders. 1991, 9p
See also PB91-149310.
Pub. in Proceedings of International Test Conference, Nashville, TN., October 26-30, 1991, p573-581.

Keywords: *Analog to digital converters, *Analog circuits, Mathematical 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 assuring 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
PB92-175066 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Two-Dimensional Arrays of Josephson Junctions as Voltage-Tunable Oscillators.
Final rept.
S. P. Benz, and C. J. Burroughs. 1991, 7p
Pub. in Supercond. Sci. Technol. 4, p561-567 1991.

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 (2D) arrays of superconductor-insulator-superconductor (sis) Josephson junctions. 2D arrays emit coherent radiation over a frequency range of 60 to 210 GHz, when coupled to detector junctions through DC-blocking capacitors. The detector junctions exhibit Shapiro steps at frequencies corresponding to the voltage across single-array junctions. The maximum power from a 10-by-10 junction array coupled to a detector junction occurs at 150 GHz and is estimated to be 0.4 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 (EEEL), Gaithersburg, MD. Electricity Div.
Standard for the 90s: IEEE C62.41 Surges Ahead.
Final rept.
F. D. Martzloff. 1991, 6p
Pub. in Compliance Engineering VIII, n5 p27-32 1991.

Keywords: *Overvoltage, *Surges, *Standards, Electromagnetic compatibility, Circuit protection, Low voltage, Alternating current, Transients, Revisions, Reprints.

After 10 years of use as a Guide, a revision has been completed and published as an IEEE Recommended Practice: Surge Voltages in Low-Voltage AC Power Circuits. The article is to be published in a trade magazine circulated to writers, users, and enforcers of standards on electromagnetic compatibility, in order to give them a preview of the forthcoming IEEE document.

200,570
PB92-198126 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Resonant Circuit Model Evaluation Using Reflected S-Parameter Data.
Final rept.
E. J. Vanzura, and J. E. Rogers. 1991, 6p
Pub. in Proceedings of IEEE (Institute for Electrical and Electronics Engineers) Instrumentation and Measurement Technology Conference Enhancing Productivity with Instrumentation and Measurement Technologies, Atlanta, GA., May 14-16, 1991, p150-155.

Keywords: *Circuit analysis, Microwave circuits, Least squares method, Regression analysis, Nonlinear problems, Dielectrics, Metrology, Reprints, Circuit models, Parameter estimation.

Nonlinear regression is used to fit S-parameter resonance data to a full-circuit model that includes coupling factors and self impedances. This model fits the data better than the simpler Q- 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 (EEEL), 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.
Pub. in CPEM '92 Proceedings of Conference on Precision Electromagnetic Measurements, Paris, France, June 9-12, 1992, p56-57.

Keywords: Electrical measurement, Thin films, Prototypes, Design, Reprints, *Thermal converters, Multilayers.

Multilayer, thin-film multijunction thermal converters (MJTCs) 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 (EEEL), Gaithersburg, MD. Electricity Div.
Intercomparison of NIST, NPL, PTB, and VSL Thermal Voltage Converters from 100 kHz to 1 MHz.
Final rept.
J. R. Kinard, R. B. D. Knight, P. Martin, M. Klonz, J. P. M. de Vreede, and J. Dessens. 1992, 2p
See also PB93-129336.
Pub. in CPEM '92 Proceedings of Conference on Precision Electromagnetic Measurements, Paris, France, June 9-12, 1992, p318-319.

Keywords: Electrical measurement, Interlaboratory comparisons, kHz range 100-1000, International, Voltage, Reprints, *Thermal converters, Transfer standards, Intercomparison.

Coaxial, thermal voltage converters (TVC'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 (EEEL), Gaithersburg, MD. Electricity Div.
Intercomparison of Thermal Converters at NIM, NIST, PTB, SIRI, and VSL from 1 to 100 MHz.
Final rept.
J. R. Kinard, G. Rebuldela, Z. Zhen, D. Janik, D. X. Huang, and J. de Vreede. 1992, 2p
See also PB93-129328.
Pub. in CPEM '92 Proceedings of Conference on Precision Electromagnetic Measurements, Paris, France, June 9-12, 1992, p320-321.

Keywords: Electrical measurement, Interlaboratory comparisons, MHz range 01-100, International, Voltage, Reprints, *Thermal converters, Transfer standards, Intercomparison.

Coaxial, thermal voltage converters (TVC's) have been intercompared between NIM, NIST, PTB, SIRI, and VSL in the frequency range from 1 to 100 MHz. The intercomparisons were made from 1988 through 1990. This paper briefly describes the methods and underlying principles on which RF-dc difference 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 (EEEL), Gaithersburg, MD. Electricity Div.
Detection of Leakage Errors in Cryogenic Current Comparator Bridges.
Final rept.
R. E. Elmquist. 1992, 2p
Pub. in CPEM '92 Proceedings of Conference on Precision Electromagnetic Measurements, Paris, France, June 9-12, 1992, p276-277.

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 100:6453.2 ohms. The major advantage of the tests is that they can be performed in situ using the full densitivity 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 (EEEL), Gaithersburg, MD. Electricity Div.
Automatic Impedance Bridge for Calibrating Standard Inductors.
Final rept.
N. M. Oldham, O. Petersons, and B. C. Waltrip. 1992, 2p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements (CPEM'92), Paris, France, June 9-12, 1992, p419-420.

Keywords: *Impedance bridges, *Inductors, *Calibration, *Standards, Electrical measurement, Electrical impedance, Electric coils, Automatic, Reprints, *Inductance standards.

An impedance bridge that compares standard inductors to characterized resistors 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 (EEEL), Gaithersburg, MD. Electricity Div.
Characterized Generator Extends Phase Meter Calibrations from 50 kHz to 20 MHz.
Final rept.
N. M. Oldham, and P. S. Hetric. 1992, 2p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements (CPEM'92), Paris, France, June 9-12, 1992, p352-353 1991.

Keywords: *Phase meters, Function generators, Time intervals, Sine waves, Calibration, Reprints, *Phase angle generators, Phase standards.

A phase angle standard generator made by phase locking two function generators is described. The generator produces two sine waves that are programmable in phase (0-360 deg), amplitude (0-40 V rms), and frequency (< 1Hz - 20 MHz). The phase linearity is characterized from + or - 50 to + or - 250 mdeg over the frequency range without external phase standards.

200,577
PB93-135572 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Automatic Inductive Voltage Divider Bridge for Operation from 10 Hz to 100 kHz.
Final rept.
S. Avramov, N. M. Oldham, D. G. Jarrett, and B. C. Waltrip. 1992, 2p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements (CPEM'92), Paris, France, June 9-12, 1992, p67-68.

Keywords: *Impedance bridges, *Voltage dividers, Alternating current, Inductance, Calibration, Automatic, Reprints.

An automatic bridge to calibrate inductive voltage dividers from 10 Hz to 100 kHz is described. The bridge is based on a programmable 30-bit binary inductive voltage divider with terminal linearity of 0.1 ppm at 400 Hz (linearity degrades to 10 ppm at frequency extremes). Measurements of programmable test dividers can be completely automated via General Purpose Interface Bus (GPIB) using software developed to align the bridge components and perform an auto balance.

Optoelectronic Devices & Systems

200,578
PB92-144518 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Materials Div.
Fast, Sensitive Magnetic-Field Sensors Based on the Faraday Effect in YIG.
Final rept.
M. N. Deeter, A. H. Rose, and G. W. Day. 1990, 5p
See also PB91-147223.
Pub. in Jnl. of Lightwave Technology 8, n12 p1838-1842 Dec 90.

Keywords: *Yttrium iron garnets, *Magnetometers, Magnetic measurement, Faraday effect, Magnetic domains, Demagnetization, Ferrimagnetism, Magnetooptics, Frequency response, Reprints, *Magnetic field sensors.

The authors characterize magnetic-field sensors based on the Faraday effect in ferrimagnetic iron garnets in terms of their sensitivity, speed, and directionality. Signal-to-noise measurements at 80 Hz on small (typically 5 mm diameter x 3 mm long) samples of yttrium iron garnet (YIG) yield noise equivalent magnetic fields of 10 nT/Hz (to the 1/2 power). Frequency response measurements exhibit virtually flat response to approximately 700 MHz.

200,579
PB92-144625 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Numerical Modeling of Short-Wavelength Internal Quantum Efficiency.
Final rept.
J. Geist, D. Chandler-Horowitz, R. Kohler, A. M. Robinson, and C. R. James. 1991, 4p
Pub. in Metrologia 28, p193-196 1991.

Keywords: *Photodiodes, Mathematical models, Numerical solution, Quantum efficiency, Silicon diodes, Simulation, Reprints.

Results of numerical modeling of short-wavelength, internal quantum efficiency of two types of p(+)nn(+) silicon photodiode are presented. The important conclusions are: (1) interpreting the data obtained from oxide-bias experiments with the help of numerical quantum efficiency models will provide higher accuracy than can be obtained from the conventional self-calibration formula; (2) for high-quality silicon photodiodes, the spectral shape of the internal quantum deficiency (one minus the quantum efficiency) is virtually independent of the density of charge trapped in the oxide, and of the surface-recombination velocity at the oxide-silicon interface.

200,580
PB92-144674 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Two-Dimensional Analysis of Microbolometer Arrays.
Final rept.
E. N. Grossman, D. G. McDonald, and J. E. Sauvageau. 1990, 6p
Pub. in Jnl. of Applied Physics 68, n11 p5409-5414, 1 Dec 90.

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 substrate. It applies both to 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 (diffractive) 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 closely packed, diffraction-limited array is limited to a thermal resistance of Z(t) = or < 0.08/(kappa)L(min), where kappa is the thermal conductivity of the substrate. An array of antenna-coupled bolometers is not subject to this 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 (EEEL), Boulder, CO. Electromagnetic Technology Div.
Annealing of Linear Birefringence in Single-Mode Fiber Coils: Application to Optical Fiber Current Sensors.
Final rept.
D. Tang, A. H. Rose, G. W. Day, and S. M. Etzel. 1991, 7p
See also PB84-223858 and PB87-104931.
Pub. in Jnl. of Lightwave Technology 9, n8 p1031-1037 Aug 91.

Keywords: *Optical fibers, *Birefringence, *Annealing, *Ammeters, Electric current, Coils, Reprints, *Fiber optic sensors.

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 cm in diameter and up to 200 or more turns. They involve temperature cycles that last 3-4 days and reach maximum temperatures of about 850 C. The residual birefringence and induced loss are minimized by proper selection of fiber. The primary application of these coils is optical fiber current sensors, where they yield small sensors that are more stable than those achieved by other techniques. A current sensor with a temperature stability of +8.4 x 10 to the -5 power/K over the range from -75 to +145 C has been demonstrated. This is approximately 20% greater than the temperature dependence of the Verdet constant. Packaging degrades the stability, but a packaged sensor coil with a temperature stability of about +1.6 x 10 to the -4 power/K over the range from -20 to +120 C has also been demonstrated.

200,582
PB92-145309 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.

ELECTROTECHNOLOGY

Optoelectronic Devices & Systems

Compensation for Temperature Dependence of Faraday Effect in Diamagnetic Materials: Application to Optical Fibre Sensors.
Final rept.
P. A. Williams, G. W. Day, and A. H. Rose. 1991, 2p
Pub. in Electronic Letters 27, n13 p1131-1132, 20 Jun 91.

Keywords: *Faraday effect, Temperature dependence, Temperature compensation, Polarized light, Electric current, Magnetic fields, Birefringence, Diamagnetism, Optical fibers, Reprints, *Fiber optic sensors, Verdet constants, Waveplates.

The temperature dependence of the Faraday effect in a diamagnetic material can be compensated for by varying the polarization state of the light entering the material as a function of temperature. The authors demonstrate that this can be done automatically by exploiting the temperature dependence of a linear retarder (waveplate).

200,583
PB92-148279 PC **A05**/MF **A01**
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Numerical Modeling of Silicon Photodiodes for High-Accuracy Applications with PC-1D.
J. Geist, D. Chandler-Horowitz, A. M. Robinson, C. R. James, and R. Kohler. Jan 92, 93p NISTIR-4592
See also PB92-110295, PB92-110303 and PB92-110311. Prepared in cooperation with Alberta Univ., Edmonton, and Bureau International des Poids et Mesures, Sevres (France).

Keywords: *Silicon diodes, *Photodiodes, *Mathematical models, *Computerized simulation, Quantum efficiency, Computer programs, Near infrared radiation, Visible radiation, Interpolation, Extrapolation, Pascal, PC-1D computer program.

The purpose of the National Institute of Standards and Technology Interagency/Internal Report (NISTIR) is to provide the source code for two Turbo Pascal 5.5 programs and an MSDOS batch program, along with a paper that describes the programs and provides examples of their use. These three programs serve as a batch mode interface to support high-accuracy photodiode modeling with Version 2 of the semiconductor device modeling program PC-1D. These programs are useful because the interactive user interface of PC-1D is optimized for solar cell modeling, and it is somewhat difficult to access the highest accuracy available from PC-1D through the interface. Part I describes PC-1D from the point of view of high-accuracy photodiode modeling and describes the programs that support its use in the application. Parts II and III present examples of the use of the programs described in Part I to model two different types of experiments performed on silicon photodiodes in various high-accuracy applications.

200,584
PB92-154509 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Commercial CMOS Fabricated Integrated Dynamic Thermal Scene Simulator.
Final rept.
M. Parameswaran, R. Chung, M. Gaitan, R. B. Johnson, and M. Syrzycki. 1991, 4p
Pub. in Proceedings of International Electron Devices Meeting, Washington, DC., December 8-11, 1991, p29.4.1-29.4.4.

Keywords: *Thermal imagery, *Integrated circuits, Chips(Electronics), Thermal targets, Simulation, Arrays, Pixels, CMOS, Reprints, Micromachining.

The authors report a prototype integrated dynamic thermal scene simulator chip, consisting of a 2x2 array of integrated thermal pixels. The chips were fabricated using commercial CMOS processes available through vendor services. The micromachining process, needed to create the thermally isolated structures, is introduced as a maskless post-processing step. The thermal pixel and the control electronics are designed as a module for an easy implementation of the array. Test results indicate that the pixels have a thermal time constant of 5mS and capable of producing an infrared output of apparent radiometric temperatures in excess of 600 C and color temperatures of at least 500 C. The control electronics is capable of switching within 900 nanoseconds, enabling the addressing of multiple pixels within the 200 Hz frame time required for a typical dynamic thermal scene simulation.

200,585
PB92-159433 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Radiometric Physics Div.
Linear HgCdTe Radiometer.
Final rept.
G. Eppeldauer, and L. Novak. 1989, 7p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Imaging Infrared: Scene Simulation, Modeling, and Real Image Tracking, Orlando, FL., March 30-31, 1989, v1110 p267-273.

Keywords: *Infrared detectors, *Mercury cadmium tellurides, *Radiometers, Photoconductors, Operation, Reprints.

The basic modes of electrical operation of photoconductive optical radiation detectors are analyzed. The nonlinearity inherent in 'voltage mode' measurements can be eliminated by using 'current mode' measurements. A HgCdTe photoconductive 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 decrease in the bias voltage, thereby achieving a higher precision.

200,586
PB92-159813 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Electronic Limitations in Phase Meters for Heterodyne Interferometry.
Final rept.
N. Oldham, P. Hetrick, J. Kramar, W. Penzes, T. Wheatley, and C. Teague. 1991, 3p
Pub. in Proceedings of Annual Conference of the American Society for Precision Engineering (6th), Santa Fe, NM., October 13-18, 1991, p47-49.

Keywords: *Phase meters, Phase angle, Time intervals, Photodetectors, Limitations, Reprints, *Heterodyne interferometry.

Reasonable attention has been given to the fidelity of the process by which heterodyne interferometers convert optical path difference between beams that have traversed a test leg and a reference leg, respectively, to a phase difference between electrical signals from the test and reference photodetectors. This paper reports on a study of the next step: to obtain a quantitative result from these signals by measuring the electrical phase difference between the two photodetector signals.

200,587
PB92-165091 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Low Coherence Optical Reflectometry of Laser Diode Waveguides.
Final rept.
C. Y. Boisrobert, D. L. Franzen, B. L. Danielson, and D. H. Christensen. 1991, 6p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Semiconductor Laser Conference (12th), Orlando, FL., April 1-5, 1991, 6p.

Keywords: *Semiconductor lasers, *Optical waveguides, Reflectometers, Reprints.

Laser diode waveguides are probed using low coherence optical reflectometry. Reflections from the launch optics, front facet, and rear facet are located with a resolution of approximately 10 micrometers. Diodes mounted in pigtailed packages and on chip carriers have been studied.

200,588
PB92-171388 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Localized Plasma Etching for Device Optimization.
Final rept.
D. R. Larson, and D. L. Veasey. 1992, 3p
Pub. in Jnl. of Vacuum Science and Technology B 10, n1 p27-29 Jan/Feb 92.

Keywords: *Plasma etching, Semiconducting films, Integrated optics, Optimization, Substrates, Reprints, In situ monitoring.

The authors have developed an unconventional approach to downstream plasma etching: only a small area of the substrate is exposed to the low pressure, reactive gaseous environment. The remainder of the substrate is outside the miniature plasma chamber, providing physical access for probing apparatus. Etch rates of 6 micrometers/h were obtained. The process can be especially useful when in situ monitoring of the effects of etching is required. Using the process, the authors improved the responsivity of a semiconductor optical detector deposited on top of an optical waveguide. This was accomplished by monitoring the transmitted intensity of light in an integrated optical waveguide while etching a thin semiconductor film covering a small region of the waveguide.

200,589
PB92-171685 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Y-Branch Waveguide Glass Laser and Amplifier.
Final rept.
N. A. Sanford, K. J. Malone, D. R. Larson, and R. K. Hickernell. 1991, 3p
See also PB91-203976.
Pub. in Optics Letters 16, n15 p1168-1170, 1 Aug 91.

Keywords: *Integrated optics, *Waveguide lasers, Near infrared radiation, Infrared lasers, Glass lasers, Doped materials, Neodymium, Silicates, Reprints.

A Y-branch channel waveguide laser operating near 1057 nm was fabricated by electric-field-assisted ion exchange in Nd-doped silicate glass. The overall length was 24 mm. Optical pumping was performed with a cw Ti:sapphire laser. Mirrors were bonded to the polished waveguide facets. The slope efficiency was 5.1% when a 4%-transmitting output coupler was used. Threshold was reached at 26-mW absorbed pump power. The device exhibited a single-pass small-signal gain of 0.034 dB/mW when operated as an amplifier. The 3-dB splitting loss of the Y-branch structure was overcome when the absorbed pump power was approximately 85 mW.

200,590
PB92-175181 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Faraday-Effect Magnetic Field Sensors Based on Substituted Iron Garnets.
Final rept.
M. N. Deeter, A. H. Rose, and G. W. Day. 1990, 6p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Fiber Optic and Laser Sensors VIII, San Jose, CA., September 16-21, 1990, v1367 p243-248.

Keywords: Ferrimagnetic materials, Yttrium iron garnets, Gallium additions, Faraday effect, Magnetooptics, Reprints, *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 magnetometry requiring high sensitivity, high spatial resolution, or high speed. Diamagnetic 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 gallium-substituted yttrium iron garnet is six times greater than of pure yttrium iron garnet. The noise-equivalent magnetic field for a sample of the material has been measured as approximately 100 pT/Hz(sup 1/2).

200,591
PB92-175439 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Issues Affecting the Characterization of Integrated Optical Devices Subjected to Ionizing Radiation.
Final rept.
R. K. Hickernell, N. A. Sanford, and D. H. Christensen. 1991, 10p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Optical Technology for Signal Processing Systems, Orlando, FL., April 1-3, 1991, v1474 p138-147.

Keywords: *Integrated optics, *Radiation effects, Optical measurement, Ionizing radiation, Refractive index, Polarization, Attenuation, Test methods, Reprints, Photorefractive effect.

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 waveguide parameters include attenuation, 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.

200,592
PB92-175702 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Optical Fiber Voltage Sensors for Broad Temperature Ranges.
Final rept.
A. H. Rose, and G. W. Day. 1992, 9p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Fiber Optic Components and Reliability, Boston, MA., September 3-6, 1991, v1580 p95-103 1992.

Keywords: *Voltage measuring instruments, *Bismuth germanate detectors, *Temperature sensors, Spacecraft instruments, Aircraft instruments, Alternation current, Thermal stability, Birefringence, Silicon dioxide, Reprints, *Optical fiber sensors.

In the paper the authors describe the development of an optical fiber AC voltage sensor for aircraft and spacecraft applications. Among the most difficult specifications to meet for the application is a temperature stability of + or - 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.

200,593
PB92-175710 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Submicroampere Per Root Hz, High Bandwidth Current Sensor Based on the Faraday Effect in Ga:YIG.
Final rept.
A. H. Rose, M. N. Deeter, and G. W. Day. 1992, 4p
Pub. in Proceedings of Optical Fiber Sensors Conference (8th), Monterey, CA., January 29-31, 1992, p394-397.

Keywords: *Electric current meters, Yttrium iron garnets, 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 3.0 deg/A, a noise-equivalent current of about 500 nA/Hz(sup 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
PB92-175900 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Waveguide Polarizers with Hydrogenated Amorphous Silicon Claddings.
Final rept.
D. L. Veasey, R. K. Hickernell, D. R. Larson, and T. E. Batchman. 1991, 3p
Pub. in Optics Letters 16, n10 p717-719, 15 May 91.

Keywords: *Integrated optics, *Polarizers, Optical waveguides, Amorphous silicon, Polarization(Waves), Reprints, *Waveguide polarizers, Photothermal displacement, Claddings.

The authors have fabricated TE- and TM-pass waveguide polarizers with polarization isolations of 42 and 35 dB, respectively. The devices were fabricated by the growth of hydrogenated amorphous silicon claddings on K(1+)-Na(1+) ion-exchanged channel waveguides in glass. Cladding thicknesses were accurately tuned to permit optimum coupling of either a TE or a TM mode 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 deflection technique.

200,595
PB92-175918 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
In-situ Optimization of Coupling between Semiconductor Claddings and Dielectric Waveguides.
Final rept.
D. L. Veasey, D. R. Larson, and T. E. Batchman. 1990, 3p
Pub. in Jnl. of Applied Physics 68, n7 p3753-3755, 1 Oct 90.

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 dielectric waveguides and the high-loss modes supported by semiconductor waveguide claddings are of prime importance in the design and fabrication of integrated optical photodetectors and polarizers. It is desirable to maximize energy transfer from dielectric waveguides to semiconductor claddings in order to achieve optimal operation of detectors and polarizers. The authors have experimentally verified that the intermodal coupling of light from a low-loss dielectric guiding region 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 hydrogenated amorphous silicon on polarization-preserving, D-shaped, optical fiber. Strong correlation exists between theoretical and experimental results for both TE and TM polarizations. The in situ, intensity monitoring technique allows for precise control of attenuation characteristics in clad-waveguide devices allowing for optimum performance of clad-waveguide polarizers and detectors.

200,596
PB92-197565 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Optical Waveguide Analysis Using Modified Airy Functions.
Final rept.
R. L. Gallawa, I. C. Goyal, and A. K. Ghatak. 1991, 10p
Pub. in Fiber and Integrated Optics 10, p1-10 1991.

Keywords: *Integrated optics, *Optical waveguides, Schrodinger equation, WKB approximation, Airy function, Wave equations, Reprints.

The authors review a little-used but powerful method of solving the scalar wave equation. It uses a modification of the well-known Airy functions, which are easily calculated on desktop computers. The techniques are reminiscent of the WKBJ methodology, but the solution, although approximate, is much more useful than the traditional WKBJ solution and can be used with almost as much ease. The method is extremely powerful but, to the authors' knowledge, is not used in the optics community. It is useful in analyzing integrated optical waveguide components.

200,597
PB92-197615 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Lithographic Spiral Antennas at Short Wavelengths.
Final rept.
E. N. Grossman, J. E. Sauvageau, and D. G. McDonald. 1991, 3p
Pub. in Applied Physics Letters 59, n25 p3225-3227, 16 Dec 91.

Keywords: *Spiral antennas, *Infrared detectors, *Bolometers, Intermediate infrared radiation, Efficiency, Reprints, Microbolometers, Microantennas.

The authors have extended the high efficiency of lithographic antennas to mid-infrared wavelengths. Pattern measurements made at 9.5 micrometer wavelength on a 65 deg, self-complementary, spiral antenna exhibit a ratio of response to orthogonal linear polarizations of 1.35 dB, a beamwidth of 85 deg (3 dB full width), a directivity of 8.2 dB, and surprisingly, a close resemblance to the theoretical pattern for a 65 deg spiral in free space. Direct detection measurements made with an ambient temperature blackbody source yield an antenna efficiency of 52 + or - 7%, when corrected for incomplete filling of the antenna beam by the source, at a mean effective wavelength of 19 micrometers.

200,598
PB92-197946 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Spatial Uniformity of Optical Detector Responsivity.
Final rept.
D. Livigni, and X. Li. 1992, 11p
Pub. in Proceedings of Measurement Science Conference, Anaheim, CA., January 30-31, 1992, 11p.

Keywords: *Optical detectors, Optical measurement, Sensitivity, Variability, Reprints, Uniformity.

The responsivity of optical detectors to light can vary when the light illuminates different areas of the detector. A scanning system for measuring the uniformity of the responsivity of optical detectors, and methods of quantifying the degree of uniformity are described here. Surface plots and topographical maps of the measured responsivity are presented, along with a statistical treatment. Sampling theorem restrictions affecting the accuracy of the results are described. Scans of actual detectors are included to show the range of uniformity possible.

200,599
PB92-217645
(Order as PB92-217637, PC **A05**/MF **A01**)
National Inst. of Standards and Technology, Gaithersburg, MD.
Radiometer for Precision Coherent Radiation Measurements.
D. B. Thomas, and E. F. Zalewski. 1992, 8p
Included in Jnl. of Research of the National Institute of Standards and Technology, v97 n3 p327-334 May/Jun 92.

Keywords: *Radiometers, *Photodiodes, Coherent electromagnetic radiation, Lasers, Standards.

A radiometer has been designed for precision coherent radiation measurements and tested for long-term repeatability at wavelengths of 488 and 633 nm. The radiometer consists of a pn silicon photodiode maintained in a nitrogen atmosphere with a quartz window designed to eliminate interference problems. At 0.5 mW, the standard deviations were 0.008% and 0.009% at 488 and 633 nm, respectively. The maximum deviations from the mean were 0.016% and 0.015% at the respective wavelengths.

200,600
PB93-129211 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Fiber-Optic Current Sensor for Aerospace Applications.
Final rept.
R. L. Patterson, A. H. Rose, D. Tang, and G. W. Day. 1990, 5p
Sponsored by National Aeronautics and Space Administration, Cleveland, OH. Lewis Research Center.
Pub. in Proceedings of Conference on Intersociety Energy Conversion Engineering (25th), NASA Technical Memorandum 103152, 7p 1990.

Keywords: *Electric current, Optical measurement, Aerospace systems, Alternating current, Faraday effect, Optical fibers, Polarimetry, Broadband, Avionics, Reprints, *Fiber optic sensors.

A robust, accurate, broad-band, alternating current sensor using fiber optics is being developed for space applications at power frequencies as high as 20 kHz. It can also be used in low and high voltage 60 Hz terrestrial power systems and in 400 Hz aircraft systems. It is intrinsically EMI immune and has the added benefit of excellent isolation. The sensor uses the Faraday effect in optical fiber and standard polarimetric measurements to sense electrical current. The primary component of the sensor is a specially treated coil of single-mode optical fiber, through which the current carrying conductor passes. Improved precision is accomplished by temperature compensation by means of sig-

Optoelectronic Devices & Systems

nals from a novel fiber-optic temperature sensor embedded in the sensing head. This paper reports on the technology contained 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 EMI tests.

Power & Signal Transmission Devices

200,601
PB92-145291 Not available NTIS
National Inst.' of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Transmission Line Capacitance Measurement.
Final rept.
D. F. Williams, and R. B. Marks. 1991, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Microwave and Guided Wave Letters 1, n9 p243-245 Sep 91.

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 impedance is discussed.

200,602
PB92-171800 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Interpretation and Use of S-Parameters in Lossy Lines.
Final rept.
D. F. Williams, and R. Marks. 1991, 6p
Pub. in Proceedings of ARFTG Conference Digest (36th), Monterey, CA., November 29-30, 1990, p84-89 Feb 91.

Keywords: *Characteristic impedance, Microwave circuits, Integrated circuits, Transmission lines, Coaxial cables, Electrical resistivity, 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.

200,603
PB92-175033 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Improvements in Transmission Line Permittivity and Permeability Measurements.
Final rept.
J. Baker-Jarvis, R. Geyer, and P. Domich. 1990, 2p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Ottawa, Canada, June 11-14, 1990, p232-233.

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.

200,604
PB92-175157 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Exact Principal Mode Field for a Lossy Coaxial Line.
Final rept.
W. C. Daywitt. 1991, 10p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques 39, n8 p1313-1322 Aug 91.

Keywords: *Transmission lines, Coaxial cables, Maxwells equations, Microwaves, Propagation, Reprints, Telegrapher equation.

Exact field equations for a lossy coaxial transmission line with an infinite outer conductor are presented. The corresponding determinantal equation 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.

200,605
PB92-175165 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
First-Order Principal Mode Fields and Distributed Line Parameters for a Slightly Lossy Coaxial Transmission Line.
Final rept.
W. C. Daywitt. 1990, 2p
See also PB92-175173.
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Ottawa, Canada, June 11-14, 1990, p404-405.

Keywords: *Transmission lines, Coaxial cables, Maxwells equations, Characteristic impedance, Admittance, Reprints, Distributed systems.

Principal mode field equations that satisfy Maxwell's equations to first order in the normalized surface impedance 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 calculations found in the literature.

200,606
PB92-175173 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
First-Order Symmetric Modes for a Slightly Lossy Coaxial Transmission Line.
Final rept.
W. C. Daywitt. 1990, 7p
See also PB92-175165.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques 38, n11 p1644-1650 Nov 90.

Keywords: *Transmission lines, Coaxial cables, Maxwells equations, Characteristic impedence, Admittance, Reprints, Distributed systems.

A complete set of solutions for Maxwell's equations to first order in the normalized surface impedance zeta3 of the coaxial conductors is found. The resulting characteristic admittance and distributed line parameters are calculated; the distributed line resistance is significantly different from other calculations found in the literature.

200,607
PB92-175249 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Effect of Cable and Strand Twist-Pitch Coincidence on the Critical Current of Flat, Coreless Superconductor Cables.
Final rept.
J. W. Ekin. 1991, 3p
Sponsored by Department of Energy, Washington, DC. Div. of High Energy Physics.
Pub. in Applied Physics Letters 59, n20 p2615-2617, 11 Nov 91.

Keywords: *Superconducting cables, *Critical current, Superconducting super collider, Twisting, Reprints, Cable pitch, Niobium titanium.

Data are presented which indicate that a very simple technique for enhancing the critical current in flat, coreless superconductor cables is to match the cable twist pitch with the strand twist pitch in such a way that the same group of filaments within each strand is degraded at each successive bend at the cable edges. The coincidence condition minimizes current transfer among filaments, enhances the slope of the voltage-current characteristic, consistently improves the critical current by about 10% in these tests, and is easy to apply.

200,608
PB92-175884 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Recent Advances in Partial Discharge Measurement Capabilities at NIST.
Final rept.
R. J. Van Brunt, K. L. Stricklett, J. P. Steiner, and S. V. Kulkarni. 1992, 16p
Sponsored by Department of Energy, Washington, DC., and Nuclear Regulatory Commission, Washington, DC.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electrical Insulation 27, n1 p114-129 Feb 92.

Keywords: *Electric cables, *Electric discharges, Dielectric materials, Stochastic processes, Hexanes, Liquids, Electrical measurement, Real time operations, Reprints, *Partial discharges, Time domain reflectometry, Trichel pulses, US NIST.

The report describes three techniques under development at the National Institute of Standards and Technology (NIST) to measure the properties of partial discharges (PD). These measurements are useful in providing new insight into the mechanisms that influence or control PD behavior and in affording a means of locating PD activity in cables. The first is concerned with an advanced, real-time PD measurement system that allows a 'complete' characterization of the stochastic properties of PD. The second technique allows PD location in cables using time-domain reflectometry with appropriate statistical analysis. With the third technique discussed here, simultaneous measurements are made of the optical and electrical characteristics of PD in liquid dielectrics using fast photography combined with broad-band, low-noise pulse current measurements. The method provides a detailed description of the temporal and spatial development of PD in highly nonuniform field configurations. Examples of results are shown for the case of PD in hexanes when a DC voltage is applied to a point-rod electrode gap.

200,609
PB92-183672 PC **A03**/MF **A01**
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Aperture Coupling to Shielded Transmission Lines: Theory and Experiment.
D. A. Hill, M. L. Crawford, M. Kanda, and D. I. Wu.
Apr 92, 32p NISTIR-3988
See also PB86-244183, PB88-155791 and PB86-227410. Prepared in cooperation with Colorado Univ. at Boulder. Dept. of Electrical and Computer Engineering.

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 air line and a TEM cell is studied theoretically and experimentally. Polarizability theory is used to compute the effective dipole moments that excite the transmission lines in the internal region. Measurements of shielding effectiveness of both structures were made in a reverberation chamber over wide frequency ranges. Agreement between theory and measurements is generally within + or - 10 dB. Recommendations for improvements in the measurements and theory are made for achieving closer agreement that would be desirable for an artifact standard for shielding effectiveness measurements.

200,610
PB92-205376 PC **A06**/MF **A02**
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.

Transmission/Reflection and Short-Circuit Line Methods for Measuring Permittivity and Permeability.
Technical note.
J. Baker-Jarvis, M. D. Janezic, J. H. Grosvenor, and R. G. Geyer. May 92, 121p NIST/TN-1355
Also available from Supt. of Docs. as SN003-003-03164-0. See also PB91-171959.

Keywords: *Transmission lines, *Magnetic permeability, *Permittivity, *Electrical measurement, Algorithms, Dielectric properties, Coaxial cables, Calibrating, Waveguides, Short circuits, Reflection.

The transmission/reflection and short-circuit line methods for measuring complex permittivity and permeability of materials in waveguides and coaxial lines are examined. Equations for complex permittivity and permeability 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 are given for 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 parameter data on materials with higher dielectric constant. An uncertainty analysis for the various techniques is developed and the results are compared. The errors incurred due to the uncertainty in scattering parameters, length measurement, and reference plane position are used as inputs to the uncertainty models.

200,611
PB93-125490 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Dynamic Strength Tests on Electrical Cables Specified for Airport Landing Structures.
Final rept.
S. R. Low, D. E. Harne, and R. J. Fields. 1991, 12p
Contract DTFA-01-85-Z-02007
Sponsored by Federal Aviation Administration, Washington, DC.
Pub. in Proceedings of Meeting of the Mechanical Failures Prevention Group (43rd), Advanced Technology in Failure Prevention, San Diego, CA., p32-43 1991.

Keywords: *Dynamic tests, *Electric wire, *Electric connectors, *Landing aids, Impact 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 determine the energy absorbed and peak force developed in breaking electrical cables specified for airport landing structures. Dynamic strength tests, which simulated 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, during contact with the cable, and following fracture of the cable. Load time traces are recorded digitally for the entire loading and fracture sequences, from which peak load and breaking energy can be computed. The dynamic impact test machine is described in this paper, and dynamic test results are given for the cables and break-away connector.

200,612
PB93-126076 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Frequency-Dependent Transmission Line Parameters.
Final rept.
D. F. Williams, and R. Marks. 1992, 3p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Topical Meeting on Electrical Performance of Electronic Packaging, Tucson, AZ., April 22-24, 1992, p125-127.

Keywords: *Transmission lines, *Characteristic impedance, *Microwaves, *Frequency response, Transmission circuits, Signal stabilization, Microwave frequencies, Waveguides, Frequency measurement, Reprints.

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 due to effects such as field penetration into the conductors. The behavior of the equivalent circuit parameters permits a comprehensive characterization of these lines using microwave measurement techniques.

200,613
PB93-131407
(Order as PB93-131381, PC **A07**)
National Inst. of Standards and Technology, Boulder, CO.
General Waveguide Circuit Theory.
R. B. Marks, and D. F. Williams. 1992, 30p
Included in Jnl. of Research of the National Institute of Standards and Technology, v97 n5 p533-562 Sep/Oct 92.

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 electromagnetic waveguides. Unlike the conventional theory, the present formulation applies to all waveguides composed of linear, isotropic material, even those involving lossy conductors, and hybrid mode fields, in a fully rigorous way. Special attention is given to distinguishing the traveling waves, constructed with respect to a well-defined characteristic impedance, from a set of pseudo-waves, defined with respect to an arbitrary reference impedance. Matrices characterizing a linear circuit are defined, and relationships among them, some newly discovered, are derived. New ramifications of reciprocity are developed. Measurement of various network parameters is given extensive treatment.

Resistive, Capacitive, & Inductive Components

200,614
PB92-171065 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Fracture Behavior of Electronic Ceramics.
Final rept.
S. W. Freiman. 1990, 10p
Pub. in Ferroelectrics 102, p381-390 1990.

Keywords: *Dielectrics, *Fracture properties, *Ceramics, Fractures(Materials), Crack propagation, Ferroelectric materials, Toughness, Barium titanates, Microstructure, Cracking(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 of these electronic ceramics has a direct effect on both their strength and fracture toughness. The paraelectric to ferroelectric phase transformation 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-domain interactions in the ferroelectric structure as well as crack deflection, etc., give rise to increased fracture toughness. Finally, crack growth rates in these materials have been shown to be accelerated by the presence of moisture in the environment, which can significantly increase the probability of failure.

200,615
PB92-171073 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.
Review of Mechanically Related Failures of Ceramic Capacitors and Capacitor Materials.
Final rept.
S. W. Freiman, and R. C. Pohanka. 1989, 6p
Pub. in Jnl. of the American Ceramic Society 72, n12 p2258-2263 1989.

Keywords: *Capacitors, *Ceramics, *Dielectrics, *Crack propagation, Barium titanates, Cracking(Fracturing), Cracks, Failure, Fractures(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 transformation in these dielectric materials 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 the capacitor are discussed. Low voltage failures arising from a short between the electrodes in multilayer capacitors are shown to be related to the growth of cracks in the dielectric. A technique for predicting the onset of these types of failures based upon fracture mechanics techniques is described. Possible effects of the electric field itself in promoting or retarding the growth of cracks are discussed.

200,616
PB92-189554 PC **A03**/MF **A01**
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Calibration Service for Low-Loss, Three-Terminal Capacitance Standards at 100 kHz and 1 MHz.
Technical note.
G. M. Free, and R. N. Jones. Feb 92, 34p NIST/TN-1348
Also available from Supt. of Docs. as SN003-003-03161-5.

Keywords: *Capacitance, *Standards, *Calibration, Electrical measurement, Ultrahigh frequency, Low 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 errors in the measurement. It also lists the calibration uncertainties for the stated frequencies and capacitances. Finally, the document discusses the quality assurance programs used at NIST to insure the integrity of the calibration.

200,617
PB92-197482 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Domain Effects in Faraday Effect Sensors Based on Iron Garnets.
Final rept.
M. N. Deeter. 1992, 4p
Pub. in Proceedings of Optical Fiber Sensors Conference (8th), Monterey, CA., January 29-31, 1992, 4p.

Keywords: *Magnetic measurement, Magnetic anisotropy, Magnetic fields, Magnetic domains, Magnetic films, Magnetooptics, Faraday effect, Thick 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 of iron garnets produce fundamentally different responses. Iron garnet films with uniaxial magnetic anisotropy exhibit domain-induced diffraction which produces a nonlinear signal even in films for which the net magnetization is exactly linear with the applied field. Fortunately, differential detection eliminates the nonlinearity. Moreover, differential detection applied to these films produces a signal which is linear regardless of the value of the saturation Faraday rotation. The behavior is quite unlike that of other Faraday effect sensors, 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

200,618
PB92-197698 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.
Observation of Quantum Susceptance in Superconducting Tunnel Junctions.
Final rept.
Q. Hu, C. A. Mears, P. L. Richards, and F. L. Lloyd. 1990, 2p
Pub. in Physica B 165, p1587-1588 Aug 90.

Keywords: *Superconducting junctions, Tunneling(Electronics), Resonant 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 microstrop stub to form a resonator; the resonant frequency is measured from the response of the junction to broadband radiation from a Fourier transform spectrometer. A 19% 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 Werthamer-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.

200,619
PB92-198167 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
High Frequency Magnetic Field Sensors Based on the Faraday Effect in Garnet Thick Films.
Final rept.
R. Wolfe, E. M. Gyorgy, R. A. Lieberman, V. J. Fratello, S. J. Licht, M. N. Deeter, and G. W. Day. 1992, 4p
Pub. in Proceedings of Optical Fiber Sensors Conference (8th), Monterey, CA., January 29-31, 1992, p390-393.

Keywords: *Magnetic measurement, Magnetic anisotropy, Magnetic domains, Magnetic films, Magnetooptics, Faraday effect, Thick films, Very high frequency, Yttrium iron garnets, Reprints, *Fiber optic sensors, *Magnetic field sensors.

Thick films of modified Yttrium Iron Garnet (YIG) with uniaxial 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.

200,620
PB92-238625 PC **A04**/MF **A01**
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Measurement of the Dielectric Constant of Polymeric Films at High Fields.
Final rept.
F. I. Mopsik, and B. Dickens. Sep 92, 52p NISTIR-4910
Sponsored by Defense Nuclear Agency, Washington, DC.

Keywords: *Polymeric films, *Dielectric properties, *Electrical insulation, Electrical measurement, Electrical impedance, 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 shielding. It also removes from the measured parameters any influence of the connecting leads. The measurement advantages of using a charge amplifier are discussed. A design for the charge amplifier is given that provides good immunity from any damage if the sample should experience an electrical breakdown. An extensive error analysis of the method is provided. Results are presented that show data with an uncertainty of <1% are possible in well defined samples.

200,621
PB93-125235 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Contact Electrification and Adhesion between Dissimiliar Materials.
Final rept.
R. G. Horn, and D. T. Smith. 1992, 3p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Science 256, p362-364, 17 Apr 92.

Keywords: *Electrification, *Electrical insulation, *Adhesion, *Static electricity, Silicon dioxide, Mica, Charge transport, Electric discharges, Reprints.

Simultaneous measurements of surface force and surface charge demonstrate strong attraction due to the spontaneous transfer of electrical charge from one smooth insulator (mica) to another (silica) as a result of simple, nonsliding contact in dry nitrogen. The measured surface charge densities are 5 to 20 millicoulombs per square meter after contact. The work required to separate the charged surfaces is typically 6 to 9 joules 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 underlying static electrical phenomena in general.

200,622
PB93-129377 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Automated System for the Measurement of High-Valued Resistors.
Final rept.
P. A. Boynton. 1992, 2p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Paris, France, June 9-12, 1992, p278-279.

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. This system is intended to calibrate standards ranging from 10(sup 10) ohms to 10(sup 14) ohms.

200,623
PB93-129401 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Improvements in Resistance Scaling at NIST Using Cryogenic Current Comparators.
Final rept.
R. F. Dziuba, and R. E. Elmquist. 1992, 2p
Pub. in CPEM '92, Proceedings of Conference on Precision Electromagnetic Measurements, Paris, France, June 9-12, 1992, p284-285.

Keywords: *Electrical resistance, Comparator circuits, Cryogenic equipment, SQUID devices, Reprints, Cryogenic current comparators, Hamon resistors, Transfer standards, Quantum Hall effect, Ohm.

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 ratio accuracies 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.

200,624
PB93-129419 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Automated AC Bridge for the Measurement of Resistors Over the Frequency Range 10 Hz to 10 kHz.
Final rept.
D. G. Jarrett, and R. F. Dziuba. 1992, 2p
Pub. in CPEM '92, Proceedings of Conference on Precision Electromagnetic Measurements, Paris, France, June 9-12, 1992, p87-88.

Keywords: *Resistance bridges, *Kelvin bridges, *Resistors, Alternating current, 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 ratio arms consist of two-stage 30-bit binary inductive voltage dividers. A guard inductive voltage divider drives an RC network to provide a known phase compensation 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

200,625
PB92-133032 PC **A03**/MF **A01**
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Electronics and Electrical Engineering Laboratory Technical Publication Announcements Covering Laboratory Programs, April to June 1991, with 1992 EEEL Events Calendar.
J. A. Gonzalez. Dec 91, 23p NISTIR-4736
See also PB92-112309.

Keywords: *Microelectronics, *Metrology, Integrated circuits, Dimensional measurement, Electromagnetic interference, Signal processing, Optical fibers, Magnetic materials, Millimeter waves, Microwaves, Antennas, Electrical measurement, Electric 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 EEEL 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; Semiconductor Microelectronics; Signal Acquisition, Processing, and Transmission; Electrical Systems; Additional Information; 1992 EEEL Calendar; EEEL Sponsors; Key Contacts in Laboratory, Laboratory Organization.

200,626
PB92-144492 Not available NTIS
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Precision Engineering Div.
Nanolithography on III-V Semiconductor Surfaces Using a Scanning Tunneling Microscope Operating in Air.
Final rept.
J. A. Dagata, W. Tseng, J. Bennett, J. Schneir, and H. H. Harary. 1991, 5p
See also PB91-194712.
Pub. in Jnl. of Applied Physics 70, n7 p3661-3665, 1 Oct 91.

Keywords: *Lithography, Scanning tunneling microscopy, Aluminum gallium arsenides, Molecular beam epitaxy, Pattern making, Fabrication, Substrates, Masking, Epitaxy, Reprints, *Nanolithography, Gallium indium arsenides, Heterostructures.

Nanometer-scale pattern generation on III-V semiconductor substrates using a scanning tunneling microscope (STM) operating in air is demonstrated. The sample substrates, consisting of arsenic-capped, epitaxial layers of n-doped GaAs, Al(x)Ga(1-x)As and In(y)Ga(1-y)As 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 strongly bonded 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 (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.

Lattice Damage and Atomic Mixing Induced by As(++) Implantation and Thermal Annealing in AlAs/GaAs Multiple Quantum-Well Structures.
Final rept.
D. Huang, M. Kallergi, J. Aubel, S. Sundaram, G. C. DeSalvo, and J. Comas. 1991, 9p
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 Ga 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 show 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/sq 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.

200,628
PB92-144765 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Kinetics of Silicon Nitride Crystallization in N(+)-Implanted Silicon.
Final.
V. S. Kaushik, A. K. Datye, D. L. Kendall, B. Martiniz-Tovar, D. S. Simons, and D. R. Myers. 1989, 5p
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, Crystallization, Microelectronics, Annealing, Reprints, Secondary ion mass spectroscopy, SOI(Semiconductors).

Silicon nitride is used in various ways in microelectronics for dielectric insulation, including insulating layers in silicon-on-insulator technology, to provide passivating layers, and as a diffusion mask. Buried layers of silicon nitride can be synthesized by ion implantation of nitrogen followed by high-temperature annealing. The paper describes the results of implantation and annealing studies on near-stoichiometric implants in (110) Si. Nitrogen profiles were studied using secondary ion mass spectrometry (SIMS) as implanted and annealed samples. Implants resulted in a deep tail of nitrogen ions along with the main peak. Upon annealing, the main peak formed a continuous layer, while the deeper fraction caused precipitation of silicon nitride about 0.5 micrometer below the main peak. Samples annealed for varying time periods were studied by optical microscopy, cross-sectional and planar transmission electron microscopy (TEM), and electron diffraction techniques.

200,629
PB92-145184 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
AC Impedance Method for High-Resistivity Measurements of Silicon.
Final rept.
W. R. Thurber, J. R. Lowney, R. D. Larrabee, and J. R. Ehrstein. 1991, 5p
Contract FY7615-87-05242
See also PB89-231203. Sponsored by Air Force Systems Command, Washington, DC.
Pub. in Jnl. of the Electrochemical Society 138, n10 p3081-3085 Oct 91.

Keywords: *Electrical resistivity, *Silicon, Electrical measurement, Electrical impedance, Alternating current, Ingots, Reprints.

An ac impedance method for measuring the average bulk resistivity of ingots and slices of high-resistivity silicon is presented. Easily removable contacts, such as silver paint, are applied to the end faces of the sample, and the complex impedance of the resulting capacitive sandwich is measured as a function of frequency. The resistivity can be calculated from the frequency of the negative peak in the imaginary part of the impedance and from the absolute values of the real and imaginary parts at that frequency. The spectroscopic nature of the method gives an inherent separation of contact, surface region, and bulk effects as the respective responses usually occur at widely different frequencies. In addition to its intended application for measuring bulk resistivity, the method is useful for determining the quality of applied contacts and the effect of surface treatments which result in a significant depletion layer. Plots and the required data can be obtained very quickly with an appropriate microprocessor-based impedance analyzer. Extensive measurements of high-resistivity silicon were done to compare the method with the dc resistance, van der Pauw, and four-probe techniques. The agreement was within 5% for slices and ingot sections greater than 0.1 cm in length and resistivity above 5 kilohms cm.

200,630
PB92-149798 PC **A04**/MF **A01**
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Precision Engineering Div.
Antireflecting-Chromium Linewidth Standard, SRM 475, for Calibration of Optical Microscope Linewidth Measuring Systems.
Special pub. (Final).
C. F. Vezzetti, R. N. Varner, and J. E. Potzick. Jan 92, 52p NIST/SP-260/117
Also available from Supt. of Docs. as SN003-003-03122-4. See also PB89-186340 and PB89-209266.

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 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. Raggedness and non-vertical walls along the edges add to 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 10.8 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 microscope image profiles. The profiles are predicted by computer modeling based on the theory of partial coherence. The performance of the system is monitored by measuring line features on a control photomask before and after calibrating each SRM. Precautions concerning care and handling and instruction for the use of SRM 475 to calibrate optical microscopes for photomask linewidth measurement are given.

200,631
PB92-153998 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Failure Mechanisms and Nondestructive Testing of Power Bipolar and MOS-Gated Transistors.
Final rept.
D. L. Blackburn. 1991, 6p
Pub. in Proceedings of EPE - MADEP '91, Florence, Italy, September 2-6, 1991, p252-257.

Keywords: *Bipolar transistors, *Field effect transistors, *MOSFET, *Nondestructive tests, Thermal stability, Failure, Reprints, Second breakdown, Power transistors.

Failure mechanisms and nondestructive testing of power bipolar and MOS gated devices are discussed. Bipolar transistor failures are initiated at relatively low temperatures and the devices can be tested nondestructively. Modern MOS gated device failure is initiated at temperatures far in excess of those normally considered safe and cannot be tested nondestructively today. The key to nondestructive testing is the ability to sense the onset of failure and to then remove all power from the transistor before the device temperature rises high enough to cause damage.

200,632
PB92-154160 Not available NTIS
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Precision Engineering Div.
P2S5 Passivation of GaAs Surfaces for Scanning Tunneling Microscopy in Air.
Final rept.
J. A. Dagata, W. Tseng, J. Bennett, J. Schneir, and H. H. Harary. 1991, 3p
Pub. in Applied Physics Letters 59, n25 p3288-3290, 16 Dec 91.

Keywords: *Gallium arsenides, *Passivation, X-ray photoelectron spectroscopy, Scanning tunneling microscopy, Electron diffraction, Aluminum gallium arsenides, Phosphorus sulfides, Superlattices, Substrates, Surfaces, Reprints, Secondary ion mass spectroscopy, Ammonium sulfides.

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 P2S5/(NH4)2S 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 is illustrated by STM imaging of an Al(0.51)Ga(0.49)As/GaAs superlattice in air. The superlattice consisted of periodic alternating AlGaAs/GaAs layers of various thicknesses from 10 to 1000 nm.

200,633
PB92-154251 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Validating Surge Test Standards By Field Experience: High-Energy Tests and Varistor Performance.
Final rept.
C. Fenimore, and F. Martzloff. 1990, 7p
Sponsored by Department of the Army, Washington, DC.
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Industry Applications Society Annual Meeting, Seattle, WA., October 7-12, 1990, p1968-1974.

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 offers a valuable criterion for validating or invalidating proposed standards. A proposal under consideration by the IEC involves so much energy that a varistor of the voltage rating 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. Proposals for high-energy tests as additional waveforms 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.

200,634
PB92-154434 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Separation by Ion Implantation of Oxygen (SIMOX) Structures: Estimating Thicknesses.
Final rept.
J. F. Marchiando, and J. Geist. 1992, 3p
Pub. in Applied Optics 31, n4 p485-487, 1 Feb 92.

Keywords: *Film thickness, Dimensional measurement, Ion implantation, Ellipsometry, Oxygen, Models, Errors, Reprints, *SIMOX.

The propagation of errors in the model parameters is compared for cases that analyze a simple separation by ion implantation of oxygen structure by using reflectometry and ellipsometry. Both methods give comparable values for the layer thicknesses. Both the radius of convergence and the values of uncertainty tend to be larger with reflectometry than with ellipsometry.

200,635
PB92-154517 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.

Microstructural Changes in Oxygen Implanted SOI Material at Intermediate Annealing Steps in Thermal Ramping.
Final rept.
J. C. Park, S. J. Krause, and P. Roitman. 1991, 2p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International SOI (Silicon-on-Insulator) Conference, Vail Valley, CO., October 1-3, 1991, p116-117.

Keywords: Ion implantation, Microstructure, Annealing, Oxygen, Wafers, Reprints, *SOI(Semiconductors), SIMOX.

The final microstructure of silicon-on-insulator material fabricated by oxygen implantation (SIMOX) is dependent 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 ramping cycle. 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.

200,636
PB92-154525 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Periodicities Associated with Low-Order AlAs/GaAs Superlattices.
Final rept.
J. G. Pellegrino, S. Qadri, W. F. Tseng, and J. Comas. 1991, 7p
Pub. in Thin Solid Films 206, p40-46 1991.

Keywords: *Superlattices, Molecular beam epitaxy, Gallium arsenides, Aluminum arsenides, X-ray diffraction, Epitaxial growth, Reprints, Heterostructures.

The use of molecular beam epitaxy to produce heterostructures has made it possible to better study superlattices with monolayer and submonolayer period spacings. In the work the authors examine the physical properties for the superlattice system (GaAs)(sub n1)(AlAs)(sub n2)/GaAs(001) for low values of n1 and n2, i.e. n1 = n2 = 3.6.12. Normal, interrupted growth, and migration-enhanced epitaxy growth techniques were used to grow the superlattice structures and the X-ray diffraction spectra were obtained and the major and satellite peak positions analyzed. An analysis of the major diffraction peaks and their associated satellites exhibited superlattice periodicity in good agreement with theory. Diffraction peaks were also observed in regions adjacent to the primary diffraction peaks which did not occur in the expected satellite positions. An analysis of these peaks relative to the primary peaks indicates periodicities which are greater than the intended period. One possible cause for these periodicities is variations in growth conditions which occur while the superlattice is being grown. An understanding of low-order superlattices is important for structures which are dependent on interface sharpness.

200,637
PB92-154640 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
High-Density Test Structures for Assessing Microwave/Millimeter Wave Monolithic Integrated Circuit (MIMIC) Performance.
Final rept.
C. E. Schuster, L. W. Linholm, and J. K. Gillespie. 1991, 4p
Pub. in Proceedings of Government Microcircuit Applications Conference, Orlando, FL., November 5-7, 1991, v17 p335-338 1991.

Keywords: *Integrated circuits, Microwave circuits, Millimeter waves, Recommendations, Performance, Reprints, Test structures.

The paper discusses the unique, high-density implementation of microelectronic test structures used to diagnose and predict MIMIC performance under MIMIC Phase 1, Task 4.E. It also presents assessments and recommendations, based on Task 4.E data, for future test structure methods to evaluate MIMIC performance.

200,638
PB92-159227 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Direct Experimental Evidence for a Dominant Hole Trapping Center in SIMOX Oxides.
Final rept.
J. F. Conley, P. M. Lenahan, and P. Roitman. 1990, 2p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) SOS/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 (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Office of Microelectronics Programs Opens at NIST.
Final rept.
C. K. Cummings. 1991, 2p
Pub. in SRC Newsletter 9, n9 p3-4 Sep 91.

Keywords: *Microelectronics, *Line width, Chemical vapor deposition, Electronic packaging, Plasma etching, Dimensional measurement, Moisture, Length, Reprints, US NIST.

The NIST linewidth measurement program has produced several photomask linewidth standards. While continuing 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 (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Analysis for the Characterization of Oxygen Implanted Silicon (SIMOX) by Spectroscopic Ellipsometry.
Final rept.
M. G. Doss, D. Chandler-Horowitz, J. F. Marchiando, S. Krause, and S. Seraphin. 1991, 6p
Pub. in Materials Research Society Symposium Proceedings, v209 p493-498 1991.

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 unusual structure in these samples. 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 polarizer 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 ('islands') within the 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 (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
NIST Linewidth Measurement Program.
Final rept.
R. L. Mattis. 1991, 2p
Pub. in SRC Newsletter 9, n9 p4-5, Sep 91.

Keywords: *Microelectronics, *Dimensional measurement, *Photomasking, *Line width, *Standards, Scanning 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 (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Measurement of Interface Defects in Gated SIMOX Structures.
Final rept.
S. Mayo, J. R. Lowney, and P. Roitman. 1991, 2p
Contract DNA-IACRO-88-800
Sponsored by Defense Nuclear Agency, Washington, DC.
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International SOI Conference, Vail Valley, CO., October 1-3, 1991, p52-53 1991.

Keywords: *Photoresistors, *Film resistors, Crystal defects, Electron traps, Hole traps, Silicon films, Ion implantation, Thin films, Photoconductivity, Annealing, Interfaces, Oxygen, Wafers, Reprints, Photoinduced transient spectroscopy, SOI(Semiconductors), SIMOX.

Defects in gated or ungated thin film resistors have been characterized by photoinduced transient spectroscopy (PITS). The resistors were fabricated with n- or p-type SIMOX (Separation by IMplanted OXygen) wafers implanted with 200-keV oxygen to 1.8 x 10 to the 18th power/sq cm total fluence. One wafer used for gated resistor fabrication was implanted at 595 C and sequentially annealed at 1325 C for 4 h in argon (plus 0.5 percent oxygen) followed by 4 h in nitrogen (plus 0.5 percent oxygen). Another wafer used for ungated resistor fabrication was implanted at 650 C and annealed at 1275 C for 2 h in nitrogen (plus 0.5 percent oxygen). PITS data indicate that electron or hole traps in the conductive silicon film are located at the film-buried silica interface. The authors estimate the average interface trap density in the SIMOX structure in the 10 to the 11th power/sq cm range.

200,643
PB92-165166 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
SIMS Study of the Deuterium Distribution in SIMOX Buried Oxides.
Final rept.
G. J. Campisi, P. Roitman, D. Simons, and W. A. Krull. 1991, 2p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International SOI Conference, Vail Valley, CO., October 1-3, 1991, p16-17.

Keywords: *MOS transistors, *Deuterium, *Hydrogen, Silicon dioxide, Reprints, *SIMOX, Secondary ion mass spectroscopy, Buried oxides.

Hydrogen in SiO2 has been extensively studied and identified as a source of MOS device degradation during hot electron stressing or exposure to ionizing radiation. In the paper, we have used SIMS analysis of deuterium annealed SIMOX samples to investigate the interaction of hydrogen with the buried oxide.

200,644
PB92-165224 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
ESR Study of E' Trapping Centers in SIMOX Oxides.
Final rept.
J. F. Conley, P. M. Lenahan, and P. Roitman. 1991, 2p
See also PB92-165232.
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International SOI Conference, Vail Valley, CO., October 1-3, 1991, p12-13.

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 trapping involve different mechanisms.

200,645
PB92-165232 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.

Electron Spin Resonance Study of E' Trapping in SIMOX Buried Oxides.
Final rept.
J. F. Conley, P. M. Lenahan, and P. Roitman. 1991, 6p
See also PB92-165224.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science 38, n6 p1247-1252 Dec 91.

Keywords: Electron spin resonance, Vacuum ultraviolet radiation, Electron traps, Hole traps, Silicon dioxide, Reprints, *SIMOX, Buried oxides.

The authors combine electron spin resonance and capacitance versus voltage measurements with vacuum ultraviolet and ultraviolet illumination sequences to study E' centers 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, probably dominating role in 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 (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Evaluation of Secco Etch Technique for Determination of Dislocation Densities in SIMOX Wafers.
Final rept.
E. Cortesi, M. K. El-Ghor, H. H. Hosack, L. P. Allen, P. Roitman, and S. J. Krause. 1991, 2p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International SOI Conference, Vail Valley, CO., October 1-3, 1991, p118-119.

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 made the measurement of dislocation densities by plan-view transmission electron microscopy extremely impractical because of the large areas that must be studied. We report here 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 (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Analytical Modeling of Device-Circuit Interactions for the Power Insulated Gate Bipolar Transistor (IGBT).
Final rept.
A. R. Hefner. 1990, 11p
See also PB92-165604.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Industry Applications 26, n6 p995-1005 Nov/Dec 90.

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 are studied. 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 inductances greater than 1 (micro)H. For slower devices, though, the voltage overshoot is much less, and a larger inductance can therefore be switched without a snubber circuit (e.g., 80 (micro)H for a 7.1-microsec device). The simulations are used to determine the conditions for which the different devices can be switched safely without a snubber protection circuit. Simulations are also used to determine the required values and ratings for protection circuit components when protection circuits are necessary.

200,648
PB92-165604 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Device Models, Circuit Simulation, and Computer-Controlled Measurements for the IGBT.
Final rept.
A. R. Hefner. 1991, 11p
See also PB92-165596.
Pub. in Proceedings of Annual IEEE (Institute of Electrical and Electronics Engineers) Workshop on Computers in Power Electronics (2nd), Lewisburg, PA., August 5-7, 1990, p233-243 1991.

Keywords: *Bipolar transistors, Mathematical models, Computerized simulation, Electrical measurement, Fortran, Algorithms, Reprints, *Insulated gate bipolar transistors, Circuit simulators.

The implementation of the recently developed Insulated Gate Bipolar Transitor (IGBT) device model into a circuit simulation program is described. It is shown that the circuit simulation program rapidly and robustly simulates the dynamic behavior of the IGBT for general external drive, load, and feedback circuit configurations. The algorithms used to extract the IGBT device parameters from computer-controlled measurements are also described, and it is shown that the model accurately describes experimental results when the extracted parameters are used.

200,649
PB92-165612 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Improved Understanding for the Transient Operation of the Power Insulated Gate Bipolar Transistor (IGBT).
Final rept.
A. R. Hefner. 1990, 10p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Electronics 5, n4 p459-468 Oct 90.

Keywords: *Bipolar transistors, Waveforms, Transients, Reprints, *Insulated gate bipolar transistors.

It is shown that a non-quasi-static analysis must be used to describe the transient current and voltage waveforms of the IGBT. The non-quasi-static analysis is necessary because the transport of electrons and holes are coupled for the low-gain, high-level injection conditions, and because the quasi-neutral base width changes faster than the base transit speed for typical load circuit conditions. To verify that both of these non-quasi-static effects must be included, the predictions of the quasi-static and non-quasi-static models are compared with measured current and voltage switching waveforms. The comparisons are performed for different load circuit conditions and for different device base lifetimes.

200,650
PB92-165810 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Oxygen Bubble Formation and Evolution during Oxygen Implantation and Annealing of Silicon-on-Insulator Materials.
Final rept.
S. J. Krause, J. D. Lee, B. L. Chen, S. Seraphin, B. Cordts, and P. Roitman. 1991, 2p
See also PB90-187774.
Pub. in Extended Abstract: Proceedings of Annual Meeting of the Electron Microscopy Society of America (49th), San Diego, CA., August 1991, 2p.

Keywords: Transmission electron microscopy, Integrated circuits, 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 the buried oxide layer. The topic of bubble formation and evolution has received only limited study. Sjoreen et al. first reported the presence 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. Maszara confirmed the presence of spheroids filled with oxygen in the silicon top surface region in the 1mA/sq cm as-implanted samples. In this work, transmission electron microscopy techniques were used to investigate the effect of implantation conditions on the bubble formation and the effect of subsequent annealing conditions on the evolution of bubbles.

200,651
PB92-166065 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Building-In Reliability: Making It Work.
Final rept.
H. A. Schafft, D. A. Baglee, and P. E. Kennedy. 1991, 8p
Contract DARPA-3882
See also PB91-203992. Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in RAC Quarterly 1, n2 p2-9 1991.

Keywords: *Reliability(Electronics), *Microelectronics, Electronic packaging, Process control, Semiconductor devices, Manufacturing, Measurement, Reprints.

Aggressive reliability and market-entry demands will require the use of a building-in approach to reliability. To adopt this approach and make it work requires that significant breaks be made from traditional ways of improving and appraising reliability. The nature of these breaks are discussed in the context of describing the basic elements of the approach of building-in reliability and the obstacles that hinder its adoption. To help visualize how the approach can be implemented, initial steps to make the transition and some specific examples of its use are described.

200,652
PB92-166156 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Effects of Localized Hot-Carrier-Induced Charge in VLSI Switching Circuits.
Final rept.
J. S. Suehle, and K. F. Galloway. 1990, 10p
See also PB88-200373.
Pub. in Microelectronics Jnl. 21, n3 p5-14 1990.

Keywords: *Switching circuits, *Gates(Circuits), Very large scale integration, Digital circuits, Inverter circuits, Charge carriers, Degradation, MOSFET, CMOS, Reprints, Hot carriers.

The paper presents data collected from CMOS test circuits designed to characterize hot-carrier effects in digital switching circuits. Test circuits were configured as CMOS inverters, transmission gates, and NMOS transmission gates. The MOSFETs within the circuits could be probed so that the degradation of their dc characteristics could be directly measured. These circuits were hot-carrier-stressed under pulsed switching conditions similar to their operation in VLSI circuits. The results indicate that device degradation is strongly dependent on the circuit configuration and switching conditions. Transmission gate circuits exhibit a more severe degradation in switching characteristics than inverter circuits due to the localization of the hot-carrier-induced charge. The localized nature of hot-carrier-induced charge must be considered at the circuit simulation level to accurately assess the effect on circuit performance.

200,653
PB92-170737 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Technology Transfer at NIST.
Final rept.
B. C. Belanger, H. S. Bennett, L. W. Linholm, T. J. Russell, and H. A. Schafft. 1989, 5p
Pub. in Proceedings of Government Microcircuit Applications Conference, Kissimmee, FL., November 7-9, 1989, p7-11.

Keywords: *Semiconductor materials, *Semiconductor devices, *Technology transfer, Government/industry relations, Reprints, US NIST.

NIST (formerly NBS) works closely with industry and other Federal agencies. Examples are provided of how NIST transfers technology, with emphasis on semiconductor materials and devices.

200,654
PB92-171115 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Accuracy of the Charge Pumping Technique for Small Geometry MOSFETs.
Final rept.
M. Gaitan, E. W. Enlow, and T. J. Russell. 1989, 8p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science 36, n6 p1990-1997 1989.

Keywords: *Field effect transistors, *MOSFET, Two-dimensional calculations, Mathematical models, Computerized simulation, Electron traps, Hole traps, Interfaces, Reprints.

The channel length dependence of the charge pumping current for MOSFETs is investigated using a two-dimensional simulation technique. The dependence of charge pumping current on signal offset voltage for various MOSFET channel lengths is studied using energy-dependent interface trap distributions. Simulations are compared to experimental charge pumping measurements on irradiated MOSFETs with different gate lengths with good agreement for the shape of the curves. It is found that as the effective channel length decreases, the accepted charge pumping model has decreasing accuracy that results in an underestimation of the mean interface trap density. The loss in accuracy is due to the nonuniformity of surface potential across the channel caused by source/drain proximity. Using the charge pumping technique to measure interface trap densities on advanced devices with an effective channel length less than 1 micrometer may result in unacceptable errors.

200,655
PB92-171404 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Analysis of Persistent Photoconductivity Due to Potential Barriers.
Final rept.
J. R. Lowney, and S. Mayo. 1991, 8p
Pub. in Proceedings of Workshop on Radiation-Induced and/or Process-Related Electrically Active Defects in Semiconductor-Insulator Systems (3rd), Research Triangle Park, NC., September 10-13, 1991, p95-102.

Keywords: *Persistent currents, *Photoconductivity, Silicon films, Electron traps, 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, which is due to the large number of surface traps at the interface. The depletion of carriers is accompanied by a built-in field on the order of 10,000 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 interface on the other side of a potential barrier is studied. 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.

200,656
PB92-171495 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Multi-Line Calibration for MMIC Measurement.
Final rept.
R. B. Marks. 1991, 9p
Pub. in Proceedings of ARFTG Conference Digest (36th), Monterey, CA., November 29-30, 1990, p47-55 Feb 91.

Keywords: *Integrated circuits, *Calibration, Microwave circuits, Network analyzers, Error analysis, Reprints, *Monolithic microwave integrated circuits.

A modification of the TRL (through-reflect-line) calibration method provides enhanced network analyzer calibration 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 matrices necessary for the application of the procedure are developed as a result of a linearized 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.

200,657
PB92-171529 Not available NTIS
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Advanced Systems Div.
VLSI Chip Set for a Multiprocessor Performance Measurement System.
Final rept.
A. Mink, and R. Carpenter. 1990, 20p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Performance Instrumentation and Visualization, Chapter 14, p213-232 1990.

Keywords: *Multiprocessors, *Computer performance evaluation, *Very large scale integration, Chips(Electronics), Integrated circuits, Parallel processing, Perturbation, Computer software, Reprints, MIMD.

A hybrid performance measurement tool for MIMD 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 address recognition 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' object was to provide a useful measurement tool at a reasonable cost, size, and implementation technology relative to the machine being measured.

200,658
PB92-171537 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Insulated Gate Bipolar Transistor (IGBT) Modeling Using IG-Spice.
Final rept.
C. S. Mitter, A. R. Hefner, D. Y. Chen, and F. C. Lee. 1991, 7p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA., and David Taylor Research Center, Bethesda, MD.
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Industry Applications Society Meeting, Dearborn, MI., September 29-October 4, 1991, p1515-1521.

Keywords: *Bipolar transistors, Mathematical models, Computerized simulation, Parallel processing, Convergence, Reprints, *Insulated gate bipolar transistors, IG-SPICE system, Power transistors, Circuit simulators.

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 conductivity 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.

200,659
PB92-171628 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
MMIC Package Characterization with Active Loads.
Final rept.
K. A. Phillips, and D. F. Williams. 1991, 9p
Pub. in Proceedings of ARFTG Conference Digest (36th), Monterey, CA., November 29-30, 1990, p64-72 Feb 91.

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
PB92-171651 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Effect of Annealing Ambient on the Precipitation Processes in Oxygen-Implanted Silicon-on-Insulator Material.
Final rept.
P. Roitman, D. S. Simons, S. Visitserngtrakul, C. O. Jung, and S. J. Krause. 1990, 2p
Pub. in Proceedings of International Congress for Electron Microscopy (12th), Seattle, WA., August 1990, p644-645.

Keywords: *Integrated circuits, *Annealing, Ion implantation, Oxygen ions, Silicon oxides, Nitrogen, Argon, Reprints, *SOI(Semiconductors), *SIMOX.

In the last decade, oxygen implanted silicon-on-insulator material (SIMOX: Separation by IMplantation of OXygen) has been extensively studied, due to its potential advantages of increased speed and radiation hardness in integrated circuits. SIMOX material requires two processing steps: first, 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 oxide precipitates. Most earlier 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 oxide-precipitate 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 chemically react with silicon. The nitrogen-containing layer acts as a barrier to further oxidation. Consequently, nitrogen influences the growth kinetics of the thermal oxide 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 oxide-precipitate removal during annealing of SIMOX material.

200,661
PB92-171727 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Extending Electrical Measurements to the 0.5mum Regime.
Final rept.
P. Troccolo, L. Mantalas, R. Allen, and L. Linholm. 1991, 14p
Pub. in Integrated Circuit Metrology, Inspection, and Process Control V, v1464 p90-103 1991.

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 from lens aberrations/distortions and proximity/corner rounding effects in the patterning of the smallest lines achievable (less than 0.5 micrometer) can result in failure of the structure. 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 these structures have been further modified and improved in order to address known lithographic limitations and establish a more process tolerant design. The resulting measurement precision accommodating these changes is discussed to provide the framework for achieving the highest practical performance attainable from both the test structure and the measurement system.

200,662
PB92-171750 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.

Anomalously Offset Quantized Hall Plateaus in High-Mobility Si-MOSFETs.
Final rept.
C. T. Van Degrift, K. Yoshihiro, M. E. Cage, D. Yu, K. Segawa, J. Kinoshita, and T. Endo. 1992, 4p
Sponsored by Department of Defense, Washington, DC.
Pub. in Surface Science 263, p116-119 1992.

Keywords: *Field effect transistors, *MOSFET, Aluminum gallium arsenides, Silicon transistors, Electron gas, Reprints, *Quantum hall effect, Heterostructures, High electron mobility transistors.

Measurements made using two independent, high-precision systems on different samples of high mobility Si-MOSFETs have revealed unexpected irregularities in their i = 4 quantized Hall plateaus in spite of exceedingly low diagonal resistivities 0.002 ppm of the plateau value. Relatively flat, metastable plateaus were observed which were offset by up to 0.4 ppm above the corresponding GaAs/AlGaAs value under the measurements at 14-14.5 T, 0.34-0.5 K with about 10 (micro)A sample current. Possible connection of these phenomena with the offset plateaus observed by Kawaji et al. is discussed. At present no satisfactory explanation has been provided for these phenomena.

200,663
PB92-171818 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Progress Toward MMIC On-Wafer Standards.
Final rept.
D. Williams, R. Marks, K. Phillips, and T. Miers. 1991, 11p
Pub. in Proceedings of ARFTG Conference Digest (36th), Monterey, CA., November 29-30, 1990, p73-83 Feb 91.

Keywords: Microwave circuits, Integrated circuits, Progress report, Error analysis, Electrical measurement, Coplanarity, Calibration, Prototypes, Reprints, *Wafer 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 standard set, the propagation of undesirable modes, and the influence of adjacent structures on the electrical connection to the elements of the standard set, will be discussed.

200,664
PB92-175025 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Voltage-Dividing Potentiometer Enhancements for High-Precision Feature Placement Metrology.
Final rept.
R. A. Allen, M. W. Cresswell, C. H. Ellenwood, and L. W. Linholm. 1992, 5p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Conference on Microelectronic Test Structures, San Diego, CA., March 16-19, 1992, v5 p175-179.

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 the voltage-dividing potentionmeter principle, and designed for the measurement of the separations of pairs of conducting features, has recently been reported. In the earlier work, the uncorrected measurements had a systematic error in the hundreds of nanometers. However, after compensating for the error, the residual errors were typically as low as 15 nm. In later work, through further measurements and extensive modeling, the origin of the systematic error was attributed to substrate-dependent asymmetries of certain imperfections in the replication of the test structure. In the paper, modified test structures are described that confirm the model and show how all design-rule and substrate-dependent systematic errors can be eliminated.

200,665
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.
Final rept.
G. J. Campisi, P. Roitman, and G. J. Shontz. 1991, 2p
Pub. in Proceedings of Workshop on Radiation-Induced and/or Process-Related Electrically Active Defects in Semiconductor-Insulator Systems (3rd), Research Triangle Park, NC., September 10-13, 1991, p171-172.

Keywords: *Field effect transistors, *MOSFET, Radiation tests, Substrates, 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 fully 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 formation anneal cycle on the radiation induced shifts, Delta V(bg). Briefly, in previously reported capacitor study, the radiation induced flat band voltage shift was reduced by 40% when the anneal temperature was increased from 1275 to 1350 C, i.e. the negative Delta V(bg) shift was lowered from -22 to -15 V respectively. The study re-examines the effect in p-MOSFETs. The authors have correlated the silicon oxygen microstructure at the interfaces with the radiation response in MOSFETs. In the authors' laboratory furnace, SIMOX substrates were annealed at temperatures between 1250 and 1350 C to complete the formation process and using XTEM compared to substrate annealed by the manufacturer. The subthreshold transfer characteristics, I(D) (V(G)), were measured before and after irradiation on devices fabricated on these substrates.

200,666
PB92-175207 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Etch Rates and Selectivities of Citric Acid/Hydrogen Peroxide on GaAs, Al.3Ga.7As, In.2Ga.8As, In.53Ga.47As, In.52Al.48As, and InP.
Final rept.
G. C. DeSalvo, W. F. Tseng, and J. Comas. 1992, 5p
Pub. in Jnl. of Electrochemical Society 139, n3 p831-835 Mar 92.

Keywords: *Etching, Aluminum gallium arsenides, Indium phosphides, Citric acid, Hydrogen peroxide, Semiconductors, Substrates, Molecular beam epitaxy, Reprints, Indium gallium arsenides, Indium aluminum arsenides.

Etching studies involving citric acid/hydrogen peroxide (C6H8O7:H2O2) at volume ratios from 0.5:1 to 50:1 were found to provide good selective etching of various III-V semiconductor materials grown on GaAs and InP substrates using molecular beam epitaxy. Both selective and uniform (nonselective) etching regions were found between these material systems by choosing different concentration volume ratios of citric acid/hydrogen peroxide (chiC6H8O7:1H2O2). The citric acid/hydrogen peroxide system can be used as a stop etch for InP-based devices, as InP is virtually unaffected by the etchant. Finally, citric acid/hydrogen peroxide can be used to preferentially etch these materials through a photoresist mask, since it does not erode photoresist at any volume ratio.

200,667
PB92-175405 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Bond Failures Resulting from Plating Impurities and Conditions.
Final rept.
G. G. Harman. 1989, 22p
Pub. in Reliability and Yield Problems of Wire Bonding in Microelectronics: The Application of Materials and Interface Science, Chapter 3, p95-116 1989.

Keywords: *Microelectronics, Failure(Electronics), Electroplating, Intermetallic compounds, Diffusion, Impurities, Reprints, *Wire bonds, Gold films.

Various failure modes of wire bonds to electroplated gold films are reviewed. These result from plating grain modifiers, hydrogen in the film, or oxydizable metals (Cu, Ni, Cr, etc.) diffused up from the substrate. Solutions to these problems are given.

200,668
PB92-175413 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Cleaning to Improve Bondability and Reliability.
Final rept.
G. G. Harman. 1989, 24p
Pub. in Reliability and Yield Problems of Wire Bonding in Microelectronics: The Application of Materials and Interface Science, Chapter 4, p117-140 1989.

Keywords: *Microelectronics, Reliability(Electronics), Thin films, Contamination, Cleaning, Argon plasma, Ozone, Ultraviolet radiation, 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.

200,669
PB92-175421 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Intermetallic Compound and Other Bimetallic Interface Related Bond Reactions.
Final rept.
G. G. Harman. 1989, 46p
Pub. in Reliability and Yield Problems of Wire Bonding in Microelectronics: The Application of Materials and Interface Science, Chapter 2, p49-94 1989.

Keywords: *Microelectronics, *Intermetallic compounds, Failure(Electronics), Aluminum intermetallics, Gold intermetallics, Nickel 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 bondability of Al-Ni, Au-Ag, Cu-Au, Ag-Cu, Al-Cu, and Al-Ag metallurgical couples are discussed.

200,670
PB92-175470 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Microstructural Evolution of Oxides during Processing of Oxygen Implanted SOI Material.
Final rept.
S. J. Krause, S. Visitserngtrakul, B. F. Cordts, and P. Roitman. 1990, 2p
Grants NSF-DMR89-01370, DNA-IACRO-88-800
Sponsored by National Science Foundation, Washington, DC., and Defense Nuclear Agency, Washington, DC.
Pub. in Proceedings of IEEE SOS/SOI Technology Conference, Key West, FL., October 2-4, 1990, p47-48.

Keywords: *Integrated circuits, Ion implantation, Electron microscopy, Annealing, Bubbles, Microstructure, Oxides, Reprints, *SOI(Semiconductors), SIMOX.

Silicon-on-insulator (SOI) material fabricated by oxygen implantation (SIMOX) is being used for radiation hard, higher speed, and higher temperature integrated circuits. The microstructural evolution of oxides during implantation, thermal ramping, and annealing plays a crucial role in development of the structure of the top Si layer and of the buried oxide layer. To control the microstructure of the oxides and silicon it is necessary to understand the effect of processing conditions on the mechanisms of oxide formation and evolution. These processing conditions include: implantation temperature, energy, and dose; thermal ramping rate; and annealing time, temperature, and atmosphere. Numerous questions still remain on the effects of processing conditions and include: formation and growth of the buried oxide; formation and evolution of oxygen bubbles in the top silicon layer, and precipitate evolution and elimination during ramping and annealing. The goal of the paper is to summarize recent work on the effects of processing conditions on oxide evolution and to present new results on; effects of implantation conditions 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.

200,671
PB92-175926 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Comments Concerning On-Wafer Noise Parameter Measurements.
Final rept.
D. F. Wait. 1990, 11p
Pub. in Proceedings of ARFTG Conference Digest (36th), Monterey, CA., November 29-30, 1990, p5-15.

Keywords: *Microwave amplifiers, *Noise measurement, Electromagnetic noise, Superhigh frequency, Wafers, Tests, Reprints, *Amplifier noise.

The National Institute of Standards and Technology (NIST) has a goal of offering an on-wafer noise parameter 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 on-wafer noise measurements. The measurement 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, preliminary on-wafer noise measurements are presented.

200,672
PB92-181239 PC **A03**/MF **A01**
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electronics and Electrical Engineering Lab. Office.
Electronics and Electrical Engineering Laboratory Technical Publication Announcements Covering Laboratory Programs, July to September 1991, with 1992 EEEL Events Calendar.
Rept. for Jul-Sep 91.
J. A. Gonzales. Mar 92, 25p NISTIR-4803
See also PB92-133032.

Keywords: *Microelectronics, *Metrology, Integrated circuits, Dimensional measurement, Electromagnetic interference, Signal processing, Optical fibers, Magnetic materials, Millimeter waves, Microwaves, Antennas, Electrical measurement, Electric power, Progress report, Superconductors, Laser radiation, Abstracts.

This is the thirtieth 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 EEEL 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; Semiconductor Microelectronics; Signal Acquisition, Processing, and Transmission; Electrical Systems; Electromagnetic Interference.

200,673
PB92-191220 PC **A07**/MF **A02**
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Semiconductor Measurement Technology: Evaluating a Chip, Wafer, or Lot Using SUXES, SPICE, and STAT2.
Special pub. (Final).
J. C. Marshall, and R. L. Mattis. Apr 92, 147p NIST/SP-400/90
Also available from Supt. of Docs. as SN003-003-03167-4. See also PB86-228616, PB83-263764 and PB84-127455.

Keywords: *Integrated circuits, Chips(Electronics), Software tools, Computerized simulation, Computer programs, Oscillators, Fortran, Wafers, MOSFET, CMOS, *Circuit simulators, SPICE computer program, STAT2 computer program, SUXES computer program, KEYS computer procedure.

The computer procedure KEYS (linKing softwarE to analYze waferS) links SUXES (Stanford University eXtractor of modEl parameterS), SPICE (a Simulation Program with Integrated Circuit Emphasis), and STAT2. Given data points for individual devices, SUXES obtains the model parameters for SPICE. SPICE predicts the behavior of an individual device or an entire circuit. After analyzing each test chip on a wafer, STAT2 determines correlation coefficients and generates wafer maps of selected parameters. The wafer maps are valuable to the designer, modeler, and process engineer. The entire package accomplishes the following: (1) standardizes the technique of running SUXES and SPICE in an integrated mode; (2) simulates and plots the characteristic curves; (3) simulates and plots the results of an optional dynamic circuit (for example, a ring oscillator); (4) performs steps (2) and (3) for every test chip on each wafer; (5) summarizes the results from each chip, each wafer, and the lot; (6) rank-orders the model parameters for each wafer according to their correlation coefficients with respect to chosen circuit parameters; and (7) generates wafer maps of several quantities. A CMOS 19-stage ring oscillator is used to illustrate the capabilities of KEYS.

200,674
PB92-191246 PC **A03**/MF **A01**
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Methodology for the Computer-Aided Design of Silicon Micromachined Devices in a Standard CMOS Process.
J. C. Marshall, M. Parmeswaran, M. E. Zaghloul, and M. Gaitan. May 92, 31p NISTIR-4845
Prepared in cooperation with Simon Fraser Univ., Burnaby (British Columbia). School of Engineering Science, and George Washington Univ., Washington, DC. School of Engineering and Applied Science. Sponsored by Army Test Measurements and Diagnostic Equipment Activity, Redstone Arsenal, AL., and Navy Advance Test Equipment/Metrology Project, San Diego, CA.

Keywords: *Computer aided design, *Transducers, Chips(Electronics), Smart structures, Software tools, Silicon dioxide, Silicon, Aluminum, Pixels, CMOS, Magic technology file, Micromachining.

The methodology for implementing the design of silicon-micromachined devices in a standard CMOS foundry process is discussed, and a modified Magic technology file is introduced. The modified technology file is used to design silicon-micromachined devices and circuits that are fabricated using a standard CMOS foundry through the MOSIS service. An additional maskless etch in EDP is required to realize the micromechanical structures once chips are delivered. The modified technology file implements a layer that the authors call 'open' that consists of a combination of active area, contact cut, via, and glass opening. The open area exposes the silicon surface for an anisotropic etch procedure that creates suspended bridges of polysilicon or metal encapsulated in SiO2. Results from fabricated chips are included.

200,675
PB92-197342 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Elimination of Effects Due to Patterning Imperfections in Electrical Test Structures for Submicrometer Feature Metrology.
Final rept.
R. A. Allen, and M. W. Cresswell. 1992, 8p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Solid-State Electronics 35, n3 p435-442 1992.

Keywords: *Very large scale integration, *Integrated circuits, Alignment, Metrology, Reprints, Systematic errors, Test structures.

The paper describes the elimination of a substrate-dependent systematic error that was experienced in prior work on measuring the separation of parallel features with an electrical test structure with total errors less than 10 nm. The test structure was an enhancement of a sliding-wire voltage-dividing potentiometer which scaled the overall test structure geometry to obtain greater sensitivity. It also incorporated features to eliminate adverse effects of voltage tap- and bridge-linewidth scaling. The measurement algorithm that was developed provided the relative separations of sets of features of the 10 nm level. However, absolute measurements were offset by a quantity characteristic of the substrate for which they were extracted. The evidence suggested that these systematic errors were not caused by the primary pattern generation tool. As a result of observations, measurements and simulations, the paper attributes the substrate-characteristic systematic error to an orientation dependence of the quality of replication of certain features of the test structure. An alternative design and measurement algorithm is shown to be able to practically eliminate these errors.

200,676
PB92-197375 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Experimentally Verified Majority and Minority Mobilities in Heavily Doped GaAs for Device Simulations.
Final rept.
H. S. Bennett, J. R. Lowney, M. Tomizawa, and T. Ishibashi. 1992, 11p
Pub. in IEICE (Institute of Electronics, Information and Communication Engineers) Trans. Electron. E75-C, n2 p161-171 Feb 92.

Keywords: *Carrier mobility, Field effect transistors, Bipolar transistors, Born approximation, Gallium arsenides, Room temperature, Quantum mechanics, Phase shift, Scattering, Reprints.

Low-field mobilities and velocity versus electric field relations are among the key input parameters for drift-diffusion simulations of field-effect and bipolar transistors. The authors have calculated the majority electron and minority hole mobilities in GaAs at 300 K for donor densities between 5 x 10(sup 16) and 1 x 10(sup 19)/cc and the majority hole and minority electron mobilities for acceptor densities between 5 x 10(sup 16) and 1 x 10(sup 20)/cc. They have included all the important scattering mechanisms for GaAs: acoustic phonon, polar optic phonon, nonpolar optic phonon (holes only), piezoelectric, ionized impurity, carrier-carrier, and plasmon scattering. These results are important for device modeling because of the need to have reliable values for the minority mobilities and velocity-field relations.

200,677
PB92-197904 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
High Spatial Resolution Mapping of Resistivity Variations in Semiconductors.
Final rept.
J. J. Kopanski, J. R. Lowney, D. S. Miles, D. B. Novotny, and G. P. Carver. 1992, 11p
Pub. in Solid-State Electronics 35, n3 p423-433 1992.

Keywords: *Electrical resistivity, *Semiconductors, Probes(Electromagnetic), Electric contacts, Spatial resolution, Mapping, Variations, Silicon, Reprints, Spreading resistance.

A new approach to the mapping of resistivity variations in semiconductors uses probe sites provided by an array of lithographically defined contacts with a density of 60,000 sites/sq cm. One- or two-probe spreading resistance or four-point-probe resistance measurements can be made. Solutions of the Laplace equation 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 resolution of lateral variations in resistivity of 45 micrometers 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.

200,678
PB92-213529 PC **A08**/MF **A02**
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Semiconductor Measurement Technology: INSTANT-IGBT Network Simulation and Transient ANalysis Tool.
Special pub. (Final).
A. R. Hefner. Jun 92, 163p NIST/SP-400-88
Also available from Supt. of Docs. as SN003-003-03168-2. See also PB89-146880 and PB92-165612.

Keywords: *Bipolar transistors, *Computerized simulation, Equivalent circuits, Software tools, Dynamic models, MOSFET, Fortran, *Insulated gate bipolar transistors, INSTANT computer program, Circuit models, Ambipolar diffusion, Power transistors.

The IGBT (Insulated Gate Bipolar Transistor) is a power semiconductor device that has gained acceptance among power electronic circuit design engineers for motor drive and power converter applications.

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 IGBTs or other power semiconductor devices, circuit simulations are needed to examine how the devices affect the behavior of the circuit. However, the semiconductor device models available in most circuit simulators were originally intended to describe microelectronic devices and cannot adequately describe the characteristics of power devices. In the publication, a compact IGBT model suitable for incorporation in circuit simulators 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 systems of differential equations (state equations) that describe each component of the circuit, where the equations for the individual components are coupled by the circuit configuration. The publication also describes the automated measurement methods developed to extract the IGBT device model parameters from terminal electrical measurements.

200,679
PB92-217603 PC **A03**/MF **A01**
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Semiconductor Measurement Technology: Version 2.0 of the TXYZ Thermal Analysis Program: TXYZ20.
Special pub. (Final).
J. Albers. Jun 92, 35p NIST/SP-400/89
Also available from Supt. of Docs. as SN003-003-03169-1. See also PB90-269564 and PB88-184767.

Keywords: *Semiconductor devices, *Integrated circuits, *Thermal analysis, Fourier analysis, Thermal conductivity, Semiconductors, Steady state, Temperature distribution, Heat transmission, Computer programs, Fortran, TXYZ20 computer program, TXYZ computer program.

The TXYZ computer program has been used for a number of years for the thermal analysis of semiconductor devices and packages. The program makes use of the closed form, Fourier series solution of the steady-state heat flow equation for the general case of a rectangular three-layer structure with multiple heat sources on the top surface. TXYZ provides for the calculation of the temperature at any set of points in the structure and has proven useful for the determination of the steady-state temperature distribution of semiconductor chips and packages. The report presents TXYZ20 (TXYZ Version 2.0) which is a revised and updated version of the original TXYZ program. The TXYZ20 program incorporates more flexible handling of input data, assignment of positive or negative noninteger weights to the various heat sources or heat sinks, and improved 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 which have been made to it to obtain TXYZ20. The second part of the report contains a discussion of several examples of the running of the code. Several annotated input data files are presented 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.

200,680
PB92-237338 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Measurement for Controlling Electromigration in Metallization Interconnects: Today and Tomorrow.
Final rept.
H. A. Schafft, J. S. Suehle, and J. A. Lechner. 1992, 5p
Pub. in Proceedings of International Conference (6th) on Interconnection Technology in Electronics, Fellbach, FRG, February 18-20, 1992, p116-120.

Keywords: *Integrated circuits, *Circuit interconnections, *Electromigration, *Stress testing, Accelerated tests, Reliability(Electronics), Metallizing, Microelectronics, Statistical analysis, Reprints, SWEAT test.

There is a new and important use for accelerated stress tests such as are used to characterize electromigration in metallizations. It is to employ these measurement tools to identify and optimize the input parameters that affect the reliability of the product and thereby promote the implementation of a new approach to reliability for the semiconductor industry -- the building-in 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 building-in reliability approach. In particular, the measurement procedure and analysis, extrapolations to use conditions, measurement and interpretation pitfalls, and ways to reduce test time by censoring are discussed.

200,681
PB92-237551 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Experimental Comparison of Measurement Techniques to Extract Si-SiO2 Interface Trap Density.
Final rept.
S. C. Witczak, J. S. Suehle, and M. Gaitan. 1992, 11p
Pub. in Solid-State Electronics 35, n3 p345-355 1992.

Keywords: *MOSFET, Silicon dioxide, Electron traps, Hole traps, Measurement, Comparison, Reprints, *Interface traps.

For the first time, five methods of measuring Si-SiO2 interface trap densities were compared experimentally on three otherwise identical MOSFETs which were radiation-stressed so as to induce different levels of interface trap densities. The results show that when sources of error and limitations are taken into account, these methods are capable of yielding interface trap density estimates which are in good quantitative agreement. Furthermore, the change in measured interface trap densities with radiation is independent of the method used. A comprehensive review of the methods is presented.

200,682
PB92-237569 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Structure of the Si(111) square root of 3x square root of 3-Sb Interface by Surface X-ray Absorption Fine Structure and Photoemission.
Final rept.
J. C. Woicik, T. Kendelewicz, K. E. Miyano, C. E. Bouldin, P. L. Meissner, and P. Pianetta. 1991, 6p
Pub. in Jnl. of Vacuum Science and Technology A 9, n3 p1956-1961 May/Jun 91.

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 core level photoelectron spectroscopy have been used to investigate the local bonding structure of the Sb/Si(111) interface. We find that the adsorption of 1 monolayer (ML) of Sb completely eliminates the surface components of the Si 2p core level spectrum. The Sb induced Si 2p interfacial core level has been found to be shifted 0.20 + or - 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 Sb shell is 2.1 + or - 0.3 Sb atoms at 2.86 + or - 0.02 A and 2.0 + or - 0.4 Si atoms at 2.66 + or - 0.03 A. Together, these results indicate that Sb trimers occupy the three fold atop sites of the Si(111) surface where each Sb atom is bonded to two Si atoms in a modified bridge configuration.

200,683
PB93-116424 PC **A04**/MF **A01**
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Precision Engineering Div.
Antireflecting-Chromium Linewidth Standard, SRM 473, for Calibration of Optical Microscope Linewidth Measuring Systems. Standard Reference Materials.
Special pub. (Final).
C. F. Vezzetti, R. N. Varner, and J. E. Potzick. Sep 92, 52p NIST/SP-260/119
Also available from Supt. of Docs. as SN003-003-03174-7. See also PB92-149798.

Keywords: *Integrated circuits, *Dimensional measurement, *Optical microscopes, *Line width, *Calibrating, *Standards, Antireflection coatings, Process control, Photomasking, Uncertainty, Precision, Accuracy, Chromium, *Standard reference materials.

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. Raggedness and nonvertical walls along the edges add to the uncertainty of the measurement. Standard Reference Material SRM 473 was developed for use in calibrating optical microscopes for measuring linewidths in the range of 0.5 to 30 micrometers on antireflecting-chromium photomasks. The SRM is described, and instructions on its use and precautions concerning its care and handling are given. The NIST linewidth measuring system and the procedures used to calibrate the SRM 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.

200,684
PB93-120715 PC **A03**/MF **A01**
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Electronics and Electrical Engineering Laboratory Technical Publications Announcements Covering Laboratory Programs, January to March 1992, with 1992/1993 EEEL Events Calendar.
J. A. Gonzalez. Oct 92, 21p NISTIR-4945
See also PB92-133032 and PB93-120723.

Keywords: *Microelectronics, *Metrology, Integrated circuits, Dimensional measurement, Signal processing, Electromagnetic interference, Optical fibers, Magnetic materials, Millimeter waves, Electrical measurement, Photodetectors, Superconductors, Electric power, Photonics, Microwaves, Progress report, Superlattices, Abstracts, Fiber optic sensors.

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 (EEEL). This issue of the EEEL Technical Publication 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 (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Electronics and Electrical Engineering Laboratory Technical Publications Announcements Covering Laboratory Programs, October to December 1991, with 1992/1993 EEEL Events Calendar.
J. A. Gonzalez. Sep 92, 34p NISTIR-4929
See also PB92-181239 and PB93-120715.

Keywords: *Microelectronics, *Metrology, Integrated circuits, Dimensional measurement, Electromagnetic interference, Signal processing, Optical fibers, Magnetic materials, Millimeter waves, Photodetectors, Microwaves, Antennas, Electrical measurement, Electric power, Integrated optics, High temperature superconductors, Progress report, Abstracts, Fiber optic sensors.

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 (EEEL) (until February 1991, the Center for Electronics and Electrical Engineering). This issue of the EEEL Technical Publication Announcements covers the fourth quarter of calendar year 1991. 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.

200,686
PB93-125508 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

ELECTROTECHNOLOGY

Semiconductor Devices

Physical Basis for Bandgap Narrowing: Roles of Carriers and Dopant Ions.
Final rept.
J. R. Lowney. 1989, 10p
Pub. in Proceedings of International Workshop on the Physics of Semiconductor Devices (5th), New Delhi, India, December 11-16, 1989, 10p.

Keywords: *Energy gap, Semiconductor doping, Doped materials, Charge carriers, Gallium arsenides, 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 injected or depleted regions, where quasi-neutrality is violated. This work shows what effects occur in such regions and demonstrates the need to revise device models so that bandgap narrowing is treated as an explicit function of both dopant and carrier density.

200,687
PB93-125730 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Test Structures at NIST.
Final rept.
R. L. Mattis. 1992, 2p
Pub. in SRC Newsletter 10, n4 p4-5 Apr 92.

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 current work are (1) to accommodate 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.

200,688
PB93-126084 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Comparison of On-Wafer Calibrations.
Final rept.
D. F. Williams, R. B. Marks, and A. Davidson. 1992, 14p
Pub. in Proceedings of ARFTG Conference Digest (38th), San Diego, CA., December 5-6, 1991, p68-81 1992.

Keywords: *Electrical measurement, Verification, Calibration, Comparison, Accuracy, Wafers, Reprints, Scattering parameters, Automatic network analyzers.

A powerful new verification technique determines the measurement accuracy of scattering parameter calibrations. The technique determines the relative reference impedance, reference plane offset, and the worst-case measurement deviations of any calibration from a benchmark calibration. The technique is applied to several popular on-wafer scattering parameter calibrations, and the deviations between those calibrations and the thru-reflect line calibration are quantified.

200,689
PB93-129492 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Observation of Rebound in Power MOSFETs.
Final rept.
G. Singh, K. F. Galloway, and T. J. Russell. 1987, 5p
See also PB90-192675.
Pub. in Proceedings of Conference on Natural Space Radiation and VLSI Technology, January 20-21, 1987, NASA CP-10023, pIII-10-1-III-10-5.

Keywords: *Field effect transistors, *MOSFET, Temperature dependence, Radiation effects, Annealing, Reprints, Power transistors, Threshold rebound.

Nonradiation-hardened n-channel power MOSFETs were irradiated under a positive gate bias. 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
PB93-130250 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Wire Bonding-Towards 6sigma Yield and Fine Pitch.
Final rept.
G. G. Harman. 1992, 8p
Pub. in Proceedings of Electronic Components and Technology Conference (42nd), San Diego, CA., May 18-20, 1992, p903-910.

Keywords: *Semiconductor devices, *Electronic packaging, Chips(Electronics), Metallizing, 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 as well as the solutions required to wire 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 reported. Almost every aspect of fine-pitch bonding requires more planning and coordination and is more expensive to achieve than bonding at normal pitch.

200,691
PB93-130300 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Reduction of DX Centers in Superlattice Alloy-Like Material High Electron Mobility Transistors.
Final rept.
W. F. Tseng, J. G. Pellegrino, J. S. Kim, R. Thurber, J. Comas, N. Papanicolou, and S. Prokes. 1992, 4p
Pub. in Jnl. of the Electrochemical Society 139, n4 p1219-1222 Apr 92.

Keywords: *High electron mobility transistors, Molecular beam epitaxy, Aluminum gallium arsenides, Aluminum 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(s)) GaAs/AlAs superlattice alloy-like material (SLAM) for Si-doped AlGaAs layers in conventional high electron mobility transistor (HEMT) structures has been demonstrated. Such a short period SLAM HEMT still preserves its field effect transistor characteristics as compared with the conventional HEMT. The shifts of threshold voltages and amounts of 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
PB93-135325 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Measurement, Use, and Interpretation of the Temperature Coefficient of Resistance of Metallizations.
Final rept.
H. A. Schafft, and J. S. Suehle. 1992, 8p
See also PB92-117282.
Pub. in Solid State Electronics 35, n3 p403-410 1992.

Keywords: *Circuit interconnections, *Metallizing, *Microelectronics, Reliability(Electronics), Temperature dependence, Metal films, Thin films, Electromigration, Measurement, Aluminum, 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 electromigration accelerated stress tests, a key element in characterizing the metallization. It can be used as a monitor for 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 problems involved in the measurement and use of TCR. This paper is also intended to complement the JEDEC Standard in preparation on the temperature coefficient of resistance of metallization lines.

General

200,693
PB92-132976 PC **A14**/MF **A03**
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Automatic Waveform Analysis and Measurement System User Manual.
S. M. Chesnut, and N. G. Paulter. Dec 91, 323p
NISTIR-3978
See also PB83-143313. Sponsored by Redstone Arsenal, AL.

Keywords: *Electric pulses, *Electrical measurement, Picosecond 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
PB92-144815 Not available NTIS
National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Statistical Engineering Div.
Probability and Random Processes for Electrical Engineering: Book Review.
Final rept.
S. Leigh. 1991, 2p
Pub. in Technometrics 33, n3 p372-373 Aug 91.

Keywords: *Electrical engineering, *Probability theory, *Random processes, Reprints, Book reviews.

The article consists of a book review of 'Probability and Random Processes for Electrical Engineering'.

200,695
PB92-144864 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Calculating the Parameters of Full Lightning Impulses Using Model-Based Curve Fitting.
Final rept.
T. R. McComb, and J. E. Lagnese. 1991, 9p
See also PB89-186423.
Pub. in IEEE (Institute of Electrical and Electronic Engineers) Transactions on Power Delivery 6, n4 p1386-1394 Oct 91.

Keywords: *High voltage, *Lighting, Electrical measurement, Electric 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. Non-linear regression, based on simple models, is 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 (EEEL), Gaithersburg, MD. Electricity Div.

Observation of Partial Discharge in Hexane Under High Magnification.
Final rept.
K. L. Stricklett, C. Fenimore, E. F. Kelley, H. Yamashita, M. O. Pace, T. V. Blalock, A. L. Wintenberg, and I. Alexeff. 1991, 7p
See also PB90-217951. Sponsored by Department of Energy, Washington, DC.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electrical Insulation 26, n4 p692-698 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 shadow photography under the application of dc voltages. A nonuniform field geometry is employed and the growth of cavities associated with partial discharges at a point cathode is photographed at 200x magnification. 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 (EEEL), Boulder, CO. Electromagnetic Fields Div.
Time-Domain Method for Characterizing the Reflection Coefficient of Absorbing Materials from 30 to 1000 MHz.
Final rept.
S. Tofani, A. Ondrejka, and M. Kanda. 1991, 7p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electromagnetic Compatibility 33, n3 p234-240 Aug 91.

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 difference 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 (EEEL), Gaithersburg, MD. Electricity Div.
Stochastic Properties of Partial-Discharge Phenomena.
Final rept.
R. J. Van Brunt. 1991, 47p
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 p902-948 Oct 91.

Keywords: *Electric discharges, Electric corona, Gas discharges, Avalanche 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 in such properties as pulse amplitude, shape, and time of occurrence. Previously published work concerned with the theory and measurement of the stochastic behavior of PD 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 probability distributions for pulse occurrence times and pulse amplitudes are discussed. Consideration is also given to special problems associated with the 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 (EEEL), Gaithersburg, MD. Electricity Div.
Influence of a Dielectric Barrier on the Stochastic Behavior of Trichel-Pulse Corona.
Final rept.
R. J. Van Brunt, M. Misakian, S. V. Kulkarni, and V. K. Lakdawala. 1991, 11p
See also PB91-134213. 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, Electrical insulation, Barrier materials, Dielectrics, Electrodes, Air, Reprints, Polytetrafluorethylene, Trichel 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 solid circular PTFE dielectric samples of varying diameter and position relative to the point electrode. This behavior is revealed from measurements of conditional and unconditional corona pulse-amplitude and pulse-time-separation distributions. The results indicate that the presence of a dielectric surface on the anode effectively reduces the electric field at the point electrode, but does not affect the occurrence of Trichel pulses, provided 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 **A08**)
National Inst. of Standards and Technology, Boulder, CO.
Simulators of Superconductor Critical Current: Design, Characteristics, and Applications.
L. F. Goodrich, A. N. Srivastava, and T. C. Stauffer. 1991, 22p
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 extremely nonlinear voltage-current 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 could significantly benefit superconductor measurement applications that require high-precision quality assurance.

200,701
PB92-159870 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Resistively-Tapered-Dipole Electric-Field Probes up to 40 GHz.
Final rept.
J. Randa, M. Kanda, and R. D. Orr. 1991, 2p
Pub. in Proceedings of International Symposium on Electromagnetic Compatibility, Cherry Hill, NJ., August 12-16, 1991, p265-266.

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 tapered dipole (RTD) probes developed for frequencies up to 18 GHz. Those probes used 8-mm tapered dipoles. In the work the authors have used 6-mm, 4-mm, and 2-mm dipoles to extend the frequency range. Because the new probes are isotropic, have relatively flat frequency response, and have a response which drops off outside 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 (EEEL), Boulder, CO. Electromagnetic Fields Div.
Thermo-Optic Designs for Electromagnetic-Field Probes for Microwaves and Millimeter Waves.
Final rept.
J. Randa, M. Kanda, and R. D. Orr. 1991, 10p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electromagnetic Compatibility 33, n3 p205-214 Aug 91.

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 probe uses an optically sensed thermometer 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. One of the designs displays a flat frequency response above 30 GHz and a sensitivity of 38 V/m. Improvements are identified in the design that should significantly increase the sensitivity and improve the low-frequency response.

200,703
PB92-164672 PC **A03**/MF **A01**
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Electronics and Electrical Engineering Laboratory Technical Progress Bulletin Covering Laboratory Programs, July to September 1991, with 1992 EEEL Events Calendar.
J. A. Gonzales. Feb 92, 39p NISTIR-4726
See also PB92-133032.

Keywords: *Electromagnetic interference, *Microelectronics, *Electrooptics, *Metrology, Integrated circuits, Semiconductor devices, High temperature superconductors, Signal processing, Millimeter waves, Magnetic materials, Antennas, Lasers, Microwaves, Magnetic materials, Optical fibers, Progress report, Abstracts, Fiber optic sensors.

This is the thirty-sixth 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 EEEL Technical Progress Bulletin covers the third quarter of calendar year 1991. Abstracts are provided by technical area 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; magnetics; microwave; optical fibers; semiconductors; and superconductors.

200,704
PB92-165273 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Proposed TEM Driven Mode-Stirred Chamber for Large System Radiated EMC/V Testing, 10 KHz - 40 GHz.
Final rept.
M. L. Crawford, and B. F. Riddle. 1991, 7p
Sponsored by Army Electronic Proving Ground, Fort Huachuca, AZ.
Pub. in Proceedings of International Zurich Symposium and Technical Exhibition on Electromagnetic Compatibility (9th), Zurich, Switzerland, March 12-14, 1991, p431-437.

Keywords: *Electromagnetic compatibility, *Reverberation chambers, *Test facilities, Electromagnetic 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 susceptibility/vulnerability (EMC/V) testing over the frequency range of 10 kHz to 40 GHz. 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 transmission line-driven, mode-stirred chamber. The anticipated test volume is 7 m x 16 m x 30 m. TEM test fields are generated in the chamber at frequencies below multimode cutoff, and mode-stirred test fields are generated at frequencies above multimode cutoff. The paper discusses a proposed design, advantages and limitations, the theoretical basis for the concept, and the experimental approach for using such a facility. Results are given for an evaluation of a model chamber, 1/10 scale at (1.3 m x 2.4 m x 3.9 m).

200,705
PB92-165497 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Precision Dielectric Measurements Using a Mode-Filtered Cylindrical Cavity Resonator.
Final rept.
R. G. Geyer, C. M. Weil, and W. A. Kissick. 1990, 2p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Ottawa, Canada, June 11-14, 1990, p174-175.

Keywords: *Cavity resonators, Helical configuration, Cylindrical configuration, Dielectric materials, Low noise, X band, Permittivity, Uncertainty, Reprints, *Dielectric measurements.

A 60 mm diameter cylindrical cavity resonator used at NIST for high-accuracy permittivity measurements on low-loss materials is described. The cavity operates at X-band in the TE(01p) mode and is of the mode-filtered type with helically wound walls. Measurement data on representative dielectric materials are presented together with an uncertainty analysis.

200,706
PB92-165877 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Electromagnetic Fields with Arbitrary Wave Impedances Generated Inside a TEM Cell.
Final rept.
M. T. Ma, E. B. Larsen, and M. L. Crawford. 1991, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electromagnetic Compatibility 33, n4 p358-362 Nov 91.

Keywords: *Electromagnetic fields, Electromagnetic susceptibility, Electromagnetic interference, Plane waves, Reprints, TEM cells.

Standard electromagnetic fields having a wide range of chosen wave impedances, and generated inside a TEM cell for rf susceptibility testing, have many potential applications. The authors propose to achieve the desired type of field by exciting one port of the TEM, as usual, but terminating the other port with an intentionally unmatched load impedance. Experimental results together with necessary theoretical justifications are presented.

200,707
PB92-171594 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Electron Attachment to SF6 and SO2.
Final rept.
J. K. Olthoff, R. J. Van Brunt, H. X. Wan, and J. H. Moore. 1991, 3p
See also AD-717 147. Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in Proceedings of Program of the Joint Symposium on Electron and Ion Swarms and Low Energy Electron Scattering, Queensland, Australia, July 18-20, 1991, p25-27.

Keywords: *Sulfur hexafluoride, *Sulfur dioxide, *Electron attachment, Total cross sections, Electron scattering, Comparison, Reprints, Gaseous dielectrics.

Total electron scattering cross sections and dissociative attachment cross sections are reported for SF6 and SO2. Comparisons are made with previous measurements.

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.
J. K. Olthoff, R. J. Van Brunt, H. Wan, J. H. Moore, and J. A. Tossell. 1991, 7p
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in Proceedings of International Symposium on Gaseous Dielectrics (6th), Knoxville, TN., September 23-27, 1990, p19-25 1991.

Keywords: *Sulfur hexafluoride, *Sulfur fluorides, *Electric discharges, Total cross sections, Milli eV range, EV range 1-10, EV range 10-100, Electron scattering, Electron attachment, Electron energy, Reprints, Gaseous dielectrics.

Using an electron transmission spectrometer, the absolute total dissociative attachment cross sections of SF6 and of its decomposition products have been measured as a function of electron energy over the range of 0.2 eV to 5.0 eV and absolute total electron scattering cross sections have been measured from 0.2 eV to 12 eV. These results are presented along with previous data where available.

200,709
PB92-171693 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
S2F10 Formation by Electrical Discharges in SF6: Comparison of Spark and Corona.
Final rept.
I. Sauers, G. Harman, J. K. Olthoff, and R. J. Van Brunt. 1991, 9p
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in Proceedings of International Symposium on Gaseous Dielectrics (6th), Knoxville, TN., September 23-27, 1990, p553-561 1991.

Keywords: *Sulfur hexafluoride, *Sulfur fluorides, *Electric discharges, *Corona discharges, Electric sparks, Water vapor, Moisture, Surfaces, Reprints, Gaseous dielectrics.

Among the SF6 by-products of electrical discharges that have been investigated S2F10 is probably the least understood (physical, chemical, and biological properties) and the most toxic. Its production in electrical discharges has been 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 known sulfur-fluorine chemistry are shown to yield reasonable agreement with experimental data. The authors show S2F10 is formed in electrical discharges that occur in compressed-gas insulated equipment and address questions concerning effects of moisture and surface conditions.

200,710
PB92-171735 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Influence of Phase-to-Phase Memory Propagation on the Stochastic Behavior of AC-Generated Partial Discharges.
Final rept.
R. J. Van Brunt, and E. W. Cernyar. 1991, 8p
See also PB91-237644. Sponsored by Department of Energy, Washington, DC. Office of Energy Storage and Distribution.
Pub. in Proceedings of Annual Report - Conference on Electrical Insulation and Dielectric Phenomena, Knoxville, TN., October 20-23, 1991, p589-596.

Keywords: *Electric discharges, Stochastic processes, Static electricity, Alternating current, Dielectrics, Reprints, Partial discharges, Polytetrafluoroethylene.

From measurements of phase-restricted conditional partial-discharge amplitude and phase-of-occurence 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. 'Memory' associated with charge deposited on the dielectric surface by preceeding discharge events is found to have a significant effect in determining the most probable phase-of-occurence and amplitudes of subsequent partial-discharge pulses. It is found, for example, that the larger amount of charge deposited during partial-discharge activity on one half cycle, the sooner will be the time (or phase) of occurence 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.
Influence of Memory on the Statistics of Pulsating Corona.
Final rept.
R. J. Van Brunt, and S. V. Kulkarni. 1991, 7p
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in Proceedings of the International Symposium on Gaseous Dielectrics (6th), Knoxville, TN., September 23-27, 1990, p383-389 1991.

Keywords: *Corona discharges, Stochastic processes, Mixtures, Oxygen, Neon, Statistics, Reprints, Trichel pulses.

In order to develop a theory that accounts for observed pulse-time-separation and pulse-amplitude distributions for pulsating corona discharges in gases, it is necessary to consider the effects of residuals from prior discharge pulses, such as ion space charge and metastables, on the development of subsequent pulses. Such 'memory effects' are shown here to be significant in controlling the statistics of Trichel-pulse corona in electro-negative gases. The memory effects are quantitatively assessed from a direct measurement of a set of conditional pulse-amplitude and pulse-time-separation distributions. The effectiveness of the method in providing a more complete description and better understanding of the stochastic behavior of corona is illustrated here for the case of self-sustained Trichel pulses in a neon-oxygen gas mixture. The amplitude and time of initiation of any discharge pulse is found to be strongly dependent on the amplitude of the previous pulse as well as on the time that has elapsed since that pulse occurred. Memory is found to extend back beyond the most recent pulse so that the process is distinctly non-Markovian.

200,712
PB92-175454 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Measurement Program Compares Automatic Vector Analyzers.
Final rept.
R. M. Judish, and J. G. Burns. 1991, 4p
Pub. in Microwaves and RF, p203-206 May 91.

Keywords: *Network analyzers, Electrical measurement, Interlaboratory comparisons, Uncertainty, Reprints, *Automatic network analyzers, Measurement Comparison Program, MCP program.

The Automated Radio Frequency Techniques Group (ARFTG) has developed a program that provides ARFTG members the opportunity to compare the performance of their Automatic Network Analyzers (ANAs) to that of their peers. The program 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 Array Systems.
Final rept.
R. Steiner, and S. Stahley. 1991, 5p
Pub. in Proceedings of NCSL (National Computer Systems Laboratory) Workshop and Symposium, Albuquerque, NM., August 18-22, 1991, p205-209.

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 various array systems relative to the national SI Volt representation at the National Institute of Standards and Technology (NIST) as well as on calibrations involving a new multi-Zener reference standard. Preliminary measurements from five other laboratories show that all agree with NIST to within 0.045 ppm with a maximum random uncertainty of 0.015 ppm (1sigma).

200,714
PB92-175934 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
PTB: NIST Bilateral Comparison of Microwave Noise Power in Coaxial Transmission Line.
Final rept.
D. F. Wait, G. J. Counas, W. Kessel, and F. I. Buchholz. 1991, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement 40, n2 p449-454 Apr 91.

Keywords: *Transmission lines, Interlaboratory comparisons, Coaxial cables, Microwaves, 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 intercomparison is of particular metrological interest as both laboratories have independently developed coaxial primary thermal noise standards using different technologies: a hot standard at PTB and cold standards at NIST. Different types of comparison radiometers are operating at each laboratory: a total power radiometer at NIST 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 (EEEL), Boulder, CO. Electromagnetic Fields Div.
Phase Characteristics and Time Responses of Unknown Linear Systems Determined from Measured CW Amplitude Data.
Technical note.
M. T. Ma, and J. W. Adams. Nov 91, 26p NIST/TN-1349
Also available from Supt. of Docs. as SN003-003-03151-8.

Keywords: *Linear systems, Hilbert transformations, Laplace transformation, Continuous waves, Transfer 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 pulsed excitation is the greatest during the initial period of excitation.

200,716
PB92-197516 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Improvements in Dielectric Measurements with a Resonant Cavity.
Final rept.
A. J. Estin, and M. D. Janezic. 1991, 7p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Instrumentation and Measurement Technology Conference Enhancing Productivity with Instrumentation and Measurement Technologies, Atlanta, GA., May 14-16, 1991, p573-579.

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, measurement 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 (EEEL), Boulder, CO. Electromagnetic Fields Div.
Electromagnetic Properties of Materials Program at NIST.
Final rept.
C. M. Weil, and W. A. Kissick. 1991, 5p
Pub. in Proceedings of IEEE (Institute for Electrical and Electronics Engineers) Instrumentation and Measurement Technology Conference Enhancing Productivity with Instrumentation and Measurement Technologies, Atlanta, GA., May 14-16, 1991, p626-630.

Keywords: Magnetic materials, Dielectrics, Electrical measurement, Microwave frequencies, Electromagnetic properties, Metrology, Standards, Reprints, *EPM program, US NIST.

The Electromagnetic Properties of Materials (EPM) program at 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 measurement techniques being used at NIST for characterizing dielectric and magnetic materials at microwave frequencies.

200,718
PB92-205350 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Two-Fluid Measurements on Thin Films.
Technical note (Final).
F. I. Mopsik. May 92, 26p NIST/TN-1294
Also available from Supt. of Docs. as SN003-003-03158-5. Errata sheet inserted. Sponsored by Defense Nuclear Agency, Washington, DC.

Keywords: *Polymeric films, *Film thickness, *Dielectric properties, *Electrical insulation, Dimensional measurement, Error analysis, Thin films, Permittivity, Computer programs, Two fluid measurement, Fortran 77 programming language.

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 non-contacting 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 second fluid are evaluated. The specifications of both the cell and the second fluid are examined. For the cell, it must be stable to good accuracy with handling, settable to small gaps and have a well-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 (EEEL), Boulder, CO. Electromagnetic Fields Div.
Three-Loop Method for Determining the Radiation Characteristics of an Electrically Small Source.
Final rept.
M. Kanda, and D. A. Hill. 1992, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electromagnetic Compatibility 34, n1 p1-3 Feb 92.

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 located at the center of three orthogonal loop antennas, each terminated with identical loads at diametrically opposite points. The electrically 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
PB92-237270 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Scanning Confocal Microscopy for Measuring Diameter and Linewidth: Numerical Modelling.
Final rept.
G. Obarski, T. Drapela, and M. Young. 1992, 12p
See also PB92-165943.
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Time-Resolved Laser Spectroscopy in Biochemistry III, Los Angeles, CA., January 20-22, 1992, v1640 p761-772.

Keywords: *Dimensional measurement, *Line width, *Diameters, Error analysis, Measurement, Reprints, Scanning conformal microscopy, Circular edges, Image profiles.

We calculated the image of a circular edge as determined by a scanning confocal microscope with fully coherent illumination. In scalar theory, the quarter-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 from locating the quarter-intensity point for diameters as small as 1 resolution limit. The error will be even greater if the object is scanned off-axis. For example, the 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 (EEEL), Boulder, CO. Electromagnetic Fields Div.
Standard Test Method for Measuring the Electromagnetic Shielding Effectiveness of Planar Materials.
Final rept.
J. W. Adams. 1990, 9p
See also PB89-161525.
Pub. in Annual Book of ASTM Standards (1990) 10.02, p1-9 Jul 90.

Keywords: *Electromagnetic shielding, Electrical measurement, Planar structures, Test methods, Effectiveness, Standards, Reprints.

The American Society of Testing and Materials (ASTM) released Standard D4935-89, Standard Test Method for Measuring the Electromagnetic Shielding Effectiveness of Planar Materials, in November, 1989. Some background efforts of ASTM Committee D.09.12.14 to accomplish this are reviewed, 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 numerous others. 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 SN003-003-03074-1 Sponsored by Aerospace Guidance and Metrology Center, Newark AFS, OH.

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 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.

ENERGY

Electric Power Transmission

200,723

PB92-159664 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Coordinating Cascaded Surge Protection Devices: High-Low versus Low-High.
Final rept.
J. S. Lai, and F. D. Martzloff. 1991, 8p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Industry Applications Society Annual Meeting, Dearborn, MI., September 28-October 4, 1991, v2 p1-8.

Keywords: *Cascaded elements, *Circuit protection, *Surges, Reliability(Electronics), Varistors, Standards, Electric fuses, Coordination, Reprints, Fuse blowing.

Cascading surge protection devices located at the service entrance of a building and near the sensitive equipment is intended to ensure that each device shares the surge stress in an optimum manner to achieve reliable protection of equipment against surges impinging from the utility supply. However, depending upon the relative clamping voltages of the two devices, their separation distance, and the waveform of the impinging surges, the coordination may or may not be effective. The paper provides computations with experimental verification of the energy deposited in the devices for a matrix of combinations of these three parameters. Results show coordination to be effective for some combinations, and ineffective for some others, a finding that should reconcile contradictory conclusions reported by different authors making different assumptions. From these results, improved coordination can be developed by application standards writers and system designers.

200,724

PB92-159698 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Transients Are Here to Stay - Learn and Live with Them.
Final rept.
F. D. Martzloff. 1991, 1p
Pub. in Proceedings of International Zurich Symposium and Technical Exhibition on Electromagnetic Compatibility (9th), Zurich, Switzerland, March 12-14, 1991, p497.

Keywords: *Electrical transients, *Surges, Electromagnetic compatibility, Circuit protection, Standards, Reprints.

This is an introductory paper to the 1991 EMC Zurich Symposium Session on 'Power and Data Line Transients.'

200,725

PB92-159706 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Cascading Surge-Protective Devices: Coordination versus the IEC 664 Staircase.
Final rept.
F. D. Martzloff, and J. S. Lai. 1991, 8p
Pub. in Proceedings of International Conference on Power Quality (1st): End-Use Applications and Perspectives, Paris, France, October 15-18, 1991, p191-198.

Keywords: *Cascaded elements, *Circuit protection, *Surges, Reliability(Electronics), Varistors, Standards, Electric fuses, Coordination, Reprints.

Cascading two or more surge-protective devices located respectively at the service entrance of a building and near the sensitive equipment is intended to ensure that each device shares the surge stress in a manner commensurate with its rating, to achieve reliable protection of equipment against surges impinging from the utility supply as well as internally generated surges. However, depending upon the relative clamping voltages of the two devices, their separation distance, and the waveform of the impinging surge, coordination may or may not be effective. The paper reports computations confirmed by measurements of the energy deposited in the devices for combinations of these three parameters.

200,726

PB93-118131 PC **A05**/MF **A01**
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Research for Electric Energy Systems: An Annual Report.
W. E. Anderson. Jun 92, 87p NISTIR-4931
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.

Keywords: *Electrical insulation, *Electric discharges, *Electrical measurement, Dielectric breakdown, Breakdown(Electronic threshold), Electric corona, Magnetic measurement, Magnetic fields, Sulfur hexafluoride, Sulfur fluorides, Power lines, Electrooptics, Transients, Progress report, Partial discharges.

The report documents the technical progress in the four investigations which make up the project 'Support of Research Projects for Electrical Energy Systems', Department of Energy Task Order Number 137, funded by the US Department of Energy and performed by the Electricity Division of the National Institute of Standards and Technology (NIST). The first investigation is concerned with the measurement of magnetic fields in support of epidemiogical and in vitro studies of biological field effects. The second investigation is concerned with two different activities: the production of S2F10 in negative corona in SF6 and the measurement of electron scattering and dissociative electron attachment cross sections for SF6 and its electrical by-products. The third investigation is also concerned with two different activities: several liquids that are currently used or have potential for use as high voltage dielectrics are studied using conventional impulse breakdown measurement techniques and high-speed photography and advances in partial discharge measurement techniques are presented. The last investigation is concerned with the evaluation and improvement of methods for measuring fast transients in electrical power systems such as might be associated with an electromagnetic impulse.

Energy Use, Supply, & Demand

200,727

PB92-175876 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Electricity in the Year 2000.
Final rept.
R. Turgel. 1991, 5p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Technical Activities Board (TAB), Mexico City, Mexico, October **3**, 1991, p1-5.

Keywords: *Electric power, *Energy demand, Projection series, Electricity, Energy management, Reprints.

Demand for electricity is predicted to rise at a rate higher than that of the creation of new generating capacity. Projections suggest that a shortfall of 100 million kilowatts may be reached by the year 2000. It is likely that a variety of measures including regional interchange of power, load management, more efficient use of power, and co-generation may be able to alleviate the projected shortfall.

Fuel Conversion Processes

200,728

PB92-193200 PC **A03**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
Chemical Fundamentals of Coal Thermolysis, Final Report, May 1, 1988-May 31, 1991.
S. E. Stein. May 92, 21p GRI-92/0172
Contract GRI-5088-260-1638
See also PB91-161299. Prepared in cooperation with West Virginia Univ., Morgantown. Sponsored by Gas Research Inst., Chicago, IL.

Keywords: *Coal gasification, Reaction kinetics, Ethyl benzene, Anisole, Chemical reactions, Charring, Combustion, Free radicals, Chemical reactivity, Surface properties, *Thermolysis.

The report presents results and implications of model compound studies done for the purpose of elucidating reaction mechanisms in the organic chemistry of coal thermolysis and gasification. Since coal and char are composed primarily of aromatic and polycyclic aromatic units, studies focussed on their reactions. Further, to ensure general applicability of results, studies were designed to provide insight at the molecular level of detail. Experiments in the liquid phase at high temperatures determined multistep mechanisms for hydrogen transfer, bond formation and bond cleavage. Gas-phase studies measured rates for single-step bond cleavage and bond formation events, emphasizing effects of substituents. Certain coal-related substituents were found to cause a significant weakening of bonds, implicating them as initiators of reaction in both coal processing and coalification. Theoretical studies established quantitative structure/reactivity relations for both free radical and ionic reactions of polycyclic aromatic molecules of arbitrary size. Collectively, these results provide a more realistic view of the molecular events underlying the thermal chemistry of coal.

Fuels

200,729

DE92015581 PC **A01**/MF **A01**
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Chemical Technology.
Structure of a burning n-heptane spray generated from a pressure-jet atomizer.
C. T. Avedisian, C. Presser, A. K. Gupta, and H. G. Semerjian. 1988, 5p CONF-881215-7
Contract AI01-86CE90213
1988 Fall technical meeting of the Eastern states section of the Combustion Institute: Chemical and Physical Processes in Combustion, Clearwater Beach, FL (United States), 5-7 Dec 1988. Sponsored by Department of Energy, Washington, DC.
Portions of this document are illegible in microfiche products.

Keywords: *Heptane, *Atomization, *Combustion Kinetics, *Sprays, *Meetings, Combustion, Droplets, Flame Propagation, Flames, Kerosene, Liquid Fuels, EDB/400800, EDB/025000.

The combustion of liquid sprays is the central component of the operation of most energy conversion devices which used liquid fuels. In addition, an understanding of liquid spray combustion is becoming increasingly important for the disposal of liquid hazardous wastes within spray fired and rotary kiln incinerators. Central to our ability to efficiently and cleanly incinerate such wastes is an understanding of the qualitative and quantitative characteristics of the internal structure of sprays. The present work was undertaken to study the structure of an n-heptane flame. The intent was to observe both the exterior and interior features of the burning spray over a range of swirl conditions. Previous investigations performed with kerosene flames revealed the presence of an intense luminous yellow zone which extended over nearly the entire 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 region of relatively low luminosity which extends over the upstream portion of the spray flame. The study of heptane may provide data for validation of fundamental models of spray combustion, because of the availability of the physical properties of heptane. The importance of observing the internal structure of a burning spray resides in the information which can be obtained about such parametric effects as swirl and nozzle type on the size and spatial distributions of the droplets, droplet trajectories, and vapor flow field. This information can be used as guidelines for more quantitative studies of spray structure via such nonintrusive, techniques as laser velocimetry and light scattering methods obtained. The advantage of studying burning sprays is to observe the spray characteristics under realistic conditions.

200,730
DE92015582 PC **A01**/MF **A01**
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Chemical Technology.
Structure of a swirl-stabilized kerosene spray flame.
C. Presser, A. K. Gupta, and H. G. Semerjian. 1990, 4p CONF-901266-1
Contract AI01-86CE90213
1990 Fall Technical Meeting of the Eastern Section of the Combustion Institute: Chemical and Physical Processes in Combustion, Orlando, FL (United States), 3-5 Dec 1990. Sponsored by Department of Energy, Washington, DC.

Keywords: *Kerosene, *Sprays, Combustion, Droplets, Flame Propagation, Flames, Lasers, Velocity, Vortex Flow, Meetings, *Combustible flow, EDB/400800, EDB/025000, EDB/330100.

The interaction of the fuel spray with the surrounding combustion air, in particular near the spray boundary, affects its combustion and emission characteristics. Near the spray boundary, droplets of many different sizes, traveling at different velocities, are expected to be found. In addition, combustion air swirl affects fuel/air mixing and modifies the entire spray pattern. Therefore spatially and 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 include a movable vane swirl burner. Droplet velocity distributions were obtained using a single-channel, dual-beam laser velocimeter (LV). The measurements were carried out using off-axis light collection optics, positioned at a scattering angle of 30(degrees), which provided a measurement volume of about 1 mm(sup 3). The measured distributions were used to obtain statistical data on mean and rms velocity, turbulence intensity, skewness and flatness factors. Time resolved data were also recorded to provide information on droplet intermittency at selected positions in the spray flame.

200,731
DE92015583 PC **A01**/MF **A01**
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Chemical Technology.
Effect of atomization air on droplet dynamics of spray flames.
C. Presser, A. K. Gupta, and H. G. Semerjian. 1988, 5p CONF-881215-6
Contract AI01-86CE90213
1988 Fall technical meeting of the Eastern section of the Combustion Institute: Chemical and Physical Processes in Combustion, Clearwater Beach, FL (United States), 5-7 Dec 1988. Sponsored by Department of Energy, Washington, DC.

Keywords: *Liquid Fuels, *Sprays, *Atomization, *Combustion, *Meetings, Air, Dynamics, Flame Propagation, Flames, Nozzles, EDB/400800, EDB/330100.

Fuel spray combustion is an important part of a wide variety of propulsion and power systems such as furnaces and gas turbine combustors, afterburners, fuel-injection internal combustion engines, liquid rocket engines, etc. Recent studies using air-assist nozzles have shown that the design and fabrication of these nozzles can directly influence spray circumferential uniformity, i.e., the presence of asymmetrical fuel flux profiles in combustors. The practical implications of these fuel flux nonuniformities are that they seriously alter the spray structure, which subsequently affects droplet/air interactions, local fuel/air mixing, overall flame characteristics and combustor performance, and pollutant emission levels. In addition, the effect of aerodynamic factors on spray characteristics has been investigated. This paper discusses the effect of atomization air on the droplet dynamics of spray flames formed by an air-assist nozzle. Presented are spatial distributions of mean droplet velocity and their probability distributions, which provide quantitative information for examination of the observed spray flame features.

200,732
DE92015584 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Spray characteristics of a research air-assist atomizer.
C. Presser, A. K. Gupta, and H. G. Semerjian. 1988, 6p CONF-8805417-1
Contract AI01-86CE90213
Institute of Liquid Atomization and Spray Systems (ILASS) annual conference (2nd), Pittsburgh, PA (United States), 18-20 May 1988. Sponsored by Department of Energy, Washington, DC.

Keywords: *Liquid Fuels, *Atomization, Air, Combustion, Droplets, Flames, Nozzles, Sprays, Meetings, EDB/400800, EDB/421000, EDB/100400, EDB/330103.

Several different techniques are utilized to atomize a liquid fuel stream into a multitude of droplets, with a wide range of sizes and velocities, in order to increase their surface-to-volume ratio. One atomizer 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 changing the fuel flow rate. The size and velocity distributions of the droplets generated by the atomizer have a critical effect on transport processes, and the resulting flame stability and ignition characteristics. It is, therefore, important to examine the atomization characteristics of the air-assist nozzles -- a topic which forms the basis for the present investigation. The results presented are from an ongoing investigation to obtain detailed information on droplet dynamics in sprays and spray flames.

200,733
DE92015585 PC **A01**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Nozzle design effects of dense spray region characteristics.
C. Presser, A. K. Gupta, and H. G. Semerjian. 1989, 5p CONF-8905401-1
Contract AI01-86CE90213
Institute of Liquid Atomization and Spray Systems (ILASS) annual conference (3rd), Irvine, CA (United States), 16-17 May 1989. Sponsored by Department of Energy, Washington, DC.

Keywords: *Liquid Fuels, *Sprays, *Nozzles, Air, Atomization, Combustion, Density, Droplets, Velocity, Meetings, EDB/400800, EDB/421000, EDB/330100.

Past investigations have revealed that nozzle design and fabrication influence significantly the structure and dynamics of fuel sprays, viz., spatial distribution of droplet size, number density, and velocity, as well as size and velocity distributions. Fuel spray nozzles used in many practical applications are of the pressure-jet or air-assist type. Studies carried out with these nozzles have generally provided spatially resolved information in non-dense regions of the spray, i.e., at axial positions downstream of approximately 20 mm. Measurements closer to the nozzle, where number concentrations exceed 10(sup 6) particles/cc, are more difficult because of problems associated with applying available particle sizing techniques (i.e., single particle counters and laser diffraction devices) to this region. The results presented are from an ongoing investigation to characterize pressure-atomized and air-assisted sprays. Spatial profiles of droplet mean size, number density and velocity have been reported in the past, with recent attention given to the droplet velocity distributions. The study has focused on the dense region of the spray immediately downstream of the nozzle exit. This region is of particular interest since it provides information on the initial structure and dynamics of the spray, without being perturbed by the surrounding aerodynamic pattern. This information can be used to furnish data for spray modeling efforts.

200,734
DE92015586 PC **A01**/MF **A01**
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Chemical Technology.
Droplet transport in alcohol-based spray flames using phase/Doppler interferometry.
C. Presser, A. K. Gupta, C. T. Avedisian, and H. G. Semerjian. 1990, 5p CONF-9005168-2
Contract AI01-86CE90213
Institute of Liquid Atomization and Spray Systems (ILASS) annual conference (4th), Hartford, CT (United States), 21-23 May 1990. Sponsored by Department of Energy, Washington, DC.

Keywords: *Ethanol Fuels, *Methanol Fuels, *Atomization, *Droplets, *Interferometry, Automotive Fuels, Combustion, Flame Propagation, Flames, Velocity, Meetings, EDB/330800, EDB/100400.

Studies with alternative fuels (i.e., methanol and ethanol) are of particular interest because of the current initiative to gradually replace the limited supply of conventional fossil fuels (i.e., gasoline, heating oils, etc.) Alcohol-based fuels are attractive, since they burn much more cleanly and represent a potential to reduce the environmental impact of combustion processes. Investigation of the effect of the alcohol fuels on spray and flame characteristics (i.e., droplet size and velocity) is important since chemical and physical properties of the fuel have a significant influence upon droplet atomization, vaporization, transport, combustion, and pollutant and particulate formation processes. This paper examines the effects of physical and chemical properties of two alcohol fuels on droplet transport processes of swirling spray flames. Experiments were carried out with methanol and miscible mixture of methanol/1-dodecanol. The mixture fuel was selected to investigate the possibility of microexplosions in spray flames. Droplet size and velocity distributions were obtained using a phase/Doppler system. Laser sheet beam photography was also used to observe the internal features of pressure-atomized spray flames.

200,735
DE92015757 PC **A03**/MF **A01**
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Chemical Technology.
Fuel property effects on the structure of spray flames.
C. Presser, A. K. Gupta, C. T. Avedisian, and H. G. Semerjian. 1990, 22p CONF-900704-14
Contract AI01-86CE90213
International symposium on combustion (23rd), Orleans (France), 22-27 Jul 1990. Sponsored by Department of Energy, Washington, DC.

Keywords: *Heptane, *Kerosene, *Methanol, *Flame Propagation, *Sprays, *Meetings, Aerosols, Combustion Kinetics, Density, Droplets, Laser Spectroscopy, Velocity, EDB/400800, EDB/100400, EDB/025000.

The effect of fuel properties on the structure of swirling spray flames 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. The results indicate that droplet mean size and velocity are influenced primarily by the fuel viscosity. No detectable trend could be attributed 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 increase with increasing C/H ratio and fuel heating value. Droplet size and velocity distributions near the nozzle are found to be quite broad, and include regions of negative velocities. Some evidence has also been found to indicate the occurrence of microexplosions in the methanol/dodecanol mixture flame.

200,736
PB92-145085 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Probing Coals for Non-Pyritic Sulfur Using Sulfur-Metabolizing Mesophilic and Hyperthermophilic Bacteria.
Final rept.
R. N. Schicho, G. J. Olson, E. J. Parks, R. M. Kelly, and S. H. Brown. 1989, 8p
See also PB91-162271.
Pub. in Fuel 68, n11 p1368-1375 1989.

Keywords: *Coal, *Bioconversion, *Bioassay, *Sulfur bacteria, *Sulfate reducing bacteria, Thiobacillus ferrooxidants, Air pollution, Chemical analysis, Oxidation,

ENERGY

Fuels

Chemical analysis, Desulfurization, Concentration(Composition), Extraction, Reprints.

Sulfur speciation in coal is limited by uncertainties in the analytical methods used. Assays based on biological activity may eliminate some of these limitations. Using bacteria capable of elemental sulfur oxidation (Thiobacillus thiooxidants) or elemental sulfur reduction, it was possible to determine the approximate levels of this sulfur species in four different coal samples. It was found that in three of the coal samples (Illinois No. 6, Indiana No. 5, and an Australian coal), only trace amounts of elemental sulfur could be detected by bioassay. However, an Indiana bog coal was found to have in excess of 1% (by weight) elemental sulfur content. Existing analytical methodology for coal sulfur speciation was shown to characterize this sulfur fraction as organic. In all cases, the results obtained by bioassay were reinforced through chemical analysis following CS2 extraction of the coals. Elemental sulfur levels in the Indiana bog coal could be determined by either oxidative or reductive microbial processing. The results obtained here suggest that bioassay can be used to screen coals for elemental sulfur content and may provide an alternate and complementary probe for sulfur speciation.

200,737
PB92-171305 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Office of Standard Reference Materials.
NIST Coal Standard Reference Materials.
Final rept.
T. E. Gills. 1989, 4p
Pub. in Jnl. of Coal Qual. 8, n3-4 p98-101 1989.

Keywords: *Coal, Certification, Chemical composition, Physical properties, Reprints, *Standard reference materials.

The paper provides a general description of the certification process and characterization of eight NIST coal SRM's. NIST methods and procedures used routinely to prepare and certify the chemical composition and physical parameters of coal SRM's are discussed along with related chemical and physical data.

200,738
PB92-181049 PC **A11**/MF **A03**
California Univ., Berkeley. Dept. of Mechanical Engineering.
Solid Fuel Flame Spread and Mass Burning in Turbulent Flow.
Doctoral thesis.
L. Zhou. Mar 92, 233p NIST/GCR-92/602
Grant NANB7D737
Sponsored by National Inst. of Standards and Technology, Gaithersburg, MD.

Keywords: *Solid fuels, *Flame propagation, *Turbulent flow, Combustion, Theses, Combustible flow, Wind tunnels, Reynolds number, Test facilities, Burning rate, Turbulence.

An experimental study has been carried out to investigate the controlling mechanisms of solid fuel flame spread and mass burning in turbulent flows. The effects of flow velocity, turbulence intensity and buoyancy on concurrent and opposed flame spread rate and surface regression rate have been examined in both floor and ceiling configurations. It is found that for opposed flows, the flame spread rate of thermally thick PMMA sheet increases initially with the flow velocity, reaches a peak value and then decreases as the flow velocity increases further. The flow turbulence effect is to increase the flame spread rate initially and then decreases it at higher turbulence intensity. The flame spread rate of thermally thin paper sheet in an opposed flow decreases monotonically with the flow velocity and turbulence intensity. The flow turbulence also has a significant effect on the flame extinction conditions, resulting in a smaller extinction velocity for larger flow turbulence intensity. For concurrent flow flame spread, it is found that the flow turbulence decreases the flame spread rate for both floor and ceiling geometries, mainly as a result of the flame length shortening at high turbulence intensity. It is also found that flow velocity intensifies the spread of the flame.

200,739
PB92-236272 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Science and Engineering Div.
Radiative Ignition of Solid Fuels in a Microgravity Environment: The Preheating Problem.
Final rept.
H. R. Baum, T. Kashiwagi, and C. di Blasi. 1988, 4p
Pub. in Chem. Phys. Processes Combust., p79/1-79/4 1988.

Keywords: *Solid fuels, *Reduced gravity, *Radiant heating, *Ignition, Mathematical models, Heat transfer, Combustion, Radiative heat transfer, Fuel combustion, Reprints.

A mathematical model of the gas motion induced by radiative heating of a solid fuel 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.

200,740
PB92-236694 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Dropwise Evaporative Cooling of a Low Thermal Conductivity Solid.
Final rept.
M. Di Marzo, Y. Liao, P. Tartarini, D. Evans, and H. Baum. 1991, 10p
See also PB87-233714.
Pub. in Proceedings of International Symposium (3rd) on Fire Safety Science, Edinburgh, Scotland, July 8-12, 1991, p987-996.

Keywords: *Droplets, *Evaporative cooling, *Fire models, *Sprinklers, *Solid fuels, Finite difference method, Control volume method, Thermography, 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 solutions 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 mixed 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 temperature distribution at 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 (CSTL), Boulder, CO. Chemical Engineering Div.
Producing Hydrogen Slush with a Small Auger.
Final rept.
R. O. Voth, P. R. Ludtke, and J. A. Brennan. 1990, 12p
See also PB91-147199.
Pub. in NASP Technical Memorandum 1099 (REF WBS 2.5.02), 12p May 90.

Keywords: *Hydrogen fuels, *Slush, *Augers, *Cryogenics, Low temperature tests, Liquid helium, Densification, Particle size, Generators, Solid hydrogen, Refrigeration, Reprints.

A 4.68 cm (1.84 in) auger rotating inside a tube refrigerated with liquid helium was used to produce slush hydrogen. 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 auger had the appearance of fine snowflakes initially and they lost most of the sharp corners as they aged. The slush produced by the auger appeared to have the same stirring and settling characteristics as 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 supplied to the auger. A temperature stratified layer of liquid could be maintained above the auger while it was producing slush and this could provide pressures above atmospheric pressure in the slush generator vessel. Nitrogen contamination was easily visible in the slush hydrogen and it consisted of small white particles that settled as slowly or more slowly than the frozen hydrogen particles.

200,742
PB93-135150 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Process Measurements Div.
Droplet Velocity Measurements in a Swirling Kerosene Spray Flame.
Final rept.
C. Presser, A. K. Gupta, and H. G. Semerjian. 1989, 14p
See also PB88-193966.
Pub. in Proceedings of Conference on Heat Transfer in Combustion Systems, American Society of Mechanical Engineers, Heat Transfer Division, HTD, v122 p21-34 1989.

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 swirl can lead to bimodal and trimodal velocity distributions at spatial positions near the spray boundary. Monomodal 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.

200,743
PB93-135556 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Fire Science and Engineering Div.
Fuel Property Effects on Burning Rate and Radiative Transfer from Liquid Pool Flames.
Final rept.
J. Gore, M. Klassen, A. Hamins, and T. Kashiwagi. 1991, 10p
Pub. in Proceedings of International Symposium on Fire Safety Science (3rd), Edinburgh, Scotland, July 8-12, 1991, p395-404.

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 emission intensities indicate that this insensitivity is due to the presence of large quantities of cold soot in heavily sooting flames.

Heating & Cooling Systems

200,744
PB92-143759 PC **A04**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Performance Evaluation of a Variable Speed, Mixed Refrigerant Heat Pump.
P. I. Rothfleisch, and D. A. Didion. Jun 91, 59p
NISTIR-4597
See also PB87-152286 and PB88-218227. Sponsored by Environmental Protection Agency, Research Trian-

gle Park, NC. Air and Energy Engineering Research Lab.

Keywords: *Heat pumps, *Space HVAC systems, Performance evaluation, Heating load, Cooling load, Air source heat pumps, Buildings, Refrigerants.

The performance of an innovative heat pump, equipped with a distillation column to shift the composition of a zeotropic refrigerant mixture, was evaluated. The results of the DoE rating tests and seasonal energy calculations are reported with the main cycle refrigerant compositions. No composition shifting of the circulating refrigerant mixture was observed. To demonstrate the potential value of composition shifting, an ideal vapor compression cycle computer program was used to predict what the system performance would have been had composition shifting occurred. Seasonal energy usage calculations based on the computer predictions demonstrated that the effect of composition shifting on HSPF was very small, increasing slightly with climate zone. However, the savings in auxiliary heat was found to be substantial. In cooling mode, computer predictions showed pure R22 to have a SEER approximately two percent higher than a mixture of 20% R13B1 and 80% R22 by weight.

200,745
PB92-159201 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Building Environment Div.
Verification of Evaporator Computer Models and Analysis of Performance of and Evaporator Coil.
Final rept.
M. Chwalowski, D. A. Didion, and P. A. Domanski. 1989, 8p
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions 1989, v95 pt1 8p.

Keywords: *Air conditioning equipment, *Cooling coils, Computerized simulation, Air flow, Refrigerants, Saturation, Reprints.

The report contains a verification of computer algorithms to predict the capacity of an evaporator coil used in an air-conditioning application. Three computer programs and a major coil manufacturer's catalog were utilized. Two direct expansion, V-shaped indoor coils and a flat coil positioned at different face angles with horizontal airflow were tested at two refrigerant saturation temperatures. Test results, comparison with models and catalog predictions, and the reasons for differences were discussed.

200,746
PB92-238567 PC **A03**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Evaluating the Off-Cycle Losses of a Gas-Fired, Power Vented Furnace Employing Post Purge.
S. T. Liu, G. E. Kelly, and C. P. Terlizzi. Aug 92, 31p NISTIR-4908
Sponsored by Department of Energy, Washington, DC. Office of Conservation and Renewable Energy.

Keywords: *Gas furnaces, *Heat loss, *Performance tests, Energy consumption, Venting, Test methods, Standards, Mass flow, Mathematical models, Purging, Tracers, Flue gases, Gas burners, ANSI/ASHRAE 103-1988.

A gas-fired, induced draft furnace employing post purge for venting after the burner shut off was tested by using a continuous tracer gas measurement technique over the entire off-cycle to determine the off-cycle sensible loss for various durations of post- purge. The results were compared with those obtained by the existing optional tracer gas method described in ANSI/ASHRAE Standard 103-1988. The existing optional tracer gas procedure uses tracer gas data obtained at one prescribed time in the off-cycle along with an analytical procedure to calculate the loss. The optional procedure was found to under-estimate the off-cycle loss and to give significant error with longer post purge durations. A new analytical procedure was developed to correct the deficiency in the existing procedure. The new procedure divides the off-cycle period into two intervals. The loss during the purging interval was calculated analytically by assuming a linear variation of the flue gas temperature and a constant volumetric flow rate of the flue gas. The loss during the interval after post-purge was calculated by the existing optional tracer gas procedure where the prescribed time to measure the one point tracer gas data was delayed by the length of the post-purge interval.

Policies, Regulations & Studies

200,747
PB92-154061 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Environment Div.
Testing Conformance to Energy Management and Control System Communication Protocols. Part 1. Test Architecture.
Final rept.
S. T. Bushby. 1990, 7p
See also Part 2, PB92-154079.
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions, v96 pt1 p1127-1133 1990.

Keywords: *Tests, *Protocols, Standards, Computer communications, Computer program integrity, Integrated systems, Reprints, *EMCS(Energy Management and Control Systems), ISO(International Organization for Standardization).

The paper is the first in a two-part series addressing the question of testing conformance to an energy management and control systems (EMCS) protocol. The paper reviews international efforts to develop procedures for testing conformance to computer communication protocol standards. A particular variation of the 'coordinated abstract test method' (ISO 1987c) is proposed as the best architecture for testing conformance to the ASHRAE protocol. This approach will minimize the burden placed on implementors by the conformance test without sacrificing the ability to conduct thorough tests. No direct access to layer boundaries will be required, and integrity of the implementor's software can be maintained. The proposed structure of the ASHRAE protocol lends itself to this approach because only one additional protocol service and one standard object type will need to be added.

200,748
PB92-154079 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Environment Div.
Testing Conformance to Energy Management and Control System Communication Protocols. Part 2. Test Suite Generation.
Final rept.
S. T. Bushby. 1990, 8p
See also Part 1, PB91-154061.
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions, v96 pt1 p1134-1141 1990.

Keywords: *Tests, *Protocols, Computer communications, Standards, Recommendations, Integrated systems, Reprints, *EMCS(Energy management and control systems), Test suites.

The paper is the second in a two-part series addressing the question of testing conformance to an energy management and control systems (EMCS) protocol. The paper reviews international efforts to develop procedures for generating test suites used to determine conformance to a communication protocol standard. Four criteria are defined for evaluating the alternatives, and recommendations for the ASHRAE standard are made. An outline for the ASHRAE test suite is presented along with comments about the future steps needed to completely define it.

200,749
PB92-171982 PC **A03**/MF **A01**
National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Office of Applied Economics.
Simplified Life-Cycle Cost Methodology for Analysis of Lamps and Ballasts in Federal Buildings (1992 Edition).
Final rept.
S. R. Petersen. Feb 92, 23p NISTIR-4784
See also PB92-112515 and PB88-138227. Sponsored by Department of Energy, Washington, DC. Federal Energy Management Program Staff.

Keywords: *Life cycle costs, *Cost analysis, *Lamps, *Ballasts(Electric), *Public buildings, National government, Economic analysis, Energy conservation, Illuminating, Cost effectiveness, FEMP(Federal Energy Management Program).

A simplified life-cycle cost (LCC) methodology for the economic analysis of lighting system components (lamps and ballasts) is presented. The use of LCC analysis encourages purchasers and installers of lighting system components to select the most cost-effective combination of lamps and ballasts for new or replacement applications. The methodology is consistent with the Federal Energy Management Program (FEMP) life-cycle cost criteria for energy conservation investments in Federal buildings. The methodology uses annual-value life-cycle costs to permit direct comparison of components with different lives. Look-up tables of annual-value factors are provided to minimize calculation requirements. Examples are provided for selection of both individual components and combinations of components. Replacement of functional components with new, higher efficiency components is also examined.

200,750
PB92-238633 PC **A04**/MF **A01**
National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Office of Applied Economics.
Energy Prices and Discount Factors for Life-Cycle Cost Analysis 1993. Annual Supplement to NIST Handbook 135 and NBS Special Publication 709.
B. C. Lippiatt. Oct 92, 63p NISTIR-85/3273-7
See also PB88-138227, PB91-159764, PB91-507970 and report for 1992, PB92-112515. Sponsored by Department of Energy, Washington, DC. Federal Energy Management Program Staff.

Keywords: *Cost analysis, *Prices, *Life cycle costs, Fuels, Residential buildings, National government, Electric appliances, Economic analysis, Energy conservation, Energy supplies, Tables(Data), Federal Management Energy Program.

The report is the 1993 annual edition of energy prices and discount factors for performing life-cycle cost analyses of energy conservation and renewable energy projects. It supports the Federal life-cycle costing methodology by updating the energy price projections and discount factors that are described, explained, and illustrated in NIST Handbook 135 (HB 135). It supports private-sector life-cycle cost analysis by updating the energy price indices that are described, explained, and illustrated in NBS Special Publication 709 (SP 709). It also supports the Energy Conservation Mandatory Performance Standards for New Federal Residential Buildings (10 CFR 435) by providing a table of factors for updating appliance label values.

Selected Studies In Nuclear Technology

200,751
PB93-113645 PC **A12**/MF **A03**
National Inst. of Standards and Technology, Gaithersburg, MD.
PDA: A PC-Based Expert System for Analysis of DOE Nuclear Energy Performance Indicator Data.
Final rept.
J. T. Fong, B. Bernstein, and J. J. Filliben. Aug 92, 266p NISTIR-4907
Contract DE-0191NE-20413.0001
Prepared in cooperation with Illinois Inst. of Tech., Chicago. Dept. of Mathematics. Sponsored by Department of Energy, Washington, DC. Office of Nuclear Energy Self-Assessment.

Keywords: *Expert systems, *Data analysis, *Nuclear energy, Artificial intelligence, Personal computers, Data base management, Performance evaluation, Computer programs, *PDA expert system, DATAPLOT 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 DATAPLOT (v. 92.2). Coded in micro-PROLOG (v. 1.4), the expert system PDA is designed to (1) 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) enhance the analysis and database management capability of an engineer or scientist through a series of tutorial exercises; and (3) encourage the modification of the Prolog code of PDA or the English-based codes of the DATAPLOT macros by users interested in customizing the system for new or proprietary applications.

General

200,752

PB92-159714 Not available NTIS

National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.

Standards: Transnational Aspects.

Final rept.

F. D. Martzloff, and A. Mendes. 1991, 4p

Pub. in Proceedings of International Conference on Power Quality (1st): End-Use Applications and Perspectives, Paris, France, October 15-18, 1991, p31-34.

Keywords: *Electric power, *Standards, Reprints.

Mass-production of electrical and electronic equipment for the world market requires a system of standards of world-wide applicability. The development of such standards is a complex task, involving various national, regional, transnational, or international organizations. The paper presents a review of the standards-writing process, in particular in the area of Power Quality.

200,753

PB92-226265 PC **A09**/MF **A02**

National Inst. of Standards and Technology (TS), Gaithersburg, MD. Office of Technology Evaluation and Assessment.

Energy Related Inventions Program: A Joint Program of the Department of Energy and the National Institute of Standards and Technology. Status Report for Recommendations 1 through 300.

Dec 91, 177p NISTIR-4898

Supersedes PB91-178871. See also PB92-226273. Sponsored by Department of Energy, Washington, DC. Inventions and Innovation Div.

Keywords: *Inventions, Technology innovation, Product development, Recommendations, Evaluation, US DOE, US NIST, Energy related inventions program, Patent status.

The Energy-Related Inventions Program was established in 1975. Since its inception, over 29,000 inventions have been evaluated. As of the printing of this report, 563 have been recommended to the Department of Energy. This report supercedes NISTIR 4533 and summarizes the status of recommended inventions 1 through 300. A companion report, NISTIR 4899, summarizes the remainder of the recommended inventions.

200,754

PB92-226273 PC **A11**/MF **A03**

National Inst. of Standards and Technology (TS), Gaithersburg, MD. Office of Technology Evaluation and Assessment.

Energy Related Inventions Program: A Joint Program of the Department of Energy and the National Institute of Standards and Technology. Status Report for Recommendations 301 through 563.

Dec 91, 242p NISTIR-4899

Supersedes PB91-184770. See also PB92-226265. Sponsored by Department of Energy, Washington, DC. Inventions and Innovation Div.

Keywords: *Inventions, Technology innovation, Product development, Evaluation, US DOE, US NIST, Recommendations, Energy related inventions program, Patent status.

The Energy-Related Inventions Program was established in 1975. Since its inception, over 29,000 inventions have been evaluated. As of the printing of this report, 563 have been recommended to the Department of Energy. This report supercedes NISTIR 4534 and summarizes the status of recommended inventions 301 through 563. A companion report (NISTIR 4898) summarizes recommended inventions 1 through 300.

ENVIRONMENTAL POLLUTION & CONTROL

Air Pollution & Control

200,755

AD-P007 132/4 PC **A01**/MF **A01**

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

Bivariate, Nonstationary Time-Series Model for Global Fossil Fuel Production.

B. W. Rust, and F. J. Crosby. 1992, 4p

This article is from 'Computing Science and Statistics: Proceedings of the Symposium on the Interface (23rd) Critical Applications of Scientific Computing: Biology, Engineering, Medicine, Speech Held in Seattle, Washington on 21-24 April 1991,' AD-A252 938, p188-191.

Keywords: *Fossil fuels, *Computerized simulation, Atmospheres, Fossils, Fuels, Greenhouses, Rates, Records, Slope, Temperature, Greenhouse effect, Component Reports, Global fossile fuel effect.

Mankind is returning fossil fuel generated C02 to 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 by some to indicate the onset of the greenhouse.

200,756

N92-15436/8 (Order as N92-15435/0, MF **A04**)

National Inst. of Standards and Technology (NML), Boulder, CO. Thermophysics Div.

Physical Properties of Alternatives to the Fully Halogenated Chlorofluorocarbons.

M. O. Mclinden. 1990, 29p

In NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 2. Appendix: Afeas Report p 9-38.

Keywords: *Chemical properties, *Chlorofluorocarbons, Alternatives, Correlation, Hydrolysis, Tables (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 correlations presented here are certain to change quickly as additional information becomes available.

200,757

PB92-144666 Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

Analysis of Atmospheric Particulate Samples via Instrumental Neutron Activation Analysis.

Final rept.

R. R. Greenberg. 1990, 10p

Pub. in Monitoring Methods for Toxics in the Atmosphere, ASTM STP 1052, p175-184 1990.

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 sample reanalysis by the same or a different analytical technique. As an example of the applicability of INAA to the study of atmospheric particulate material, a study of the emissions from municipal incinerators is described.

200,758

PB92-149947 (Order as PB92-149889, PC **A08**)

National Inst. of Standards and Technology, Gaithersburg, MD.

Standard Reference Material for Calibration of the Cup Furnace Smoke Toxicity Method for Assessing the Acute Inhalation Toxicity of Combustion Products.

B. C. Levin, M. Paabo, and S. B. Schiller. 1991, 14p

Included in Jnl. of Research of the National Institute of Standards and Technology, v96 n6 p741-755 Nov/Dec 91.

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, Autoignition, Comparison, Materials testing, Plastics, *Standard reference materials, *Cup Furnace Smoke Toxicity Method, SRM 1048, Acrylonitrile butadiene styrene.

A standard reference material (SRM 1048) has been developed for use with the cup furnace smoke toxicity 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 the combustion products of a test material are more or less toxic than those from this SRM). SRM 1048 is an acrylonitrile-butadiene-styrene (ABS) and is the same as SRM 1007B which is used for calibrating the flaming mode of the Smoke Density Chamber test method (ASTM E-662 and NFPA 258).

200,759

PB92-150705 PC **A03**/MF **A01**

Environmental Protection Agency, Research Triangle Park, NC.

Standard Reference Materials for Chemical and Biological Studies of Complex Environmental Samples.

Journal article.

W. E. May, B. A. Benner, S. A. Wise, D. Schuetzle, and J. Lewtas. c1992, 14p EPA/600/J-92/056

Pub. in Mutation Research, v276 n1 p11-22 Jan 92. See also PB84-219948, PB87-152021 and PB91-242511. Prepared in cooperation with National Inst. of Standards and Technology, Gaithersburg, MD., and Ford Motor Co., Dearborn, MI.

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. SRM 1649 (Urban Dust/Organics), SRM 1650 (Diesel 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 validating analytical procedures for the determination of polycyclic organic compounds in complex mixtures. In addition, the SRM's have been valuable for the comparison of methodologies for bacterial bioassays and the development of bioassay-directed fractionation and bioassay directed chemical analysis techniques. Most recently the SRM's were chosen for use as test samples in a collaborative study coordinated 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 these types of studies will be provided also. (Copyright (c) 1992 Elsevier Science Publishers B.V.)

200,760
PB92-159656 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Surface and Microanalysis Science Div.
Source Apportionment of Wintertime Organic Aerosols in Boise, Idaho by Chemical and Isotopic ((14)C) Methods.
Final rept.
G. A. Klouda, D. Barraclough, and L. A. Currie. 1991, 15p
Sponsored by Environmental Protection Agency, Washington, DC.
Pub. in Proceedings of Air and Waste Management Association Annual Meeting and Exhibition (84th), Vancouver, British Columbia, June 16-21, 1991, p1-15.

Keywords: *Combustion products, *Wood burning furnaces, *Indoor air pollution, *Aerosols, *Organic compounds, Winter, Carcinogens, Mutagenesis, Risk assessment, Carbon 14, Residential buildings, Stationary sources, Reprints, *Source apportionment, Integrated Air Cancer Project, Boise(Idaho).

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 wintertime organic aerosols collected in Boise ID (1986-87); of which some aerosols were carcinogenic. The contribution of RWC was determined from (14)C measurements performed on organic material extracted from fine-particulate filter samples. Aliquots of these extracts were also subjected to mutagenicity testing to determine their bioactivity. Lastly, (14)C 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 (14)C 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.
Final rept.
R. A. Fletcher, E. B. Steel, M. Beard, C. C. Wang, and J. W. Gentry. 1989, 4p
Pub. in Jnl. of Aerosol Science 20, n8 p1593-1596 1989.

Keywords: *Air sampling, *Deposition, *Aerosols, Performance evaluation, Wind tunnels, Simulation, Asbestos, Reprints, *Filter collection efficiency.

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 train, wind tunnel tests simulating indoor air conditions, the effect of cassette orientation, and wind velocities. Sampling was carried out in a National Institute of Standards and Technology 0.91 x 0.91 m wind tunnel with wind velocities of 0.15 - 0.5 m/sec. Test aerosols were monodisperse ammonium fluorescein 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 walls of the sampler. Comparison was made between samples collected isokinetically and anisokinetically. The deposits for the smaller particle size were uniform for all sampling orientations, but a loss of collection efficiency was observed when the cassette 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.
14C Source Apportionment Technique Applied to Wintertime Urban Aerosols and Gases for the EPA Integrated Air Cancer Project.
Final rept.
G. A. Klouda, L. A. Currie, A. E. Sheffield, B. I. Diamondstone, B. A. Benner, S. A. Wise, R. K. Stevens, and R. G. Merrill. 1990, 5p
Sponsored by Environmental Protection Agency, Washington, DC.
Pub. in Emissions from Combustion Processes: Origin, Measurement, Control, Chapter 12, p153-157 1990.

Keywords: *Aerosols, *Urban areas, *Exhaust emissions, *Motor vehicles, *Air pollution monitoring, *Carbon 14, Pollution sources, Combustion products, Wood, Winter, Reprints, *Source apportionment, Integrated Air Cancer Project, Albuquerque(New Mexico), Raleigh(North Carolina).

The (sup 14)C source apportionment technique for tracing environmental carbon has been applied 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 carbon source) and motor-vehicle ((sup 14)C = 0) emissions on these urban airsheds through (sup 14)C measurements. Additionally, (sup 14)C measurements were necessary for evaluation of the EPA's single-tracer multiple-linear regression model (MLR) for source apportionment. Good agreement was attained between (sup 14)C and MLR. Future work includes applying these two techniques to samples collected in Boise, ID.

200,763
PB92-236595 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Source Apportionment of Individual Carbonaceous Particles Using (14)C and Laser Microprobe Mass Spectrometry.
Final rept.
L. Currie, R. Fletcher, and G. Klouda. 1989, 9p
Pub. in Aerosol Science and Technology 10, n2 p370-378 Apr 89.

Keywords: *Aerosols, *Soot, *Tracer techniques, *Pollution sources, *Air pollution detection, *Carbon 14, Combustion products, Mass spectroscopy, Chemical analysis, Agglomerates, Particles, Laser spectroscopy, Wood burning furnaces, Exhaust emissions, Motor vehicles, Reprints.

An exploratory study of laser microprobe mass spectra of individual atmospheric soot particles has been made in search of a potential combustion source tracer index. A tentative 'cluster ratio index' (CRI = C4(-)/C2(-)) has been found and compared with bulk measurements of (14)C in a set of ambient samples exhibiting varying impacts from woodburning and motor vehicle exhaust. A CRI - (14)C calibration curve resulted, and it led to the conclusion that at the present level of precision, 3 particles (or agglomerates) of micrometer size or about 25 pg of carbon would be required for discrimination between the two pure sources. Mixture samples, such as those reported here, would require about 40 times as much. Classification of a small set of individual particles from the mixed source ambient samples, suggests preservation of carbonaceous source identity on the single particle level.

200,764
PB92-236843 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Environment Div.
Sources and Source Strengths of Volatile Organic Compounds in a New Office Building.
Final rept.
A. T. Hodgson, J. M. Daisey, and R. A. Grot. 1991, 1p
See also DE88009328. Sponsored by General Services Administration, Washington, DC.
Pub. in Jnl. of the Air and Waste Management Association 41, n11 p1461 1991.

Keywords: *Volatile organic compounds, *Pollution sources, *Indoor air pollution, *Office buildings, *Air pollution sampling, Ventilation, Photocopying, Motor vehicles, Fugitive emissions, Exhaust emissions, Air quality, Hydrocarbons, Plotters, Reprints, Portland(Oregon).

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 source strengths. Samples for VOC were collected on four occasions over 14 months starting with the first month of occupancy. Samples were also collected over four days (Friday - Monday) in the final sampling period. The primary source of VOC in the building was liquid process photocopiers 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, which was dominated by the photocopier emissions, remained 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
PB92-238575 PC **A03**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Environmental Evaluation of the Federal Records Center in Overland Missouri.
A. K. Persily, W. S. Dols, and S. J. Nabinger. Aug 92, 29p NISTIR-4883
Sponsored by Public Buildings Service, Washington, DC.

Keywords: *Office buildings, *Indoor air pollution, *Air pollution monitoring, *Environmental surveys, Federal buildings, Ventilation, Radon, Air quality, Carbon dioxide, Carbon monoxide, Design criteria, Formaldehyde, Long term effects, Performance evaluation, Thermal analysis, Overland(Missouri).

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 preoccupancy 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-basement level, and less than or equal to 0.4 pCi/L on the other levels. Formaldehyde concentrations ranged from 0.03 to 0.07 ppm. Daily peak levels of carbon dioxide in the building were typically between 500 and 800 ppm. Maximum carbon monoxide levels were typically on the order of 1 to 2 ppm, essentially tracking outdoor levels induced by automobile traffic. There have been some occasions of elevated carbon monoxide and carbon dioxide levels in the building associated with unexplained episodic increases in the outdoor levels.

Solid Wastes Pollution & Control

200,766
N92-14458/3
(Order as N92-14445/0, PC **A08**/MF **A02**)
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.
Chemical Processes During Incineration and Implications of Detoxification of Hazardous Wastes Using Solar Photons.
W. Tsang. 1991, 3p
In NAS-Nrc, Potential Applications of Concentrated Solar Energy p 48-50.

Keywords: *Incinerators, *Photodecomposition, *Photons, *Solar energy, *Thermal decomposition, *Waste disposal, Chemical reactions, Hazards, Thermodynamics, Wastes, Destruction, Failure, Molecules.

A review is given of the chemistry of incineration. The aim is to demonstrate that it is possible to explain in semiquantitative terms the nature of failure mechanisms. There are no thermodynamic barriers to the transformation of any organic molecules during incineration to their thermodynamic end states. In other words, if one can confine an organic molecule in a hypothetical incineration environment for sufficient time, the destruction is total. Failure must, therefore, be due to kinetic effects. These can be divided into physical and chemical. Interest here is in the latter. These chemical reaction pathways are examined. The use of solar photons in direct photodecomposition or thermal decomposition is explored.

200,767

PB92-170729 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Chromium(VI)-Resistant Yeast Isolated from a Sewage Treatment Plant Receiving Tannery Wastes.
Final rept.
F. Baldi, A. M. Vaughan, and G. J. Olson. 1990, 6p
Pub. in Appl. Environ. Microbiol. 56, n4 p913-918 1990.

Keywords: *Materials recovery, *Waste disposal, *Yeasts, *Tanning materials, Sewage treatment plants, Italy, Chromium, Concentration(Composition), Comparison, Reprints, *Microbial metal resistance.

A Cr(VI)-resistant yeast, designated strain DBVPG 6502, was isolated from a sewage treatment plant receiving wastes from tannery industries in Italy. The strain was tentatively identified as a species of Candida based on morphological and physiological analyses. This strain was highly resistant to Cr(VI) when compared to 8 other species of yeast, growing at Cr(VI) concentrations up to 500 microg/ml (10 mM). This resistance was constitutive. The Cr(VI)-resistant yeast did not reduce Cr(VI) to Cr(III) species, but showed very little accumulation of Cr(VI). Consequently, the mechanism of resistance of the yeast to Cr(VI) appears to involve reduced accumulation of Cr, as has been shown in Cr(VI)-resistant bacteria.

Water Pollution & Control

200,768

PB92-143718 PC **A07**/MF **A02**
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.
P. R. Becker, S. A. Wise, M. M. Schantz, B. J. Koster, and R. Zeisler. Feb 92, 139p NISTIR-4731
See also PB88-199732 and PB91-184796. 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 sites. 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.
Preparation and Analysis of a Frozen Mussel Tissue Reference Material for the Determination of Trace Organic Constituents.
Final rept.
S. A. Wise, B. A. Benner, R. G. Christensen, B. J. Koster, J. Kurz, M. M. Schantz, and R. Zeisler. 1991, 10p
See also PB91-149237.
Pub. in Environmental Science and Technology 25, n10 p1695-1704 Oct 91.

Keywords: *Water pollution detection, *Mussels, *Marine biology, *Bioassay, *Tissues(Biology), Aromatic polycyclic hydrocarbons, Trace elements, Polychlorinated biphenyls, Gas chromatography, Mass spectroscopy, 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 (Organics in Mussel Tissue (Mytilus edulis)) is a frozen mussel tissue homogenate that has been certified for the concentrations of nine polycyclic aromatic hydrocarbons (PAHs) from results obtained from gas chromatography-mass spectrometry and reversed-phase liquid chromatography with fluorescence detection. Noncertified concentrations for 19 additional PAHs are also reported. Gas chromatography with electron capture detection and gas chromatography with mass spectrometric detection were used to provide noncertified concentrations for 13 polychlorinated biphenyl congeners and 9 chlorinated pesticides. In addition to the organic contaminants, noncertified concentrations for 36 trace elements were determined primarily by instrumental neutron activation analysis. SRM 1974 is the first frozen tissue SRM for environmental measurements of organic and inorganic constituents.

200,770

PB92-238559 PC **A09**/MF **A02**
Naval Research Lab., Washington, DC.
Development of a Video Image-Based Methodology for Estimating Large Scale Hydrocarbon Smoke Plume Size and Extent.
J. T. Leonard, E. K. Budnick, G. G. Back, and S. J. Ganey. Aug 92, 187p NIST/GCR-92/614
0M0415
Prepared in cooperation with Hughes Associates, Inc., Columbia, MD. Sponsored by National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.

Keywords: *Oil spills, *Video signals, *Plumes, *Fire tests, Estimating, Ignition, Computer programs, Field tests, Image processing, Pattern recognition, Oil pollution, Test methods, Optical measurement, Wind velocity, Image analysis, Trajectories, Computer vision, Smoke, Digital data, Video data.

Interest in burning crude oil as a means to mitigate large scale oil spills at sea led to mid-scale evaluation of relevant crude oil burning characteristics. As part of this effort, a computer-based field measurement technique for estimating the size, shape, and extent of visible smoke plumes was developed. Of the experiments in which measurements were made, Test 7 provided data on plume trajectory for the largest distance from the pan. Good agreement was obtained between corresponding 35 mm photographs and digitized images used to estimate plume volume and trajectory. In Test 7, at 600 s after ignition, the leading edge of the smoke plume had risen to 780 m and traveled 1800 m downwind from the pan. The estimated total volume of the smoke plume at 600 s after ignition was 3.8 x 10(exp 8)cum. At that time, the total volume of the smoke plume was increasing at a rate of 3.2 x 10(exp 6)cum/s. Limited evaluation indicates that the MS-DOS based method provides reasonably accurate estimates of visible smoke plume geometry in the near-field. Field accuracy depends on plume size, wind speed and direction, and the resolution of the equipment.

General

200,771

PB92-171339 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Quality Assurance, Reference Materials and the Role of a Reference Laboratory in Environmental Measurements.
Final rept.
H. S. Hertz. 1988, 4p
Pub. in Proceedings of International Symposium on Trace Analysis in Environmental Samples and Standard Reference Materials, Honolulu, HI., January 6-8, 1988, p5-8.

Keywords: *Environmental surveys, *Pollution, *Chemical analysis, *Laboratories, Quality assurance, Trace amounts, Reviews, Standards, Analytic chemistry, Reprints, *Certified reference materials.

The purpose of the paper is to document the important role which quality assurance practices, the use of certified reference materials, and the role of the reference laboratory play in producing quality environmental measurements. To put these three components of an environmental measurement program in proper perspective, one also must understand the current state-of-the-practice and current needs in trace analysis (and environmental analysis, in particular). These topics will also be reviewed in the paper.

HEALTH CARE

Environmental & Occupational Factors

200,772

PB92-205483 PC **A04**/MF **A01**
George Mason Univ., Fairfax, VA.
Affordable Fire Safety in Board and Care Homes: A Regulatory Challenge. Interim Report.
B. M. Levin, N. E. Groner, and R. Paulsen. May 92, 65p NIST/GCR-92/611
Grant NANB-9D0974
See also SHR-0103214. Sponsored by National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.

Keywords: *Fire safety, *Nursing homes, Standards, Building codes, Handicaps, Cost analysis, Sprinkler systems, Human factors engineering, *Board and care homes.

The interim report on a project concerning fire safety in Board and Care Homes. Homes vary greatly in the level of disability of residents and financial resources of the residents. A major concern is the availability of satisfactory care for clients with limited funds. Meeting fire safety codes can mean an unaffordable capital cost to financially marginal providers who cannot borrow money. One focus of the study is the use of the provisions in the Life Safety Code. Many agencies use these requirements and find they lead to a high level of safety without excessive costs. All have developed or adopted a procedure for rating Evacuation Difficulty that they find workable, and many find satisfactory. Other agencies use other requirements, sometimes more lenient and often more strict. Costs of fire safety systems, such as sprinklers, can vary greatly, impeding a dialogue on the benefit-cost relationships of these systems. It appears that in some locations there are many homes that provide the services of Board and Care Homes but are not regulated.

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 Sensitivity and Residual Current Measurements for Several Commercial Ionization Gauges.
Final rept.
A. R. Filippelli. 1988, 8p
Pub. in AIP Conference Proceedings Vacuum Design of Advanced and Compact Synchrotron Light Sources, Upton, NY., May 1988, n171 p236-243.

Keywords: *Vacuum gages, *Ionization gages, *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 extractor 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.

Industrial Safety Engineering

200,774
PB92-170687 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Cone Calorimeter: A New Tool for Fire Safety Engineering.
Final rept.
V. Babrauskas. 1990, 4p
See also PB87-134730.
Pub. in ASTM (American Society for Testing and Materials) Standardization News 18, n1 p32-35 Jan 90.

Keywords: *Calorimeters, *Fire detectors, Heat measurement, Ignition, Fire tests, Reprints.

The Cone Calorimeter standard is proceeding towards adoption in ASTM. The article summarizes some of the main features of the apparatus and discusses applications using the Cone Calorimeter.

200,775
PB92-170695 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Fire Measurement and Research Div.
North American Experiences in the Use of Cone Calorimeter Data for Classification of Products.
Final rept.
V. Babrauskas. 1991, 15p
Pub. in Proceedings of International EUREFIC Seminar, Copenhagen, Denmark, September 11-12, 1991, p89-103.

Keywords: *Calorimeters, *Fire detectors, Heat measurement, Ignition, Fire tests, Building codes, Reprints.

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 heat release rate exists. The scale should be used to quantify the performance of products for any required applications. Nonetheless, as an intermediate step, it is shown that replacement of noncombustibility and various degree-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 5660) has prompted a number of exploratory studies. The goal of these studies has been to determine if a heat release-based substitute for these traditional measures could be established. Such a scheme would correct existing classification anomalies, but otherwise classify products into exactly the same categories as used 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.

Laboratory & Test Facility Design & Operation

200,776
AD-P007 934/3 PC **A01**/MF **A01**
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.
Scanning Scattering Microscope: A Novel Optical Technique for Imaging Surface Microtopography.
D. Marton, and J. Fine. 22 May 92, 3p
This article is the 'Optical Society of America (OSA) Photonic Science Topical Meeting Series. Volume 3. The Microphysics of Surfaces: Beam-Induced Processes. Held in Santa Fe, New Mexico on 11-13 Feb 1991,' AD-A254 135,p146-148.

Keywords: High resolution, High sensitivity, Sensitivity, Surface roughness, *Scanning scattering microscopes, 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.

200,777
PB92-144583 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Thermophysics Div.
Search for Pressure Dependence in the Sensitivity of Several Common Types of Hot-Cathode Ionization Gauges for Total Pressures Down to 10(sup -7) Pa.
Final rept.
A. R. Filippelli, and S. Dittmann. 1991, 9p
Pub. in Jnl. of Vacuum Science and Technology A 9, n5 p2757-2765 Sep/Oct 91.

Keywords: *Ionization gages, Bayard-Alpert ionization gages, Hot cathodes, Pressure dependence, Hydrogen, Helium, Nitrogen, Sensitivity, Reprints.

Dependence of sensitivity on pressure in He, N2, and H2 has been investigated for a group of 16 hot-cathode ionization gages, representing both extractor and Bayard-Alpert types, for total pressure as low as 5 x 10 to the -8 power Pa. Absolute sensitivities were determined using a primary high vacuum standard. An independent method, that of measuring the sensitivity ratio of one gage to another, was also employed. Within a scatter of about + or - 3%, + or - 4%, and + or - 4% respectively, the N2, He, and H2 sensitivity ratio data showed no clearly discernible pressure dependence down to total pressures as small as 5 x10 to the -8 Pa. The absolute sensitivity measurements in He and N2 over the range 10 to the -7 power to 10 to the -3 power Pa. As a consequence of drift in the background component of the total pressure, all the absolute sensitivity measurements at total pressures below 10 to the -7 power Pa exhibited an apparent pressure dependence not evident in the sensitivity ratio results. Results of further investigation suggest that the apparent pressure dependence in the sensitivities is an artifact produced by the well-known phenomenon of thermal dissociation of H2 at hot filaments and associated processes of H2 pumping and production of other species such as CO and C2H4.

200,778
PB92-144807 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD.
Round Robins: Simplest Is Best.
Final rept.
T. W. Lashof, and J. Mandel. 1988, 3p
Pub. in ASTM (American Society for Testing and Materials) Standardization News, p42-44 Jul 88.

Keywords: *Precision, Interlaboratory comparisons, Reproducibility, Consistency, Test methods, Reprints, *Round robins.

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.

200,779
PB92-144914 Not available NTIS
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Automated Production Technology Div.
Misalignment Sensitivity Test for Load Cells.
Final rept.
R. A. Mitchell. 1991, 4p
See also PB89-235915 and PB91-175406.
Pub. in Experimental Mechanics, p140-143 Jun 91.

Keywords: *Load cells, *Test methods, *Loads(Forces), Weight indicators, Measuring instruments, Mechanical tests, Test facilities, Metrology, Force, Calibration, Sensitivity, Reprints.

A relatively simple test to measure the misalignment sensitivity of load cells is described. Eccentric compression loads are applied by the use of an angular block above the spherical loading button of the load cell. The results of replicate tests on six load cells, of five different types, produced by five different manufacturers, are presented.

200,780
PB92-149905
(Order as PB92-149889, PC **A08**)
National Inst. of Standards and Technology, Gaithersburg, MD.
Certification of SRM 1960: Nominal 10 micrometer Diameter Polystyrene Spheres ('Space Beads').
T. R. Lettieri, A. W. Hartman, G. G. Hembree, and E. Marx. 1991, 23p
Included in Jnl. of Research of the National Institute of Standards and Technology, v96 n6 p669-691 Nov/Dec 91.

Keywords: *Microspheres, *Particle size, *Dimensional measurement, Space manufacturing, Reduced gravity, Light scattering, Electron microscopy, Polystyrene, Diameters, Metrology, *Standard reference materials, Micrometrology.

Experimental, theoretical, and calculational details are presented for the three independent micrometrology 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 agreed remarkably 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 + or - 0.04 micrometers, which was chosen to be the certified mean diameter. The report gives a detailed description of the apparatus, the experimental methods, the data-reduction techniques, and an error analysis for each of the micro-metrology techniques. A distinctive characteristic of the SRM is that it was manufactured in microgravity aboard the NASA space shuttle Challenger and is the first commercial product to be made in space.

200,781
PB92-154228 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Thermophysics Div.
Critical Review: Recommended Practices for the Calibration and Use of Leaks.
Final rept.
C. D. Ehrlich, and J. A. Basford. 1992, 17p
Pub. in Jnl. of Vacuum Science and Technology A 10, n1 p1-17 Jan/Feb 92.

Keywords: *Leakage, Vacuum systems, Recommendations, Calibration, Standards, Uses, Reprints.

The document is the consensus view of the Calibrated Leak Subcommittee of the Recommended Practices Committee of the American Vacuum Society. It is divided into four main sections: Description, Calibration, Proper Usage, and Recommended Documentation of Leaks. Included in Sec. II are discussions of types of leaks, temperature effects, depletion rates, and units of leakage rate measurement. Section III addresses primary and secondary techniques for leak calibration, including uncertainties. Section IV addresses the proper handling and usage of leaks to achieve optimum results, recommendations of standardization of connections, and safety. The documentation to accompany and to be attached to each calibrated leak, recommended in Sec. V, is intended to provide the user with sufficient information about the leak for accurate and safe use. The appendices contain a glossary and a discussion of the use of throughput and flow rate units and conversions.

200,782
PB92-159219 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Process Measurements Div.
Automated Air Flowrate Calibrations at the National Institute of Standards and Technology.
Final rept.
W. G. Cleveland, and G. E. Mattingly. 1992, 9p
Pub. in Proceedings of Measurement Science Conference, Anaheim, CA., January 30-31, 1992, 9p.

Keywords: *Calibration, *Air flow, *Flowmeters, *Automation, Flow measurement, Test facilities, Flow rate, Measuring instruments, Accuracy, Volume, Mass flow, Reprints, Bell gasometer.

The paper describes the recently completed automation of air flowrate calibration facilities at the National Institute of Standards and Technology (NIST) in Gaithersburg, MD. The effort encompassed the automation of the flow calibration facilities used for meters flowing air up to approximately 0.05 cu m/s using timed collection techniques. The flowrate of air passing through the meter under test is determined using conservation of mass principles and automated measurements of pressure, temperature, and collection time of a known volume of air. Two types of displacement devices are used: mercury-sealed piston provers for lower flowrates and bell gasometers for higher rates. The techniques used for automated calibrations and the menu-driven software are described. The accuracy improvements due to automation justify an overall accuracy quotation for NIST air flowrate measurements in the range at + or - 0.20% or better.

200,783
PB92-159391 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Temperature and Pressure Div.
Molecular Drag Gauge as a Calibration Standard.
Final rept.
S. Dittmann, B. E. Lindenau, and C. R. Tilford. 1989, 5p
Pub. in Jnl. of Vacuum Science and Technology 7, n6 p3356-3360 1989.

Keywords: *Vacuum gages, *Calibration standards, High vacuum, Stability, Accuracy, Reprints, *Molecular drag gages, Transfer standards.

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. 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, on the predictability of the effective accommodation 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. Process Measurements Div.
Spectral Analysis on a PC.
Final rept.
D. E. Hess. Dec 91, 76p NISTIR-4733

Keywords: *Spectrum analysis, *Computer applications, *Personal computers, Input output processing, Data structures, Files(Records), Data processing, Computation, Run time(Computers), Utility routines.

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 softward implementation of spectral analysis procedures on a personal computer: data transformation, mean value and linear trend removal, digital filtering, time history tapering and data overlapping. The various spectral density functions are then defined and explained along with a means for the calculation of the error associated with a particular estimate. Several detailed examples are included which serve to illustrate the methods described. The manual also contains a brief description of the considerations necessary when sampling the data to be analyzed.

200,785
PB92-165513 Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD. Lab. Accreditation Program.
Advantages of Laboratory Accreditation.
Final rept.
R. L. Gladhill. 1989, 5p
See also PB89-127187.
Pub. in Accreditation Practices for Inspections, Tests, and Laboratories, ASTM STP 1057, p19-23 1989.

Keywords: Assessments, Evaluation, Reprints, *Laboratory accreditation, *Accreditation, NVLAP testing.

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 feature (for example, an independent audit), and by saving both time and money through the possible elimination of multiple audits from many potential clients. Users of laboratory services 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 a 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
PB92-171354 Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD. National Voluntary Lab. Accreditation Program.
Interlaboratory and Intralaboratory Proficiency Testing.
Final rept.
J. Horlick. 1989, 10p
Pub. in Accreditation Practices for Inspections, Tests, and Laboratories, ASTM STP 1057, p85-94 1989.

Keywords: *Laboratories, Performance, Abilities, Evaluation, Reprints, Proficiency testing, NVLAP program, Accreditation.

Proficiency testing is an integral part of the NVLAP laboratory accreditation process. Demonstration of appropriate facilities, equipment, personnel, etc. is essential, but 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
PB92-183680 PC **A10**/MF **A03**
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Process Measurements Div.
Proceedings: Workshop on the Measurement of Transient Pressure and Temperature. Held in Gaithersburg, Maryland on April 23-24, 1991.
V. E. Bean, and G. J. Rosasco. Apr 92, 219p NISTIR-4828
See also PB88-105002.

Keywords: *Pressure measurement, *Meetings, Temperature measurement, Military requirements, Explosion 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 measurement needs, the state-of-the-art in making these measurements, the need 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 Technology Div.
Automation of Strain-Gauge Load-Cell Force Calibration.
K. W. Yee. Apr 92, 13p NISTIR-4823
See also PB87-116091.

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-precision digital voltmeter, all controlled by a PC-XT class computer. Subsequently, environmental chambers have been added to three machines to perform automatically 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. Doiron, and J. Fu. 1992, 13p
Included in Jnl. of Research of the National Institute of Standards and Technology, v97 n2 p253-265 Mar/Apr 92.

Keywords: *Microspheres, *Particle size, *Standards, Diameters, Certification, 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 techniques 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 (NML), Gaithersburg, MD. Temperature and Pressure Div.

Capacitance Method of Measuring the Radial Displacement of the Outer Diameter of the Cylinder of a Piston Gage.
Final rept.
V. E. Bean, and Y. P. Lin. 1989, 5p
Pub. in Proceedings of Symposium on High Pressure Metrology, Paris, May 24-25, 1988, p22-26 1989.

Keywords: *Elastic deformation, *Pressure measurement, *Capacitive fuel gages, Cylinders, Measuring instruments, Displacement, Electrical properties, Pressure, Capacitance, Metrology, Reprints, *Piston gages.

Theoretical calculations of the distortion coefficients for piston gages require experimental verification in order to establish a basis for error analysis. A three-terminal 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 contained in the paper. The measurements are repeatable at the nanometer level.

200,791
PB92-197474 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Length and Mass Div.
Possible Change in the U.S. Legal Unit of Mass.
Final rept.
R. S. Davis. 1988, 7p
Pub. in Proceedings of National Conference of Standards Laboratories Workshop and Symposium Competitiveness in a World Market, Washington, DC., August 14-18, 1988, p58-1-58-7.

Keywords: *Primary standards, *Standards, International system of units, Calibration, Metric system, Prototypes, US NBS, Reprints, *Mass standards, Kilogram.

At present the working standard for NBS mass calibrations is based on two nickel-chromium kilograms 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 uncertainty of the calibration or the long-term stability of the assigned value. The authors now find that the mass values assigned to the N kilograms are offset from the SI value by about 0.15 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 at NBS of a kilogram comparator with sub-microgram precision.

200,792
PB92-197870 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Statistical Engineering Div.
Interaction Graphs: Graphical Aids for Planning Experiments.
Final rept.
R. Kacker, and K. L. Tsui. 1990, 14p
Pub. in Jnl. of Quality Technology 22, n1 p1-14 1990.

Keywords: *Experimental design, Planning, Reprints, *Interaction graphs, Fractional factorial experiments, Orthogonal arrays.

Interaction graphs make it possible for engineers to plan fractional factorial experiments on their own without undergoing specialized statistical training. A fractional factorial plan can be generated from an orthogonal array by selecting certain columns of the orthogonal array and deleting the rest. Interaction graphs are very-easy-to-use graphical aids for identifying the appropriate columns. They are most useful for planning two-level fractional factorial experiments that allow unconfounded estimation of all main effects and some specified interaction effects under the assumption that all unspecified interaction effects are negligible. 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 unconfounded estimation of all main effects and some specified interaction effects, interaction graphs require no prior statistical training.

200,793
PB92-198019 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Application of Parameter Estimation Theory in Low Frequency Accelerometer Calibration.
Final rept.
B. F. Payne, and M. R. Serbyn. 1987, 6p
Pub. in Proceedings of Transducer Workshop (14th), Colorado Springs, CO., June 16-18, 1987, p162-167.

Keywords: *Vibration measurement, *Accelerometers, Extremely low frequency, Data acquisition, Seismometers, Transducers, Calibration, Reprints, Parameter estimation.

Low frequency accelerometers, velocity transducers, and seismometers are used extensively to investigate vibrations on mechanical structures. The measurement of low frequency (1-100 Hz), low amplitude (<10 mV) signals from these transducers has been a problem for conventional data acquisition systems. The paper describes a system for low-frequency transducer measurements which first digitizes the voltage signal using a commercial high speed digitizer. Software routines developed at NBS for a desktop computer then estimate the rms amplitude, dc offset, and any distortion components in the transducer signal.

200,794
PB92-201094 PC **A09**/MF **A02**
National Inst. of Standards and Technology (TS), Gaithersburg, MD. National Voluntary Lab. Accreditation Program.
National Voluntary Laboratory Accreditation Program 1992 Directory.
Special pub. (Final).
V. R. White. Apr 92, 177p NIST/SP-810-ED-1992
Also available from Supt. of Docs. as SN003-003-03163-1. Supersedes PB92-222646.

Keywords: *Laboratories, *Directories, Acoustics, Asbestos, Carpets, Computer applications, Construction materials, Dosimetry, Electromagnetic compatibility, Paints, Paper, Plastics, Sealers, Seals(Stoppers), Stoves, Telecommunication, Thermal insulation, *National Voluntary Laboratory Accreditation program, NVLAP program.

The 1992 Directory provides a listing of laboratories accredited by the National Institute of Standards and Technology, National Voluntary Laboratory Accreditation Program (NVLAP). The names of approximately 800 laboratories in 19 fields of testing are included. A brief description of the NVLAP program and a summary of laboratory participation are provided. As an aid to the user, indexes are cross-referenced by laboratory name, field of testing, geographic location (state or country), and NVLAP Lab Code. A listing of the test methods (Scope of Accreditation) is provided for each laboratory.

200,795
PB92-213289 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MEL), Gaithersburg, MD.
Algorithm to Position the NIST Advanced Automated Master Angle Calibration System (AAMACS) to the Least Angular Step.
D. E. Gilsinn, and W. T. Estler. Jul 92, 33p NISTIR-4878

Keywords: *Metrology, Diophantine equations, Number theory, Numerical solution, Calibration, Polygons, Mirrors, Algorithms, *Angle measurement, AAMACS system.

An algorithm based on number theoretic arguments is given that shows how to position the NIST Advanced Automated Master Angle Calibration System (AAMACS) to its least angular step. AAMACS consists of three stacked independently driven serrated tooth indexing tables arranged to rotate concentrically around a common vertical axis. The least angular step between nearest neighbor positions of the topmost table is delta(theta)min = 2pi/(379,080,000) rad. The problem of how to select the indexed tooth position of each of the independent tables reduces to the solution of a Diophantine equation in three unknowns. The equation is solved by use of the classic Euclidean Algorithm.

200,796
PB92-226315 PC **A03**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
NIST Impact Test Facility.
H. W. Shenton, E. D. Anderson, J. L. Gross, and R. D. Marshall. Jan 92, 27p NISTIR-4896

Keywords: *Impact tests, *Test facilities, Impact forces, Data acquisition, Dynamic response, Kinetic energy, Calibration, Dynamic tests, Mechanical tests, Loads(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 structural elements 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 peak impact velocity of 17 m/s can be attained in the ITF with a full-height drop, delivering 10,600 N-m of kinetic energy to a specimen using a 59 kg impact sled. The components of the system include the 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.

200,797
PB92-236587 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Statistical Engineering Div.
Extended Error Model for Comparison Calibration.
Final rept.
C. Croarkin. 1989, 7p
Pub. in Metrologia 26, n2 p107-113 1989.

Keywords: *Calibration, Error analysis, Random error, Variance(Statistics), Mass, Comparison, Reprints.

The paper extends the usual error model for calibration experiments to situations where there are both random errors in measurement and random changes in the artifacts themselves. Such error models are useful where measurement errors are related to instrumentation and changes in artifacts are related to operating procedures or environmental factors. The concept of a check standard is advanced for estimating variability and maintaining statistical control of the measurement process.

200,798
PB92-236785 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.
Fire Research at NBS: The First 75 Years.
Final rept.
D. Gross. 1991, 15p
Pub. in Proceedings of International Symposium (3rd) Fire Safety Science, Edinburgh, Scotland, July 8-12, 1991, p119-133.

Keywords: *Fire safety, *US NBS, *History, *Laboratories, Fire resistance, Research, Flammability tests, Fire tests, Fire extinguishers, Test facilities, Spontaneous combustion, Reprints.

A short history is presented of fire research and testing activities at the National Bureau of Standards from its beginnings in 1914 to 1989. Many of the principal technical projects undertaken to provide information needed by Government agencies, practicing architects and engineers, code officials and the general public are noted. Brief mention is made of organizational, staff and budget changes through the years. References to selected staff publications and source materials are cited.

200,799
PB93-125094 PC **A04**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Cone Calorimeter Annotated Bibliography, 1982-1991.
Technical note (Final).
V. Babrauskas. Sep 92, 57p NIST/TN-1296
Also available from Supt. of Docs. as SN003-003-03175-5.

Keywords: *Bibliographies, *Fire tests, *Calorimeters, Temperature measuring instruments, Abstracts, Test facilities, Measuring instruments, Calorimetry, Temperature measurement, Heat measurement, *Cone calorimeters.

An annotated bibliography is presented of published papers and reports on the topic of Cone Calorimeter apparatus, test data, and engineering applications of the test data. While most of the material surveyed is in English, the known 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 rept.
J. L. Mullen, and D. S. Lashmore. 1987, 8p
Pub. in Proceedings of Meeting of the Mechanical Failures Prevention Group (40th), Use of New Technology to Improve Mechanical Readiness, Reliability and Maintainability, Gaithersburg, MD., April 16-18, 1985, p450-457 1987.

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 errors 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 indenter 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.
Precision and Bias in Charpy V-Notch Testing (ASTM Standard Test Method E-23).
Final rept.
D. A. Shepherd, and T. A. Siewert. 1992, 25p
Pub. in ASTM Research Publication, RR: E28-1014, 25p, 12 Dec 91.

Keywords: *Test methods, *Standards, *Impact tests, *Precision, Notch tests, Laboratories, Test facilities, Hardness tests, Mechanical tests, Consistency, Reprints, *Charpy V-Notch Tests.

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.
Numerical Simulation of Flaw Detection with a Capacitive Array Sensor Using Finite and Infinite Elements.
Final rept.
P. R. Heyliger, J. C. Moulder, and N. Nakagawa. 1989, 8p
See also PB90-152893.
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v8A p1023-1030 1989.

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.

Infinite elements with exponential decay were used to model a three-fingered capacitive array sensor interrogating dielectric slabs. Flaw geometries modeled were a step and a square groove. The influence of boundary condition 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 electrostatic potential and its normal derivative along the surface of the tested sample. By using infinite elements to model the infinite region around the probe, more accurate values of the change in admittance were obtained.

LIBRARY & INFORMATION SCIENCES

Information Systems

200,803
PB92-175397 Not available NTIS
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Advanced Systems Div.
Retrieving Records from a Gigabyte of Text on a Minicomputer Using Statistical Ranking.
Final rept.
D. K. Harman, and G. T. Candela. 1990, 9p
Pub. in Jnl. of the American Society for Information Science 41, n8 p581-589 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 seen 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 806 megabytes of text, but very favorable user reaction. Work was also done in devising 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 (TS), Gaithersburg, MD. Office of Information Services.
Databases Available in the Research Information Center of the National Institute of Standards and Technology.
Special pub. (Final).
D. Cunningham. Sep 92, 146p NIST/SP-842
Also available from Supt. of Docs. as SN003-003-03179-8. 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.
Using Standards to Facilitate Access and Reuse of Museum Information.
Final rept.
J. Moline. 1991, 9p
Pub. in Proceedings of International Conference on Hypermedia and Interactivity in Museums, Pittsburgh, PA., October 13-16, 1991, p307-315.

Keywords: *Museums, *Records management, *Standards, User needs, Information systems, Documents, Reprints, Open System Environment.

Standards for dealing with electronic records must be selected based on a careful analysis of user requirements. These requirements must take into account the long range goals of the larger community. For any particular museum the larger community could include archives and libraries, as well as other museums and the patrons of the 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.
Automatic Indexing.
D. Harman. Sep 92, 20p NISTIR-4873
See also PB-266 262.

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.
NIST Serial Holdings, 1992.
Special pub. (Final).
S. A. Sanders. Apr 92, 269p NIST/SP-777/ED-1992
Also available from Supt. of Docs. as SN003-003-03157-7. Supersedes PB91-171330.

Keywords: *Periodicals, *Catalogs(Documentation), *Collection, *Information centers, Standards, Libraries, Metrology, *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 Supt. of Docs. as SN003-003-03166-6. Supersedes PB91-148494.

Keywords: *Indexes(Documentation), *Abstracts, Technical reports, Information centers, Technical information center, Subject indexing, Document types, *National Institute of Standards and Technology, Research Information Center.

An alphabetical arrangement of abstracts and indexes available in the Research Information Center (RIC) of the National Institute of Standards and Technology (NIST) is listed by most current title of the publication. Other information includes description of the abstract or index, RIC holdings, principal sources, publisher or association, corresponding RIC database and CD-ROM availability and the classification number. A general subject and former title/database name index follow the main text of the report.

General

200,809
PB93-125045 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Protection of Archival Record from Pollutants: The Measurement of the Diffusion of SO2 through and Absorption of SO2 by Archival Boxboard.
C. M. Guttman, and K. L. Jewett. Nov 92, 43p NISTIR-4719

Keywords: *Archives, *Documents, *Records management, *Sulfur dioxide, *Preserving, *Boxboard, Diffusion, Absorption, Laboratory tests.

The diffusion and absorption properties of boxboards, commonly used to store archival documents, with sulfur dioxide have been measured. For the most common boxes used by National Archives and Record Administration (NARA) a diffusion constant of about 0.001 sq cm/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)

200,810
PB92-143726 PC **A03**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
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 PB92-123090. Sponsored by Assistant Secretary of Defense (Production and Logistics), Washington, DC. Computer-aided Acquisition and Logistic Support Program.

Keywords: *Models, Specifications, Computer aided design, Computer aided manufacturing, Automation, Software tools, Computer systems programs, Tests, *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), a project of the International Organization for Standardization (ISO), addresses this need by providing information models which clearly and unambiguously describe 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 essential for success in sharing data in a highly automated environment. The document describes how application models will be validated in the National PDES Testbed at the National Institute of Standards and Technology.

200,811
PB92-143734 PC **A03**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
Architecture for the Validation Testing System Software Testbed Report Series.
K. C. Morris. Dec 91, 27p NISTIR-4742
See also PB92-143726. Sponsored 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 using STEP), *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 integrated software environment to support the validation of STEP application protocols. The architecture provides a basis for software development to support the Validation Testing System (VTS) within the National Product Data Exchange using STEP (PDES) 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 ISO Tolerancing Standards for Harmonization and Completion of Part 47. National PDES Testbed.
S. C. Feng. 8 Jan 92, 41p NISTIR-4744
See also PB91-167221.

Keywords: *Standards, *Comparison, Computer aided design, Computer aided manufacturing, Product development, Data, Dimensional measurement, Tolerances(Mechanics), *STEP(Standard for the Exchange of Product Model Data), *STEP Part 47, ISO(International Organization for Standardization), ANSI(American National Standards Institute), DMIS(Dimensional Measuring Interface Standard).

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 dimensioning and tolerancing standards. Comparison results are summarized in tables in each section. The comparison of the Part 47 draft with other standards is made in basic tolerancing principles, size tolerance, datum and datum establishment, and geometric tolerances specified in standards. Recommendations for additions and modifications of Part 47 are at the end of each section. The objective is to have Part 47 completely cover the basic principles, concepts, and geometric tolerancing methods specified in ANSI and ISO standards.

200,813
PB92-148246 PC **A03**/MF **A01**
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Factory Automation Systems Div.
IGES/PDES Organization Document Tracking System.
Final rept. Jul 90-Oct 91.
J. Wellington. Oct 91, 17p NISTIR-4707
See also PB83-137448 and PB90-150368.

Keywords: *Configuration management, *Data bases, Information systems, Documents, Indexes(Documentation), Cataloging, Standardization, *IGES(Initial Graphics Exchange Specification), *PDES(Product Data Exchange using STEP), IPO(IGES/PDES Organization), STEP(Standard for the Exchange of Product Model Data), DTS(Document Tracking System).

The document gives an overview of the IGES/PDES Organization Document Tracking System. In addition, it outlines the procedures for registering documents in the system and gives information on the roles of those who administer the system and directions for obtaining copies of items registered in the system.

200,814
PB92-158286 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Machine Intelligence Group.
User's Guide for the Apparel STEP Translator for PC Compatible Computers.
T. Murphy, and H. T. Moncarz. Jan 92, 18p NISTIR-4745
See also PB90-247438 and PB91-216663. Sponsored by Defense Logistics Agency, Alexandria, VA.

Keywords: *Clothing industry, *Computer aided design, Computer aided manufacturing, Product development, Data processing, File structures, Format, Translators, Computer applications, User manuals(Computer programs), *STEP(Standard for the Exchange of Product Model Data), PDES(Product Data Exchange using STEP), APDES(Apparel PDES), National Institute of Standards and Technology.

The Apparel Standard for the Exchange of Product Model Data (STEP) Translator is a computer program for translating apparel pattern data between different file formats using a set of neutral data structures based on the National Institute of Standards and Technology (NIST) apparel information model. The document describes how to install and run the program on a PC compatible computer.

200,815
PB92-158294 PC **A03**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
Requirements and Recommendations for STEP Conformance Testing. National PDES Testbed Report Series.
S. J. Kemmerer. 30 Jan 92, 44p NISTIR-4743
See also PB88-215645 and PB91-107227. Sponsored by Assistant Secretary of Defense (Production and Logistics), Washington, DC. Computer-aided Acquisition and Logistic Support Program.

Keywords: *Computer aided design, *Computer aided manufacturing, *Standards, *Product development, *Tests, Standardization, Evaluation, Systems engineering, Technology transfer, Recommendations, *STEP(Standard for the Exchange of Product Model Data), *CT(Conformance testing), ITI(Industrial Technology Institute), CALS(Computer-aided Acquisition and Logistic Support), NIST(National Institute of Standards and Technology).

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 presented here draws from the Industrial Technology Institute's (ITI's) past conformance testing experience in order to provide a perspective of the 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 major 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.

200,816
PB92-172758 PC **A04**/MF **A01**
National Inst. of Standards and Technology (MEL), Gaithersburg, MD.

MANUFACTURING TECHNOLOGY

Computer Aided Design (CAD)

Status Report for First Quarter, FY 92 (October 1 through December 31, 1991). National PDES Testbed Report Series.
H. M. Bloom. Mar 92, 55p NISTIR-4787
Sponsored by CALS Evaluation and Integration Office, Washington, DC.

Keywords: *Computer aided design, *Computer aided manufacturing, Protocols, Configuration management, Testing, Test equipment, Administration, Travel, Standards, Government/industry relations, Education, Technology transfer, *PDES(Product Data Exchange using STEP), *STEP(Standard for the Exchange of Product Model Data), CALS, Department of Defense.

The status report summarizes the activities and milestones of the National PDES Testbed (NPT) during the first quarter of the U.S. Government's 1992 fiscal year (1Q92). Much of the activity revolved around two major events: Computer-aided Acquisition and Logistics Support (CALS) Expo '91 and the joint meeting of IPO (IGES/PDES Organization) and ISO (International Organization for Standardization). At these events, Testbed staff enhanced their coordination with the STEP (Standard for the Exchange of Product model data) community and took several leads in charting the course of STEP's development. Testbed staff were elected to chair three STEP-related working groups or committees. And under the Testbed project 'AP for Inspection Planning,' a work-sharing agreement was informally established with counterparts from Europe's ESPRIT program. Nine technical thrusts of the PDES, Inc. consortium were supported, including electrical/electronics standards. The Testbed Hotline fielded 20 calls, while the STEP On-Line Information Service was used to transmit more than 900 files to users. A prototype STEP Data Access Interface (SDAI) implementation was demonstrated, while a major upgrade of the Fed-X compiler was readied for shipping. Five technical reports were issued. Through tutorials and technical sessions, Testbed staff played prominent educational roles at CALS Expo '91.

200,817
PB92-172782 PC **A03**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
Considerations for the Transformation of STEP Physical Files. National PDES Testbed Report Series.
R. Kohout, and S. N. Clark. 10 Mar 92, 20p NISTIR-4793
See also PB90-257734 and PB92-143734. Sponsored by Assistant Secretary of Defense (Production and Logistics), Washington, DC. Computer-aided Acquisition and Logistic Support Program.

Keywords: Files(Records), Format, Syntax, Computer aided design, Computer aided manufacturing, Automation, *STEP(Standard for the Exchange of Product Model Data), *EXPRESS information modelling language, *Data transformation, Data translation, Translations.

The problem of automatically transforming valid STEP (Standard for the Exchange of Product Model Data) exchange files in the face of changes to the corresponding EXPRESS information models is discussed. The related problems of dealing with changes to the EXPRESS language and to the exchange file format itself are also briefly discussed. Requirements are proposed for a language to represent the data transformations which may be required when the underlying information model changes. These requirements address such areas as attribute movement and retyping, entity reclassification, and other manipulations of entity definitions. Two alternative syntaxes for such a language are presented and contrasted.

200,818
PB92-181023 PC **A04**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
NIST Express Working Form Programmer's Reference. (Revised April 1992). National PDES Testbed Report Series.
S. N. Clark, and D. Libes. 3 Apr 92, 63p NISTIR-4814
See also report for 1990, PB91-157164.

Keywords: *Computer aided design, *Computer aided manufacturing, *Software tools, Programming manuals, Parsers, Input output processing, Translators, Algorithms, Express programming language, PDES(Product Data Exchange using STEP), STEP(Standard for the Exchange of Product Model Data).

The National Institute of Standards and Technology (NIST) Express Working Form (WF), with its associated Express parser, Fed-X, is a Public Domain set of software tools for manipulating information models written in the Express language. The Express WF is part of the NIST Product Data Exchange using STEP (PDES) Toolkit. The reference manual discusses the internals of the WF, including the Fed-X parser. The information presented will be of use to programmers who wish to write applications based on the WF, including output modules for Fed-X, as well as those who will maintain or modify the WF or Fed-X. The reader is assumed to be familiar with the design of the Working Form.

200,819
PB92-181098 PC **A04**/MF **A01**
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Fabrication Technology Div.
Shop of the 90's: The Implementation of a CAD/CAM System for Small Machine Shops.
A. Moll. Mar 92, 52p NISTIR-4810
See also PB92-172774.

Keywords: *Machine shops, *Computer aided design, *Computer aided manufacturing, Automation, Numerical control, Management, Systems analysis, Personnel selection, Standards, Productivity, Job analysis.

The document outlines logical implementation steps and procedures that should be followed after a small machine shop has purchased a computer aided design/computer aided manufacturing (CAD/CAM) system.

200,820
PB92-181130 PC **A04**/MF **A01**
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Fabrication Technology Div.
Shop of the 90's Project: An Evaluation Tool for Wireframe CAD Software.
B. Bluethmann, and J. Johnson. Apr 92, 64p NISTIR-4813
See also PB92-181098.

Keywords: *Computer aided design, *Computer software, *Evaluation, Machine shops, Machine tools, Machining, Automation, Ratings, National Institute of Standards and Technology, Shop of the 90s project.

The document provides a methodology for small machine shops to benchmark Computer-Aided Design (CAD) packages. The initial step of the process is to determine a shop's CAD requirements, and to convert those requirements into specific CAD features. After determining the necessary features, the methodology is a three part process. Part one involves completing a checklist to determine which features are available on each CAD package. The second part consists of giving values to the features of the CAD package, biased toward the more important features. Part three generates a weighted tally of each package. Employing the evaluation tool simplifies the difficult process of determining the most suitable CAD package for each individual shop.

200,821
PB92-181205 PC **A03**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
Fed-X: The NIST Express Translator (Revised, April 1992).
S. N. Clark, and D. E. Libes. 3 Apr 92, 29p NISTIR-4822
See also PB91-132126. Sponsored by Assistant Secretary of Defense (Production and Logistics), Washington, DC. Computer-aided Acquisition and Logistic Support Program.

Keywords: *Computer aided design, *Computer aided manufacturing, *Software tools, *Translators, Parsers, Data structures, Input output processing, Algorithms, Express programming language, PDES(Product Data Exchange using STEP), STEP(Standard for the Exchange of Product Model Data), National Institute of Standards and Technology.

The Product Data Exchange using STEP (PDES) is an emerging standard for the exchange of product information among various manufacturing applications. PDES includes an information model written in the Express language; other PDES-related information models are also written in Express. The National PDES Testbed at the National Institute of Standards and Technology (NIST) has developed software to manipulate and translate Express models. The software consists of an in-memory working form and an associated Express language parser, Fed-X. The design and capabilities of Fed-X and the Express Working Form are discussed. The document has been revised to reflect modifications in the implementation of Fed-X software to support changes in the Express language.

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 down loaded 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, implementated by the RTEC, which modify the tool path during the finish cut. The system has the capability of reducing errors in the finished part to less than the correction resolution which for the machine used is 4 micrometers.

200,823
PB92-237486 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Role of Off-Line Robot Programming in Hierarchical Control.
Final rept.
N. Tarnoff, and R. Lumia. 1988, 8p
Pub. in Proceedings of International Symposium (2nd) on Robotics and Manufacturing: Research, Education and Applications, Albuquerque, NM., November 16-18, 1988, p967-974.

Keywords: *Robots, *Computer programming, *Off line systems, Computer aided design, Computer aided manufacturing, Control systems, Hierarchies, Computerized simulation, Data transfer(Computers), Manipulators, Object-oriented programming, Reprints, Automated Manufacturing Research Facility, National Institute of Standards and Technology.

The paper discusses the integration and use of an Off-Line Programming (OLP) system that is being implemented at the National Institute of Standards and Technology (NIST) Automated Manufacturing Research Facility (AMRF). The OLP project will serve as an environment where new OLP capabilities are developed and integrated in an effort to build a complete hierarchical robot manipulation system. The two phase project first involves making a commercially available OLP system operational and integrated with a CAD/CAM system. In phase two, the system will become a development tool for feature based (object oriented) task level robot programming with the support of a global object oriented database, real time sensory capabilities, and a Hierarchical Control System (HCS).

200,824
PB93-113686 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Fabrication Technology Div.
STEP Development Methods: Specification of Semantics for Information Sharing.
W. F. Danner, and Y. Yang. Sep 92, 26p NISTIR-4915
Prepared in cooperation with Product Data Integration Technology, Long Beach, CA.

Keywords: *Product development, *Standards, Computer aided design, Computer aided manufacturing, Specifications, Mathematical models, Information systems, *STEP(STandard for the Exchange of Product Model Data), ISO(International Organization for Standardization).

The document describes the information sharing requirements and approaches used to fulfill those requirements in 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.

200,825
PB93-118123 PC **A14**/MF **A03**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Information Systems Engineering Div.
Incorporating CALS Requirements into the CGM Standard and the CALS Application Profile: MIL-D-28003.
Rept. for Jan-Dec 91.
D. R. Benigni. Feb 92, 323p NISTIR-4775
Prepared in cooperation with Assistant Secretary of Defense (Production and Logistics), Washington, DC. Computer-aided Acquisition and Logistic Support Program.

Keywords: *Data transfer(Computers), *Standards, *Computer graphics, Computer aided design, Computer aided manufacturing, Graphic arts, Data processing, *CALS, *CGM(Computer Graphics Metafile), National Institute of Standards and Technology, Computer-aided Acquisition and Logistics Support, MIL-D-28003A.

In support of the Computer-aided Acquisition and Logistics Support (CALS) initiative, one of the National Institute of Standards and Technology's (NIST's) major tasks has been to augment the Computer Graphics Metafile (CGM) standard with functionality necessary to fulfill CALS requirements for graphical data exchange. The report details the results of NIST representatives' attendance at and monitoring of CGM-related national and international standards meetings. NIST has had significant impact on the development of CGM Amendments 3 and 4 in particular. Amendment 3, which is nearing completion, provides support for advanced two-dimensional drawing capabilities for technical illustration, graphics art quality picture definition, and graphics in technical publishing. Much of the revision to the CGM application profile for CALS, known as MIL-D-28003A, is due to Amendment 3 functionality. Amendment 4, a new standards project, will define rules for profiles and conformance requirements for CGM software components.

Computer Aided Manufacturing (CAM)

200,826
N92-24989/5
(Order as N92-24987/9, PC **A10**/MF **A03**)
National Inst. of Standards and Technology (MEL), Gaithersburg, MD.
Intelligent Processing Equipment Research and Development Programs of the Department of Commerce.
J. A. Simpson. Apr 92, 12p
In NASA, Washington, the Federal Conference on Intelligent Processing Equipment p 20-31.

Keywords: *Artificial intelligence, *Computer aided manufacturing, *Control equipment, *Process control (Industry), *Research and development, *Robot control, Commerce, Automatic control, Robots.

The intelligence processing equipment (IPE) research and development (R&D) programs of the Department of Commerce are carried out within the National Institute of Standards and Technology (NIST). This institute has had work in support of industrial productivity as part of its mission since its founding in 1901. With the advent of factory automation these efforts have increasingly turned to R&D in IPE. The Manufacturing Engineering Laboratory (MEL) of NIST devotes a major fraction of its efforts to this end while other elements within the organization, notably the Material Science and Engineering Laboratory, have smaller but significant programs. An inventory of all such programs at NIST and a representative selection of projects that at least demonstrate the scope of the efforts are presented.

200,827
N92-24993/7
(Order as N92-24987/9, PC **A10**/MF **A03**)
National Inst. of Standards and Technology, Gaithersburg, MD.
Intelligent Processing Equipment Developments within the Navy's Manufacturing Technology Centers of Excellence.
P. Nanzetta. Apr 92, 6p
In NASA, Washington, the Federal Conference on Intelligent Processing Equipment p 68-73.

Keywords: *Defense industry, *Industrial plants, *Manufacturing, *Military technology, *Productivity, *Research facilities, Technology transfer, Artificial intelligence, Electronic equipment, Metal working, Navy, Process control (Industry).

The U.S. Navy has had an active Manufacturing Technology (MANTECH) Program aimed at developing advanced production processes and equipment since the late-1960's. During the past decade, however, the resources of the MANTECH program were concentrated in Centers of Excellence. Today, the Navy sponsors four manufacturing technology Centers of Excellence: the Automated Manufacturing Research Facility (AMRF); the Electronics Manufacturing Productivity Facility (EMPF); the National Center for Excellence in Metalworking Technology (NCEMT); and the Center of Excellence for Composites Manufacturing Technology (CECMT). This paper briefly describes each of the centers and summarizes typical Intelligent Equipment Processing (IEP) projects that were undertaken.

200,828
PB92-165109 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Automated Production Technology Div.
Requirements for Global Programming Languages.
Final rept.
J. C. Boudreaux. 1988, 8p
Pub. in Proceedings of Symposium on Manufacturing Application Languages, Winnipeg, Manitoba, Canada, June 20-21, 1988, p107-114.

Keywords: *Computer aided manufacturing, *Programming languages, Prototypes, Workstations, Requirements, Reprints, *Global programming languages, ISO(International Organization for Standardization).

The paper is an attempt to clarify some of the technical issues raised in the final report of ISO/TC184/SC3/WG2 on the requirements for global programming languages (gpl) for industrial automation systems. The working group identified two general functions of every gpl: (1) to provide communication from/to the management level, and (2) to control the individual pieces of equipment in the work station. Though WG 2 clearly recognized the importance of the first function, they concluded that it was not possible to address these issues at any depth within the time allotted and focused instead on the second function. Although this may seem reasonable, in this instance the original assignment to WG 2 was entirely proper. The paper identifies the sources of data which constitute the informational environment of work station programming, then presents requirements for gpl, and, finally, draws some implications for the future design of the language family.

200,829
PB92-187038 PC **A03**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
NIST PDES Toolkit: Technical Fundamentals. National PDES Testbed Report Series. Revised April, 1992.
S. N. Clark, and D. Libes. 3 Apr 92, 33p NISTIR-4815
See also PB91-132159. Sponsored by CALS Evaluation and Integration Office, Washington, DC.

Keywords: *Computer aided manufacturing, *Software tools, Standards, Computer aided design, Subroutine libraries, Translators, *PDES(Product Data Exchange using STEP), STEP(Standard for the Exchange of Product Model Data).

The Product Data Exchange using STEP (PDES) is an emerging standard for the exchange of product information among various manufacturing applications. A software toolkit for manipulating PDES data has been developed at the National PDES Testbed at NIST. A technical overview of the PDES Toolkit is provided. Fundamental software libraries are described, and techniques for creating applications based on the Toolkit are discussed.

200,830
PB92-187046 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Automated Production Technology Div.
Alternative Designs of a Real-Time Error Corrector for Machine-Tools with 'Encoder' Position Feedback.
K. W. Yee. Apr 92, 17p NISTIR-4832
See also PB91-112771.

Keywords: *Machine tools, *Automation, *Error correction codes, Numerical control, Computer aided manufacturing, Coding, Real time, Feedback control, NIST.

As a part of Quality in Automation project, the author has implemented fast part-probing and real-time error compensation on a computer-numerical-control (CNC) machine tool using the existing machine-tool controller. He has inserted a black box called the Real-Time Error Corrector (RTEC) between the 'encoder' position feedback elements of the axes of the machine tool and the machine-tool controller. Further details of the 'Original RTEC' will be given and three alternative designs proposed. Some implementations and application considerations are discussed.

200,831
PB92-197821 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Decentralized Control Architecture for Computer Integrated Manufacturing Systems.
Final rept.
A. Jones, and A. Saleh. 1989, 10p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Symposium on Intell Control, Albany, NY., September 25-26, 1989, p44-49.

Keywords: *Computer aided manufacturing, *Control theory, Hierarchies, Automation, Control systems, Reprints.

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.

200,832
PB92-197839 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Manufacturing Engineering.
Multi-Level/Multi-Layer Architecture for Intelligent Shopfloor Control.
Final rept.
A. Jones, and A. Saleh. 1990, 11p
Pub. in International Jnl. of Computer Integrated Manufacturing 3, n1 p60-70 Jan/Feb 90.

Keywords: *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 to manage production activities in the factories of tomorrow. Those factories will have computers and other automated machinery performing many of the functions currently done by humans. It proposes a multi-layer/multi-level control architecture to manage shop floor activities. Each module in that architecture performs three functions: adaptation, optimization, and regulation. It describes these functions and discusses integration and future research issues.

200,833
PB92-197847 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Factory Automation Systems Div.

Computer Aided Manufacturing (CAM)

Multi-Layer/Multi-Level Control Architecture for Computer Integrated Manufacturing Systems.
Final rept.
A. Jones, and A. Saleh. 1989, 7p
Pub. in Proceedings of Annual Conference of IEEE (Institute of Electrical and Electronics Engineers) Industrial Electronics Society (15th) - IECON '89, Philadelphia, PA., November 6-10, 1989, p519-525.

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. Those systems will have computers and robots executing most of the functions currently done by humans. The authors use spatial and temporal decomposition to develop a multi-level control architecture to manage shop floor activities. Each module within that architecture is a multi-layer controller performing the functions of adaptation, optimization, and regulation. They describe these functions and discuss future research needs.

200,834
PB92-205392 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Factory Automation Systems Div.
Technical Program of the Factory Automation Systems Division 1992.
H. M. Bloom, and L. W. Masters. May 92, 43p
NISTIR-4856

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.

200,835
PB92-236892 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Integration Issues in the Factory of the Future.
Final rept.
A. Jones. 1988, 8p
Pub. in Proceedings of Manufacturing International Conference, Atlanta, GA., April 17-20, 1988, p107-114.

Keywords: *Automation, *Computer aided manufacturing, Data bases, Control systems, Industrial plants, Organizational structure, Process control, Product development, Data management systems, Reprints, Automated Manufacturing Research Facility, National Institute of Standards and Technology.

The advent of sophisticated automation equipment and computer hardware and software is guiding the evolution toward the factory of the future. To be competitive, manufacturing companies must integrate these new technologies into their existing and future factories. The paper discusses the major decisions which will influence those integration strategies. They include choices for an organizational structure, process planning system, product data definition, data management system, and a data communication system. It also describes the strategies used by researchers at the National Bureau of Standards to build a prototype of the factory of the future, the Automated Manufacturing Research Facility.

200,836
PB92-237072 Not available NTIS
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Systems and Software Technology Div.
Generating Extended State Transitions from Structured Specifications for Process Control Systems.
Final rept.
D. R. Kuhn. 1989, 9p
Sponsored by Army Strategic Defense Command, Huntsville, AL.
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 execution of modules emulating both physical processes and decision processes. The concurrent modules are specified as extended finite state machines; essentially decision tables with procedural code to specify actions. 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 a simple method for transforming code written with structured control constructs into an extended state machine representation usable on the Emulator. A transformation is given for each construct and an attribute grammar is provided to implement the translation process. The method is straightforward and has been implemented in a prototype translator.

200,837
PB92-237510 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Feature-Based Process Planning in the AMRF.
Final rept.
M. B. Unger, and S. R. Ray. 1988, 7p
Pub. in Proceedings of ASME (American Society of Mechanical Engineers) Int. Computers in Engineering Conference and Exhibition, San Francisco, CA., July 31-August 4, 1988, p563-569.

Keywords: *Automation, *Computer aided manufacturing, Process control, Planning, Reprints, *Features, National Institute of Standards and Technology, Automated Manufacturing Research Facility.

The growing use of 'features' in the design and manufacturing communities is due to the fact that features better capture the functionality or intent associated with a part design. The process planning team at the National Institute of Standards and Technology is using features and their associated functionality to derive process plans from a part model in a semi-automatic fashion. The process planning team believes that features are the key to having a fully automated planning system. The paper discusses the feature-based process planning work currently in progress at the Automated Manufacturing Research Facility (AMRF). Before the current work is described, background information will be given on the AMRF, process planning in the AMRF, some existing definitions of a feature, how the process planning team defines a feature, and current research in the field of features.

200,838
PB93-113611 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Robot Systems Div.
Inventory in the Advanced Deburring and Chamfering System.
R. T. Russell. Sep 92, 16p NISTIR-4932

Keywords: *Deburring, *Chamfering, *Workstations, *Computer aided manufacturing, Robotics, Inventories, Real time operations, Controllers, Robots, Computers, 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 of the National Institute of Standards and Technology.

200,839
PB93-130318 Not available NTIS
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Robot Systems Div.
Methodology for Integrating Sensor Feedback in Machine Tool Controllers.
Final rept.
F. Proctor, J. Michaloski, and T. Kramer. 1992, 11p
Pub. in Proceedings of International Conference on Flexible Automation and Information Management (2nd), Washington, DC., June 30, 1992, 11p.

Keywords: *Machine tools, *Control systems, Hierarchies, Methodology, Computer architecture, Computer aided manufacturing, Sensors, Feedback control, Reprints, NASREM(NASA/NBS Standard Reference Model), NIST(National Institute of Standards and Technology).

A reference model architecture for real-time hierarchical control systems has been proposed by researchers at the National Institute of Standards and Technology (NIST). This architecture was formalized during work with the National Aeronautics and Space Administration on the Flight Telerobot Servicer for the space station, and is known as the NASA/NBS Standard Reference Model (NASREM). Although NASREM was intended to serve as a guideline for space application robot control, it has applicability to a wide range of real-time control applications. This paper adapts the NASREM reference model architecture to a machine tool control model. A computational architecture is presented that describes expected behavior at each layer. A functional analysis will outline a baseline task tree vocabulary. The task tree vocabulary is given by a set of command verbs for each layer and is a critical component of task description within a hierarchical control system.

Job Environment

200,840
PB92-226398 PC **A11**/MF **A03**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Office Workspace for Tomorrow DOT Workshop. Transcript of Proceedings. Held in Washington, DC. on November 13-14, 1991.
A. Rubin. Jul 92, 232p NISTIR-4802
Sponsored by Department of Transportation, Washington, DC. Office of the Secretary.

Keywords: *Meetings, *Office buildings, *Workplace layout, *Design, Workstations, Human factors engineering, Standards, Environmental design, Telecommunication, Furniture, Department of Transportation.

The report contains the proceedings of a workshop held to assist the Department of Transportation in planning a new Headquarters Building. Workshop presentations covered the following topics: workstation design process, programming tradeoffs, workstation standards and criteria, ergonomics, human resource issues, leading edge workstation design, impact of new technologies on office and workstation design, lighting, environmental technologies, information and data systems, building design, facility management, forecasts of the office-of-the-future.

Joining

200,841
PB92-159979 Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Report on 1990 Actions by International Institute of Welding.
Final rept.
T. A. Siewert. 1991, 3p
See also report for 1989, PB91-134619.
Pub. in Materials Evaluation 49, n4 p470-472 Apr 91.

Keywords: *Welding, *Nondestructive tests, Reliability, Tolerances, Research projects, Inspection, Radiography, International organizations, Technology assessment, Test 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 focus for NDE research and standardization activities. Many of its documents are accepted by the International Standards Organization (ISO) and become standards. It also provides an opportunity for U.S. researchers to present data, and have discussions with other researchers.

200,842
PB92-159987 Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Welding Technology in Eastern Europe.
Final rept.
T. A. Siewert, and J. M. Gerken. 1991, 4p
Pub. in Welding Jnl., p49-52 Mar 91.

Keywords: *Welding, *Technology assessment, International trade, Research, Hungary, Czechoslovakia, Technology transfer, Reprints, *Foreign technology, *Eastern Europe.

During May and June 1990, Drs. Siewert and Gerken traveled (independently) through 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 the activities at these organizations and lists some opportunities for interaction with them.

200,843
PB92-165018 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 rept.
G. Adam, and T. A. Siewert. 1990, 5p
See also PB90-117391.
Pub. in Proceedings of International Conference on 'Trends in Welding Research' (2nd), Gatlinburg, TN., May 1989, p979-983 1990.

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 the data using Fourier transforms, amplitude frequency histograms, 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 circuiting, globular 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
PB92-181171 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 rept.
S. W. Stiefel. Apr 92, 25p NISTIR-4817
See also Part 2, PB92-181189.

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 intent of the Act is to increase fastener quality and reduce the 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 March 22, 1991, announcing an April 22, 1991 workshop at NIST to provide interested parties an opportunity to participate in the development of a list of test methods to be included in the laboratory accreditation program. The workshop resulted in presentations and lists of fastener specifications and test methods submitted by laboratories, users (both public and private), manufacturers, standards organizations, instrument manufacturers, distributors and importers. The presentations and summary statistics for the lists are presented in the report. The lists have been categorized by fastener specification, and by type of fastener inspection or testing. 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 report (NISTIR 4817) summarizes the workshop presentations and the test method categories submitted in response to the notice published in the Federal Register. Part II of the report (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. Appendices. Held in Gaithersburg, Maryland on April 22, 1991.
Final rept.
S. W. Stiefel, and E. R. Lindstrom. Apr 92, 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 certain fasteners. The Act provides for the use of National Institute of Standards and Technology (NIST) procedures followed by the National Voluntary Laboratory Accreditation Program (NVLAP). In accordance with procedures a notice was 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 method list. Part I of the report (NISTIR 4817) summarizes the workshop presentations and the test method categories submitted in response to the notice published in the Federal Register. Part II of the report (NISTIR 4818) contains the appendices: (1) 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 formal 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 rept.
F. Biancaniello, C. Presser, and S. D. Ridder. 1990, 9p
Pub. in Materials Science and Engineering A 124, n1 p21-29 1990.

Keywords: *Particle size distribution, *Metal powder, *Diffractometers, *Lasers, Sieve analysis, Size determination, Laser applications, Process control, Feedback control, Atomizing, Diffraction, Reprints, *Inert gas atomization.

Metal powder produced by inert gas atomization was analyzed with a nonintrusive particle sizing instrument. The in-situ particle sizer operates on the principle of laser Fraunhofer diffraction and provides a line-of-sight measurement of the particle size distribution and mean size. The instrument has been successfully tested during several metal powder atomization runs. Results obtained with the particle sizing apparatus compare favorably 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), Boulder, CO. Materials Reliability Div.
Report on 1991 Actions by International Institute of Welding.
Final rept.
T. A. Siewert. 1992, 2p
Pub. in Materials Evaluation 50, n3 p422-423 Mar 92.

Keywords: *Quality assurance, *Weldments, *Nondestructive tests, *Standardization, *Meetings, Quality control, Welding, Product inspection, Welded joints, Reprints, International Institute of Welding.

Commission V on Quality Control and Quality Assurance of Welded Products (formerly Testing, Measurement, and Control of Welds) met during the Annual 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 focus for research and standardization activities in nondestructive evaluation. Many of its documents are forwarded to the International Organization for Standards (ISO) and become standards. The meeting provides an opportunity to present and discuss U.S. research and standards 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.
Sensing of Contact Tube Wear in Gas Metal Arc Welding.
M. A. Mornis, T. P. Quinn, T. A. Siewert, and J. P. H. Steele. Sep 92, 37p NISTIR-3996
Prepared in cooperation with Colorado School of Mines, Golden. Dept. of Mechanical Engineering. Sponsored by David Taylor Research Center, Annapolis, MD.

Keywords: *Wear tests, *Gas metal arc welding, *Welding current, *Sensors, Weldments, Welding electrodes, Wear, Welding machines, Weld line, Fatigue(Materials), Wear resistance.

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 integral power spectral density curve (W) of the voltage, within the 0 to 4 Hz range, correlated with wear. W in this frequency range was found to measure 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 line contact between the electrode and the contact tube, then 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 (IMSE), Boulder, CO. Fracture and Deformation Div.
Metal Transfer Mode in Gas Metal Arc Welding.
Final rept.
S. Liu, T. A. Siewert, and H. G. Lan. 1990, 5p
Pub. in Proceedings of International Conference on Trends in Welding Research (2nd), Gatlinburg, TN., May 14-18, 1989, p475-479 1990.

Keywords: *Gas metal arc welding, *Weld metal, *Mass 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 size and rate of transfer of these droplets determine the metal transfer mode and stability of the process. The arc current and voltage signals associated with each droplet transfer are affected by the droplet transfer and can be used to monitor the metal transfer mode and the stability of the process. In this paper, a set of droplet transfer criteria is established, using arc voltage variations observed during each transfer cycle, to characterize the different metal transfer modes. This study also indicates that metal transfer occurs mostly 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 two or more transfer modes, resulting in unstable transfer of metal.

Manufacturing, Planning, Processing & Control

200,850
PB92-181213 PC **A04**/MF **A01**
Catholic Univ. of America, Washington, DC. Dept. of Mechanical Engineering.
Library of Material Removal Shape Element Volumes (MRSEVs).
T. R. Kramer. Mar 92, 68p NISTIR-4809, NISTIR-4809
Grant NANB9H0923
See also PB88-164181 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, Subroutine libraries, *MRSEVs(Material Removal Shape Element Volumes), 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 proposed. 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
PB92-226307 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Factory Automation Systems Div.
User's Guide to the On-Line Bibliographic Reference System for the NIST Process Planning Testbed.
A. B. Feeney. 3 Aug 92, 13p NISTIR-4891
8609
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.

Keywords: *Information systems, *Tests, On line systems, Data bases, Information services, Interactive systems, *Process planning, *NIST(National Institute of Standards and Technology).

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 NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Inverse Problems in the Sensing of Materials Processing.
Final rept.
S. J. Norton, A. H. Kahn, F. A. Mauer, and H. N. G. Wadley. 1990, 17p
Sponsored by Virginia Univ., Charlottesville. Dept. of Materials Science.
Pub. in Proceedings of Symposium on Intelligent Processing of Materials, Fall Meeting of the Minerals, Metals and Materials Society, Indianapolis, IN., October 2-5, 1990, p275-291.

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 axisymmetric 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.

Productivity

200,853
PB92-172774 PC **A04**/MF **A01**
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Fabrication Technology Div.
Shop of the 90's: The Automation of Small Machine Shops Using Existing and Affordable Technology.
A. Moll. Feb 92, 73p NISTIR-4786
See also PB92-164664.

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.

Quality Control & Reliability

200,854
PB92-144732 Not available NTIS
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 Jnl. of Nondestructive Evaluation 7, n1-2 p3-14 Jun 88.

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-flaw interactions is presented. Two-dimensional problems are presented which 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 v-groove 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 NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Characterizing Differential Air-Core Eddy Current Probes.
Final rept.
T. E. Capobianco, and S. J. Ciciora. 1991, 7p
See also PB90-187550.
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v10A p897-903 1991.

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 5 factors which were varied at 2 levels. These 5 factors include: (1) the number of layers of the inner coils, (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 probe constructed in their laboratory and they also discuss some of the idiosyncracies 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 NTIS
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. Lagergren. 1990, 10p
See also AD-A194 695.
Pub. in Jnl. of Statistical Planning and Inference 26, p253-262 1990.

Keywords: *Quality control, *Combinatorial analysis, *Dispersing, Mathematical models, Experimentation, Mathematical residues, Mathematical arrays, Reprints.

The paper considers the problem of estimation of dispersion effects of factors in replicated factorial experiments under a general dispersion model. It also characterizes the arrays so that the estimation of dispersion effects is possible. The problem considered in the paper arises in quality control studies and the methodologies are applicable to industrial experiments.

200,857
PB92-172014 PC **A03**/MF **A01**
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Form Error Models of the NIST Algorithm Testing System.
M. E. A. Algeo, and T. H. Hopp. Jan 92, 13p NISTIR-4740
Sponsored by Naval Research Lab., Washington, DC. Navy Manufacturing Technology Program.

Keywords: *Metrology, *Mathematical models, *Algorithms, *Computer program verification, Testing, Manufacturing, Computer software, Euclidean geometry, Errors, Data processing, Computerized simulation, National Institute of Standards and Technology.

The National Institute of Standards and Technology (NIST) Algorithm Testing System (ATS) 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 form errors. The report documents the form error models used in the Algorithm Testing System.

200,858
PB92-181940 PC **A07**/MF **A02**
Marley Organization, Inc., Ridgefield, CT.
Directory of Professional/Trade Organization Laboratory Accreditation/Designation Programs.
Special pub. (Final).
C. W. Hyer. Mar 92, 135p NIST/SP-831, NIST/SP-831
Grant 43NANB013668
Also available from Supt. of Docs. as SN003-003-03144-5. Supersedes PB92-108968. See also PB91-167379 and PB91-194415. Sponsored by National Inst. of Standards and Technology, Gaithersburg, MD. Office of Standards Code and Information.

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 and 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 accreditation or designation is based on an assessment of the capability of the laboratory to conduct the testing. However, the nature of the assessment varies considerably by organization and program. Entries in the directory are based on information provided by each organization and reflect the organization's view of its 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.

200,859
PB92-191204 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Robot Systems Div.
Use of Vision and Touch Sensors for Dimensional Inspection Tasks.
M. Nashman. Apr 92, 16p NISTIR-4839
See also PB89-221188.

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 in 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 tasks and to suggest alternative strategies for the use of these sensors to increase their capabilities.

200,860
PB92-236900 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Statistical Engineering Div.
Taguchi Methods.
Final rept.
R. N. Kacker. 1990, 27p
Pub. in Handbook of Statistical Methods for Engineers and Scientists, Chapter 19, p19.1-19.27 1990.

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 manufacturer's tolerances from 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-measurers against the chronic causes of variation. A key element of Taguchi's approach is the use of statistically planned experiments to reduce the sensitivity of engineering designs to the chronic causes of variation. Some of the details of statistical methods proposed by Taguchi are controversial. The last section includes a discussion of the competing viewpoints.

200,861
PB92-237387 Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Rotationally Symmetric Image Quality Indicator for Digital X-ray Imaging Systems.
Final rept.
T. A. Siewert, D. W. Fitting, and M. W. Austin. 1992, 7p
Pub. in Materials Evaluation 50, n3 p360-366 Mar 92.

Keywords: *X-ray radiography, *X ray inspection, X ray imagery, Quality control, Digital systems, Reprints, Image quality indicators, Nondestructive evaluation, X ray tomography, Radioscopy.

A new image quality indicator (IQI) is proposed. The 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 plaque-type IQIs in that it is easier to locate when near the lower detection limit and provides image-quality information even when rotated through large angles around any axes of symmetry. These attributes 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 radioscopic image containing an IQI. This technique is useful for quantitatively determining whether the desired thickness sensitivity has been achieved. The method is operator-independent and yields the same results on repeated evaluations of the image data. Images made with IQIs of new design and also of the plaque design are amenable to evaluation with this method.

200,862
PB92-238583 PC **A04**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
Comparative Study of CMM Flat-Surface Inspection Plans.
J. P. Hsu, T. W. Hsu, J. J. Filliben, and T. H. Hopp. Aug 92, 57p NISTIR-4897
See also PB91-167221. Prepared in cooperation with Texas Univ. at El Paso. Dept. of Mechanical and Industrial Engineering.

Keywords: *Inspection, *Flatness, Sampling, Computer aided design, Computer aided manufacturing, Dimensional measurement, Comparison, Data acquisition, 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 baseline in the sense that the recommendations flow from a part geometry which is, by design, fundamental (a plane) and a part characteristic which is fundamental (flatness). The report provides details on the engineering considerations that went into setting up and running an appropriate experiment, and the several 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.

200,863
PB92-238666 PC **A03**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD. Technology Administration.
Strategy for the Quality Control of Automated Machine Tools.
T. V. Vorburger, K. W. Yee, B. R. Scace, and F. F. Rudder. Feb 92, 48p NISTIR-4773
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 manufacturing, Inspection, QIA(Quality in Automation), National Institute of Standards and Technology.

The automated control of machine tool accuracy is discussed within a quality architecture containing three control loops: real-time, process-intermittent, 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 deterministic metrology for improving the accuracy of machine tools. Deterministic metrology relies on repeatability of the process and emphasizes the measurement of process variables over statistical process control of the product. At present, active investigation 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 parameters, parameters of a geometrical thermal model, and weighting factors for each of the above quantities. The stages of automating the system are also proposed.

200,864
PB93-125086 PC **A08**/MF **A02**
National Inst. of Standards and Technology, Gaithersburg, MD. Technology Administration.
Uniform Laws and Regulations in the Areas of Legal Metrology and Motor Fuel Quality, 1993 as Adopted by the 77th National Conference on Weights and Measures 1992.
Handbook (Final).
J. A. Koenig. Oct 92, 169p NIST/HB-130-1993
Also available from Supt. of Docs. as SN003-003-03184-4. Supersedes PB92-112416.

Keywords: *Weight measurement, *Regulations, *Handbooks, Packaging, Standardization, Revisions, Automotive fuels, Consumer affairs, Commodities, Labels, Prices, Food, Sales, Metrology, Law(Jurisprudence), *Weights and measures, Open dating, Unit pricing, 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 (NCWM). The compilation itself was approved by the NCWM in 1979, and this edition includes amendments adopted by the Conference at its annual meeting in 1992. The NCWM recommends adoption and promulgation by the States of these uniform laws and regulations as updated in this handbook.

200,865
PB93-129351 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Reconstructing Electrical-Conductivity Profiles from Variable-Frequency Eddy Current Measurements.
Final rept.
S. J. Norton, A. H. Kahn, and M. L. Mester. 1989, 13p
Sponsored by Aluminum Association, Inc., Washington, DC.
Pub. in Res. Nondestr. Eval. 1, p157-179 1989.

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 in cylindrical conductors is described. Solenoidal driving and sensing coils surround the cylindrical sample and an AC magnetic field applied by the driving solenoid induces axisymmetric 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-recorded 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.

200,866
PB93-129518 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Automated Production Technology Div.
Implementing Error Compensation on Machine Tools.
Final rept.
R. J. Gavin, and K. W. Yee. 1989, 9p
Pub. in Proceedings of Quality Control/Quality Improvement Southern Manufacturing Technology Conference, Charlotte, NC., May 2-4, 1989, p2-132-2-140.

Keywords: *Error correcting devices, *Machine tools, Real time, Accuracy, Coders, Machining, Reprints.

Using a personal computer, signals corresponding to machine tool geometric and thermally induced errors can be inserted between the position feedback elements and the machine tool controller to provide easy real-time compensation for these errors.

200,867
PB93-130474 PC **A10**/MF **A03**
National Inst. of Standards and Technology (TS), Gaithersburg, MD.
Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices as Adopted by the 77th National Conference on Weights and Measures, 1992.
Handbook.
H. V. Oppermann. Oct 92, 217p NIST/HB-44
Also available from Supt. of Docs. as SN003-003-03185-2. Supersedes PB92-112424. See also PB93-130466.

Keywords: *Measuring instruments, *Weight indicators, *Handbooks, Tolerances(Mechanics), Volume unit meters, Dimensional measurement, Specifications, Odometers, Length, Liquids, Vapors, Grain moisture, Taximeters.

Handbook 44 was first published in 1949, having been preceded by similar handbooks of various designations and in several forms beginning in 1918. The 1993 edition was developed by the Committee on Specifications and Tolerances of the National Conference on Weights and Measures with the assistance of the Office of Weights and Measures of the National Institute of Standards and Technology. It includes amendments adopted by the 77th annual meeting of the National Conference on Weights and Measures in 1992. Handbook 44 is published in its entirety each year following the annual meeting of the National Conference on Weights and Measures.

200,868
PB93-135242 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Determination of Electrical Conductivity Profiles from Multi-Frequency Impedance Measurements.
Final rept.
S. J. Norton, A. H. Kahn, and M. L. Mester. 1990, 5p
Pub. in Proceedings of Conference Review of Progress in Quantitative Nondestructive Evaluation, v9B p2025-2029 1990.

Keywords: *Eddy currents, *Impedance, *Electrical resistivity, *Profiles, Electrical properties, Nondestructive tests, Simulation, Electromagnetic testing, Eddy current tests, Conductivity, Frequencies, Reprints.

Eddy-current measurements at varied frequencies penetrate conductors to varying depths and thus are sensitive to spatial variations in electrical conductivity. Determination of spatial profiles of conductivity offers the possibility of use in metals processing, where the interest is in composite materials or materials with nonuniform temperature distributions. In this paper we present simulations of this inverse eddy-current problem based on calculated multi-frequency impedance data. Cylindrical models were used for generating the synthetic data; stepped and continuously varying radical profiles were assumed. Results of the inversion calculation by nonlinear least-squares fitting are presented.

Research Program Administration & Technology Transfer

200,869
PB92-158310 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MEL), Gaithersburg, MD.
Manufacturing Technology Centers Program. A Sampling of Individual Case Histories.
Special pub. (Final).
R. Suenram. Feb 92, 28p NIST/SP-830
Also available from Supt. of Docs. as SN003-003-03141-1. See also PB91-208314.

Keywords: *Manufacturing, *Technology transfer, *Industries, Case histories, Organizational structure, Government/industry relations, Regional centers, National Institute of Standards and Technology.

The National Institute of Standards and Technology (NIST) Special Publication introduces the NIST Manufacturing Technology Centers (MTC) Program and the organizations which serve as its regional centers. The purpose of the program is to speed the transfer of advanced manufacturing technology to U.S. industry, especially small- and medium-sized firms, through a series of regional technology centers. The brochure highlights a variety of interactions that the regional centers have had with manufacturing firms. These interactions are presented in case history format.

200,870
PB92-239045 PC **A05**/MF **A01**
National Research Council, Washington, DC. Commission on Engineering and Technical Systems.
Proposal Evaluation for the Manufacturing Technology Centers Program, 1992.
Final rept.
c1992, 79p
Contract SBNB2C7053
See also PB91-208314. Sponsored by National Inst. of Standards and Technology, Gaithersburg, MD. Acquisition and Assistance Div.

Keywords: *Research management, *Manufacturing, *Technology transfer, Competition, Research projects, Proposals, Evaluation, Universities, Government/industry relations, MTCs(Manufacturing Technology Centers), National Institute of Standards and Technology.

The report documents the National Research Council (NRC) committee's technical evaluation of 16 proposals submitted to the National Institute of Standards and Technology (NIST). The committee reached consensus on the merit of each proposal according to specific criteria provided by NIST. The proposals were each considered independently; they were not ranked or prioritized by the committee. In addition, the report contains information on the MTC selection process, the Manufacturing Technology Center (MTC) program, and other related NIST activities.

Robotics/Robots

200,871
PB92-133016 PC **A03**/MF **A01**
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Invariants in Visual Motion.
D. Raviv. Nov 91, 24p NISTIR-4722
See also PB90-254863 and PB91-157156. Prepared in cooperation with Florida Atlantic Univ., Boca Raton.

Keywords: *Robots, *Computer vision, *Motion, Image processing, Visual perception, Invariance, Three dimensional bodies.

The paper deals with new and simple representations of 3-D points in a moving-observer coordinate system. Assuming rectilinear motion with no rotation of an observer where the optical axis coincides with the direction of motion, and a stationary scene, points in 3-D space that lie on a particular 3-D surface produce constant value of some nonlinear function of the measurable image optical flow. Five sets of different surfaces are introduced, and there is one optical-flow based constant value for each surface. These values are called 'invariants'. It is shown how to extract these invariants and how to use them for representing 3-D space.

200,872
PB92-165844 Not available NTIS
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Robot Systems Div.
Computer Simulation of a Parallel Link Manipulator.
Final rept.
J. D. Lee, J. S. Albus, N. G. Dagalakis, and T. Tsai. 1989, 10p
Pub. in Robotics and Computer Integrated Manufacturing 5, n4 p333-342 1989.

Keywords: *Manipulators, *Computerized simulation, Robot arms, Robot dynamics, Control systems, Algorithms, 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 can be used to perform tasks such as position control, path tracing, and force control. For each task, the control algorithm is formulated and tested.

200,873
PB92-217686
(Order as PB92-217637, PC **A05**/MF **A01)**
National Inst. of Standards and Technology, Gaithersburg, MD.
NIST SPIDER: A Robot Crane.
J. Albus, R. Bostelman, and N. Dagalakis. 1992, 13p
Included in Jnl. of Research of the National Institute of Standards and Technology, v97 n3 p373-385 May/Jun 92.

Keywords: *Robots, *Cranes(Hoists), Cables(Ropes), Performance evaluation, Design, *Stewart platform.

The Robot Systems Division of the National Institute of Standards and Technology has been experimenting for several years with new concepts for robot cranes. These concepts utilize the basic idea of the Stewart Platform parallel link manipulator. The unique feature of the NIST approach is to use cables as the parallel links and to use winches as the actuators. So long as the cables are all in tension, the load is kinematically constrained, and the cables resist perturbing forces and moments with equal stiffness to both positive and negative loads. Based on these concepts, a revolutionary new type of robot crane, the NIST SPIDER (Stewart Platform Instrumented Drive Environmental Robot) has been developed that can control the position, velocity, and force of tools and heavy machinery in all six degrees of freedom (x, y, z, roll, pitch, and yaw). Depending on what is suspended from its work platform, the SPIDER can perform a variety of tasks. Examples are: cutting, excavating and grading, shaping and finishing, lifting and positioning.

200,874
PB92-237478 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Control System Architecture for the TEAM Program.
Final rept.
S. Szabo, H. A. Scott, and R. D. Kilmer. 1988, 9p
Pub. in Proceedings of International Symposium (2nd) on Robotics and Manufacturing: Research, Education, and Applications, Albuquerque, NM., November 16-18, 1988, p483-491.

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 vehicles 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 of the hierarchical control concepts. A review of the design methodology, including an example task decomposition follows.

200,875
PB93-116416 PC **A03**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD. Technology Administration.
Development of the Forward and Inverse Kinematic Models for the Advanced Deburring and Chamfering System (ADACS) Industrial Robot.
K. A. Stouffer. Sep 92, 26p NISTIR-4928

Keywords: *Robots, *Deburring, *Chamfering, *Kinematics, Computer aided manufacturing, Position(Location), Robotics, Manipulators, Real time operations, Matrices(Mathematics), Mathematical models.

The kinematic model for the Advanced Deburring and Chamfering System (ADACS) robot, which determines the position and orientation of the manipulator end-effector for a given set of joint angles, is developed using the standardized Denavit-Hartenberg method as well as an alternative link transform method. The Denavit-Hartenberg notation is described and the parameters for each link are provided in table form. The transform matrix for each link is then derived using these parameters and the mathematical kinematic model is developed. 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 and trigonometric manipulation of the rotation part of the transformation matrix. There are two problems that are dealt with when the inverse kinematic model is solved for. One is the presence of a singularity point in the manipulator. A singularity occurs when two or more joint axes 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.

200,876
PB93-125037 PC **A05**/MF **A01**
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Robot Systems Div.
Real-Time Control System Methodology for Developing Intelligent Control Systems.
R. Quintero, and A. J. Barbera. Oct 92, 86p NISTIR-4936
Also available from Supt. of Docs. Prepared in cooperation with Advanced Technology and Research, Inc., Laurel, MD.

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 complies with 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 in the area of hierarchical real-time control systems for automation and robotics, for more than a decade. NIST researchers, working in the Automated Manufacturing Research Facility (AMRF) and on a number of other agency projects, have defined a theoretical reference model architecture as a first step in establishing a framework for standards development. The paper represents a second step toward that goal.

200,877
PB93-135408 Not available NTIS
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Robot Systems Div.
Architecture to Support Autonomy, Teleoperation and Shared Control.
Final rept.
R. Lumia, J. C. Fiala, and A. J. Wavering. 1988, 5p
See also PB91-101428.
Pub. in Proceedings of Conference IEEE International Conference System Man. and Cybern., Beijing/Shenyang, China, August 8-12, 1988, p472-476.

Keywords: *Robots, *Control systems, Autonomy, Teleoperators, Man machine systems, Robot sensors, Reprints.

Described is an approach to the functional architecture of a telerobot so that autonomy, teleoperation and shared control can all be supported. The system is hierarchically organized where task decomposition, world modeling, and sensory processing are explicitly represented. Goals at each level of the hierarchy are decomposed spatially and temporally into simpler tasks which become goals for lower levels. The spatial decomposition facilitates control and coordination of multi-arm robots. A description of the lowest level, the Servo Level, is presented, along with the operator control interface at that level.

Tooling, Machinery, & Tools

200,878
PB92-164664 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Fabrication Technology Div.
Shop of the 90's Project In-House Machine Tool Evaluation and Machine Tool Evaluation Form (with Instructions).
A. Moll. Feb 92, 19p NISTIR-4772

Keywords: *Machine tools, *Evaluation, Machine shops, Numerical control, Return on investment, Forms(Paper), *FTD(Fabrication Technology Division), National Institute of Standards and Technology.

The document evaluates all machine tools within the Fabrication Technology Division's (FTD's) shops as to their condition and need for repair. A return on investment can be calculated to allow the shop management to make repair or replace decisions on defective or outmoded equipment. Appendix A is a sample equipment evaluation form developed during the project. The completed form in Appendix B represents an actual evaluation of one of the numerical control machines in FTD. It contains all necessary information and a completed return on investment calculation.

200,879
PB92-183730 PC **A04**/MF **A01**
National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.
Effects of Flow Conditioners and Tap Location on Orifice Flowmeter Performance.
Technical note Feb-Dec 90.
J. L. Scott, C. F. Sindt, M. A. Lewis, and J. A. Brennan. Oct 91, 73p NIST/TN-1352, GRI-91/0229
Contract GRI-5088-271-1680
Also available from Supt. of Docs. as SN003-003-03150-0. See also PB91-111989 and PB92-116490. Sponsored by Gas Research Inst., Chicago, IL.

Keywords: *Orifice meters, *Flowmeters, *Flow distortion, Orifice flow, Pipe flow, Flow measurement, Reynolds number, Orifices, Discharge coefficient, Taps.

Current research is being conducted to provide information which will be used to improve the existing industry standards for proper installation of orifice meters. The research includes experimental investigation of a Zanker, an etoile, and several tube bundle flow conditioners at various positions relative to the orifice plate. Also included are the effects of pressure tap location, both with and without flow conditioning, as reflected in determination of discharge coefficients. Of the flow conditioners tested at approximately 11 pipe diameters upstream of the orifice plate, the Zanker flow conditioner resulted in discharge coefficients most similar to baseline values. There was only a slight difference in orifice meter performance when a flanged or an in-line tube bundle flow conditioner was used at the tested location upstream of the orifice plate. The effect of pressure tap location was found to be significant with the 0.73 beta ratio plate. Recommendations for future research, as a result of these findings, are included.

200,880
PB92-197490 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
High Vacuum Standards at the National Bureau of Standards.
Final rept.
S. Dittmann. 1988, 14p
Pub. in Proceedings of National Conference of Standards Laboratories Workshop and Symposium Competitiveness in a World Market, Washington, DC., August 14-18, 1988, p57-1-57-14.

Keywords: *Vacuum gages, *Standards, High vacuum, US NBS, Reprints, *Vacuum standards, Molecular drag gages, Spinning rotor gages, Residual drag.

A vacuum standards program was started at the National Bureau of Standards (NBS) almost a decade ago. The range and capability of services offered have steadily improved since that time with recent improvements following a significant increase in NBS support four years ago. At this time, the primary high vacuum standard at NBS is an orifice-flow system which is used for the calibration of molecular drag and hot-cathode ionization gauges over the range 10(sup -6) to 10(sup -1) Pa (10(sup -8) to 10(sup -3) Torr). The total uncertainties (systematic plus three times the standard deviation) using this standard are 5.7% at 10(sup -6) Pa, 1.4% at 10(sup -4) Pa and 1.6% at 10(sup -2) Pa. The operation and performance of this vacuum standard will be discussed. In addition, the performance of the molecular drag gauge as it is used as a transfer standard between 10(sup -4) and 10(sup -1) Pa will be reviewed. Efforts are underway to extend the range of this system to lower pressures, develop a new system for higher pressures, and develop calibration techniques for residual gas analyzers.

200,881
PB92-198118 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Temperature and Pressure Div.
New Developments in Barometric Range Pressure Standards.
Final rept.
C. R. Tilford. 1988, 15p
Pub. in Proceedings of National Conference of Standards Laboratories Workshop and Symposium Competitiveness in a World Market, Washington, DC., August 14-18, 1988, p35-1-35-15.

Keywords: *Pressure measurement, *Standards, Barometers, Manometers, Calibration, US NBS, Reprints, *Pressure standards, Dead weight machines, Piston gages.

The largest number of pressure measurements and the most exacting accuracy requirements exist in the atmospheric or barometric pressure range, which extends from a few pascal to a few tenths of a megapascal. Standards in this range are maintained using mercury manometer primary standards or gas-operated piston gage transfer standards. In an effort to improve NBS pressure standards, and allow industrial laboratories to go beyond the current 25-30 ppm state-of-the-art, NBS has developed a new type of mercury manometer and is exploring the performance limitations of gas-operated piston gages. The ultrasonic interferometer manometer is a highly automated mercury manometer that uses an ultrasonic phase shift measurement technique to achieve a reproducibility of 10(sup -2) Pa at low pressures and an uncertainty of 15 ppm at higher pressures. The design and performance of this instrument will be described, along with the results of experiments in which the manometer has been used to explore the dependence of piston gages on various operating parameters, including gas composition, and gage or differential vs. absolute mode operation.

200,882
PB92-205368 PC **A07**/MF **A02**
National Inst. of Standards and Technology (TS), Gaithersburg, MD. Office of Standards Services.
Conformity Assessment Workshop: Mobile Machinery (4th). Held in Washington, DC. on November 12, 1991.
R. L. Gladhill. Jun 92, 139p NISTIR-4853
Sponsored by Equipment Mfrs. Inst., Chicago, IL.

Keywords: *Machinery, *Hoists, *Industries, *Standards, *International trade, Mobile equipment, Conformity, Certification, Tests, Specifications, Europe, United States, ISO 9000.

On November 12, 1991, the National Institute of Standards and Technology (NIST) and the Equipment Manufacturers Institute (EMI) cosponsored a workshop to explore ways in which the U.S. Government can assist the mobile machinery industry to meet conformity assessment requirements and gain acceptance of its products in international markets such as the European Community (EC). The report summarizes the discussions.

200,883
PB92-237502 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Optimum Stiffness Study for a Parallel Link Robot Crane Under Horizontal Force.
Final rept.
J. Unger, N. G. Dagalakis, T. M. Tsai, and J. D. Lee. 1988, 10p
Pub. in Proceedings of International Symposium (2nd) on Robotics and Manufacturing: Research, Education, and Applications, Albuquerque, NM., November 16-18, 1988, p1037-1046.

Keywords: *Cranes(Hoists), *Robotics, *Stiffness, Manipulators, Optimization, Reprints, Horizontal force, Suspension mechanisms.

A new type of crane suspension mechanism is described. This mechanism can provide a significant increase in the payload stiffness to external and inertial 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 of 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 assumed external load and height. The paper reports the optimization results for the case of a single external horizontal force.

200,884
PB93-131399
(Order as PB93-131381, PC **A07**)
National Inst. of Standards and Technology, Gaithersburg, MD.
Characterization of a Piston Displacement-Type Flowmeter Calibration Facility and the Calibration and Use of Pulsed Output 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 requires proper and quantified verification data. 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 make a measurement are 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 instrumentation 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.

Tribology

200,885
PB92-137553 PC **A10**/MF **A03**
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Ceramic Bearing Technology: Proceedings of the NIST/DARPA Workshop on Ceramic Bearing Technology. Held in Gaithersburg, Maryland on April 17-18, 1991.
Special pub. (Final).
S. Jahanmir. Nov 91, 222p NIST/SP-824
Also available from Supt. of Docs. as SN003-003-03131-3. Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.

Keywords: *Ceramics, *Bearings, *Meetings, Machining, Ball bearings, Lubrication, Service life, Design, Quality control, Nondestructive tests, Grinding.

The objectives of the workshop were to assess the status of ceramic bearing technology, and identify the key research topics needed to expand the range of applications for ceramic bearings. A total of eleven invited presentations were given at the workshop which was attended by seventy-five representatives from industry, government and universities. The presentations and subsequent discussions covered present and potential future applications of ceramic bearings, and topics related to processing, machining, quality control, design, testing and performance evaluation. The report includes short abstracts and the viewgraphs used in the presentations, summary of the discussions, and a list of recommendations for future research.

200,886
PB92-145267 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Study of the Relative Surface Conformity between Two Surfaces in Sliding Contact.
Final rept.
F. X. Wang, P. Lacey, R. S. Gates, and S. M. Hsu. 1991, 7p
Pub. in Jnl. of Tribology 113, p755-761 Oct 91.

Keywords: *Surface roughness, *Wear, *Conformity, Surface properties, Friction, Tribology, Roughness, Lubrication, Contacting, Surfaces, Profiles, Reprints.

The surface roughnesses of two surfaces in a wear contact can change throughout the course of the wear process. This may or may not change the lubrication mechanism of the system depending on the real area of contact as influenced by the changes in the surface roughness. The present work examines the changes in surface roughness within the contact area, as well as the relative mating of the two surfaces. To quantify the similarity between the two wear surfaces, a new concept, the relative surface conformity, has been defined and developed. To effectively measure this parameter, a computer program was written to input the wear scar profilometry traces and to calculate the relative surface conformity of the two. Finally, the relative surface conformity was shown to rise with increasing test duration, during running in.

200,887
PB92-159318 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.
Analysis of Subsurface Crack Propagation and Implications for Wear of Elastically Deforming Materials.
Final rept.
J. W. Dally, Y. M. Chen, and S. Jahanmir. 1990, 20p
Pub. in Wear 141, n1 p95-114 1990.

Keywords: *Crack propagation, *Wear, *Stress intensity factors, Elastic properties, Cracking(Fracturing), Tribology, Fatigue(Materials), Crack tips, Fracture mechanics, 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 generation. The specimen represents a half plane 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 shearing modes 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 (MSEL), Gaithersburg, MD. Ceramics Div.
Friction and Wear Characteristics of Silicon Nitride-Graphite and Alumina-Graphite Composites.
Final rept.
A. Gangopadhyay, and S. Jahanmir. 1991, 9p
Pub. in Tribology Transactions 34, n2 p257-265 1991.

Keywords: *Ceramics, *Coefficient of friction, *Tribology, *Wear tests, *Solid lubricants, *Friction factor, Composite materials, Graphite, Intercalation, Aluminum oxides, Silicon nitrides, Scanning electron microscopy, Microstructure, Raman spectroscopy, Reprints.

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 solid lubricant phase in the ceramic matrix. In the study ceramic-matrix composites were fabricated by drilling a series of small holes in alumina and silicon nitride which were subsequently filled with NiCl2 intercalated graphite under a high pressure. It was found that addition of graphite to silicon nitride considerably reduces the friction coefficient, but alumina-graphite composites exhibit only a marginal reduction in friction coefficient compared to alumina. The worn surfaces of the composites and the steel 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 wear particles, inhibiting the formation of graphite containing transfer films.

200,889
PB92-171156 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Reduction in Friction Coefficient in Sliding Ceramic Surfaces by In-situ Formation of Solid Lubricant Coatings.
Final rept.
A. Gangopadhyay, S. Jahanmir, and B. E. Hegemann. 1990, 10p
Pub. in Proceedings of Leeds-Lyon Symposium on Tribology (16th) - Mechanics of Coatings, Lyon, France, September 5-8, 1989, 10p 1990.

Keywords: *Tribology, *Coefficient of friction, *Solid lubricants, *Ceramics, *Friction factor, Coatings, Intercalation, Graphite, Spectrum analysis, Microstructure, Scanning electron microscopy, Raman spectroscopy, Silicon nitrides, Aluminum oxides, Nickel chlorides, Reprints.

Research investigations on the tribological performance of advanced structural ceramics have shown that the coefficients of friction of these materials are generally larger than 0.5 under unlubricated sliding conditions. The aim of the research was to explore whether the high friction coefficient of ceramic materials can be reduced by solid lubrication. The ceramic materials chosen for the investigation were alumina and silicon nitride using graphite intercalated with NiCl2 as the solid lubricant. Friction coefficients as low as 0.17 were observed when intercalated graphite was used as a solid lubricant with either alumina or silicon nitride. The worn surfaces of the steel counterface, alumina and silicon nitride were examined under a scanning electron microscope and chemically analyzed using energy dispersive spectroscopy, micro-Raman spectroscopy and micro-Fourier transform infrared spectroscopy to gain a better understanding of the mechanism of friction reduction. It was concluded that the reduction in friction is related to the formation of transfer films which consist of a mixture of materials from the surfaces in contact.

200,890
PB92-197730 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Tribology and Mechanical Systems.
Final rept.
S. Jahanmir, N. S. Eiss, L. D. Wedeven, M. B. Peterson, and H. S. Cheng. 1990, 4p
Pub. in Mechanical Engineering 112, n3 p64-67 1990.

Keywords: *Tribology, *Research and development, *Mechanical engineering, Lubrication, Friction, Wear, Forecasting, Operation, Life(Durability), Service life, Industrial production, Reprints, *Research Committee on Tribology, *Advanced materials, American Society of Mechanical Engineers.

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, the essential elements for mechanical systems. During the past seventy five years the ASME - Research Committee on Tribology (RCT) has been instrumental in shaping the 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 (MSEL), Gaithersburg, MD. Ceramics Div.
Development and Use of a Tribology Research-In-Progress Database.
Final rept.
S. Jahanmir, and M. B. Peterson. 1990, 6p
See also PB89-228274.

Pub. in Lubrication Engineering 46, n3 p153-158 Mar 90.

Keywords: *Tribology, *Data bases, *Information systems, Research, Abstracts, Lubrication, Bearings, Gears, Technology transfer, Wear, Reprints.

Preliminary efforts leading to the development of a research-in-progress database on tribology are described in the paper. The database contains brief abstracts of current tribology research being conducted by industry, universities, research institutes and government laboratories based on a survey of active researchers. It also contains information on the types of activities, general areas of interest, program objectives, and tribology applications. The database can be used to evaluate the current status of research and development activities in the United States. The survey results suggest that there is a strong interest in an applied research in tribology, and that the funding of basic fundamental research is extremely limited. The primary program objectives cited in connection with the tribology activities include long life, low maintenance, failure-free machinery, fundamental understanding, and materials development for improved performance. It is planned to expand and update the database on the regular basis.

General

200,892
PB92-144781 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Building Materials Div.
Practical Fin Shapes for Surface-Tension-Drained Condensation.
Final rept.
M. A. Kedzierski, and R. L. Webb. 1990, 7p
Pub. in Jnl. of Heat Transfer 112, p479-485 May 90.

Keywords: *Refrigerants, *Condensing, *Cooling fins, *Design, *Interfacial tension, Condensers(Liquefiers), Heat exchangers, Cooling systems, Condensates, Geometry, Drainage, Reprints.

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 radius, the fin height, and the fin base thickness. Consequently, 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, commercial 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 recommended design practice for fins for surface-tension-drained condensation is given also.

200,893
PB92-159490 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.
Aerodynamic Analysis of the Aspiration Phenomena in a Close-Coupled Inert Gas Atomizer.
Final rept.
P. I. Espina, S. D. Ridder, F. S. Biancaniello, and G. E. Mattingly. 1989, 13p
Pub. in Proceedings of Symposium TMS Annual Meeting Synth. Anal. Mater. Process.: Charact. Diagn. of Ceram. Met. Part. Process., p49-61 1989.

Keywords: *Atomizers, Compressible flow, Supersonic 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. Experimental data is compared to a mathematical model that explains the measured aspiration behavior (the aerodynamic pulling force acting on the molten metal delivery nozzle). Results of the study include the measured pressure and temperature fields in the supersonic gas flow as well as the calculated velocities and Mach numbers derived from these measurements. The values combined with schlieren photographs 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 characteristics. The discussion includes the implication of these results on various geometric design parameters, especially their relationship to atomization efficiency.

200,894
PB92-159847 Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.
Development of a Thermoacoustically Driven Orifice Pulse Tube Refrigerator.
Final rept.
R. Radebaugh, K. M. McDermott, G. W. Swift, and R. A. Martin. 1991, 16p
See also PB88-189857.
Pub. in Proceedings of Interagency Meeting on Cryocoolers (4th), Plymouth, MA., October 24, 1990, p205-220 Jan 91.

Keywords: *Refrigerators, *Cryogenics, Orifices, Oscillations, Pressure measurement, Mathematical models, Helium, Nitrogen, Test facilities, Gas flow, Reprints, Pulse tube refrigerators.

The project to develop a thermoacoustically driven orifice pulse tube refrigerator (TADOPTR) was started in February 1989 to meet the infrared sensor cooling requirements of Strategic Defense Initiative Office (SDIO) satellite programs. It is a cooperative effort involving development of a thermoacoustic driver (TAD) 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, thermoacoustically-produced pressure source for the OPTR, eliminating the need for a mechanical compressor. The TADOPTR is the first cryocooler with no moving parts; thus, it has potential for exceptional reliability and low cost. The first laboratory model built to test the concept achieved 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 temperatures up to 965 K. This paper documents the design, fabrication, and performance of the first TADOPTR, and states developmental goals for the future.

200,895
PB92-159854 Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.
Performance of the Second Stage in a Two-Stage Pulse Tube Refrigerator.
Final rept.
R. Radebaugh, W. Rawlins, and L. Brady. 1991, 15p
Pub. in Proceedings of Interagency Meeting on Cryocoolers (4th), Plymouth, MA., October 24, 1990, p179-193 Jan 91.

Keywords: *Cryogenics, *Refrigerators, Liquid nitrogen, Temperature measurement, Refrigerating machinery, Mass flow, Helium, Heat transfer, Mathematical models, Test facilities, Reprints, Pulse tube refrigerators.

To reach temperatures below 60 K with a pulse tube refrigerator, a second stage is usually required. An apparatus to measure the performance of the second stage of a two-stage pulse tube refrigerator has been constructed. The warm end of the second stage regenerator is held fixed at 77 K by the use of a liquid nitrogen bath. The warm end of the second stage pulse tube and the second stage reservoir volume can be held at either 77 K or room temperature. The net refrigeration power, the amount of heat rejected at the warm end, pressures, mass flow rates, and temperature are measured at the second stage. Results of measurements on a test regenerator and pulse tube are given. A low temperature of 44 K was obtained and the gross refrigeration agrees fairly well with our analytical model.

200,896
PB92-159896 Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.
Measurement of Regenerator Performance in a Pulse Tube Refrigerator.
Final rept.
W. Rawlins, K. D. Timmerhaus, and R. Radebaugh. 1991, 10p
See also PB92-116482.
Pub. in Proceedings of International Cryocoolers Conference (6th), Plymouth, MA., October 25-26, 1990, p183-192 Jan 91.

Keywords: *Regenerators, *Refrigerators, *Cryogenics, Temperature measurement, Refrigerating machinery, Performance evaluation, Frequencies, Enthalpy, Mathematical models, Mass flow, Effectiveness, Reprints, Pulse tube refrigerators.

An apparatus has been constructed to measure the performance of regenerators in pulse tube refrigerators operating at pressures oscillating at frequencies between 5 and 30 Hz. The apparatus measures the ineffectiveness of a regenerator using either the liquid nitrogen boil-off method or the instantaneous enthalpy flow method. The latter method relies on measurements of the instantaneous mass flow rate, temperature, and pressure at both ends of the regenerator. This method required the design and use of devices able to measure temperature and mass flow rate at high speeds. The ineffectiveness of a regenerator in a pulse tube refrigerator has been evaluated using both methods.

200,897
PB92-164680 PC **A03**/MF **A01**
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Precision Engineering Div.
Challenges to NIST in Dimensional Metrology: The Impact of Tightening Tolerances in the U.S. Discrete-Part Manufacturing Industry.
D. A. Swyt. Jan 92, 30p NISTIR-4757

Keywords: *Metrology, *Manufacturing, Dimensions, Measurement, Production control, Tolerances(Mechanics), United States, Industries, Trends, Precision, Tables(Data), *NIST(National Institute of Standards and Technology).

The report looks at recent changes in dimensional tolerances in a number of U.S. discrete-parts manufacturing industries and the measurement challenges to the National Institute of Standards and Technology (NIST) they pose. 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 approximately a factor of three every ten years. The report has also shown that whether by the twice-applied Gage-Makers factor-of-ten or Military-Standard factor-of-four relationship of measurement accuracy to manufacturing tolerances, NIST needs to be more accurate than these moving-target tolerances by factors of sixteen to one hundred. Since NIST does not have the current capability to adequately address such needs, it needs to develop new laboratory-based capability in each of the three tolerance regimes: the normal-tolerance regime of metal-cutting machine tools and coordinate measuring machines, the precision-tolerance regime of diamond slicing and advanced interferometers, and the ultraprecision-tolerance regime of scanning tunneling lithography and microscopy.

200,898
PB92-175132 Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.
Regenerator Performance with Sinusoidal Flow.
Final rept.
D. E. Daney. 1991, 3p
Sponsored by National Aeronautics and Space Administration, Moffett Field, CA. Ames Research Center.
Pub. in Cryogenics 31, p839-841 Sep 91.

Keywords: *Heat exchangers, *Cryogenic equipment, Effectiveness, Regenerators, Heat transfer, Cryogenic cooling, Refrigerating machinery, Laminar flow, Cryogenic fluids, Reprints.

The ineffectiveness of regenerators with sinusoidal laminar flow through parallel plate, screen and packed sphere matrices is evaluated in the limit of infinite matrix heat capacity. Increases in ineffectiveness of up to 23% over the constant flow values result for parallel plate regenerators.

200,899
PB92-175645 Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.
Progress in Cryocoolers.
Final rept.
R. Radebaugh. 1991, 14p
Pub. in Applications of Cryogenic Technology, v10 p1-14 1991.

Keywords: *Cryogenic cooling, *Refrigerators, Thermodynamic cycles, Stirling cycle, Refrigerating machinery, Cryogenics, Reliability, Cryopumps, Cryogenic fluids, Refrigerating, Brayton cycle, Reprints.

A significant number of advances have been made during the last few years in a variety of cryocoolers. The paper discusses some of these advances in Brayton, Joule-Thomson, Stirling, pulse tube, Gifford-McMahon, and magnetic refrigerators. Reliability has been a major driving force for new research areas. The paper reviews various approaches taken in the last few years to improve cryocooler reliability. The advantages and disadvantages of different cycles are compared, and the latest improvements in each of these cryocoolers is discussed.

200,900
PB92-187061 PC **A13**/MF **A03**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
3D Piping IGES Application Protocol, Version 1.1.
M. E. Palmer, and K. A. Reed. Mar 92, 282p NISTIR-4797
See also PB91-120196. Sponsored by Naval Sea Systems Command, Washington, DC., and Assistant Secretary of Defense (Production and Logistics), Washington, DC. Computer-aided Acquisition and Logistic Support Program.

Keywords: *Piping systems, *Computer aided design, *Protocols, Data transfer(Computers), Standards, Quality assurance, Data management, Design criteria, Pipes(Tubes), Distribution systems, Three dimensional models, Tests, *IGES(Initial Graphics Exchange Specification).

The 3D Piping Initial Graphics Exchange Specification (IGES) Application Protocol (AP) specifies the mechanisms for defining and exchanging 3D piping system models in IGES format. The AP defines three-dimensional 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 it is recognized that few implementations will support all of the specification. An application protocol defines a logical subschema of the IGES specification, the usage of the subschema, 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.

200,901
PB93-131381 PC **A07**
National Inst. of Standards and Technology, Gaithersburg, MD.
Journal of Research of the National Institute of Standards and Technology, September-October 1992. Volume 97, Number 5.
1992, 133p
Also available from Supt. of Docs. as SN703-027-00048-2. See also PB93-131399 through PB93-131423 and PB93-124246.

Keywords: *Research, Flow measurement, Flowmeters, Calibration, Waveguides, Liquid-vapor interfaces, Resistance thermometers, Liquid nitrogen, Liquid hydrogen, Fracture strength, Silicon nitrides, Zirconium oxides, Aluminum oxides, Ceramic composites.

Contents:
- The Characterization of a Piston Displacement-Type Flowmeter Calibration Facility and the Calibration and Use of Pulsed Output Type Flowmeters;
- A General Waveguide Circuit Theory;
- Resistive Liquid-Vapor Surface Sensors for Liquid Nitrogen and Hydrogen;
- Fracture Toughness of Advanced Ceramics at Room Temperature.

MATERIALS SCIENCES

Carbon & Graphite

200,902
PB92-236710 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Raman Spectroscopy of Synthesized Diamond Grown by Hot Filament Chemical Vapor Deposition.
Final rept.
E. S. Etz, E. N. Farabaugh, A. Feldman, and L. H. Robins. 1988, 9p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Diamond Optics, San Diego, CA., August 16-17, 1988, v969 p86-94.

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 of thin diamond films deposited by the hot-filament chemical vapor deposition (CVD) method are focused on the determination of the purity of the diamond phase and on the extent and nature of defects of the diamond structure. The findings are discussed in relation to deposition parameters, growth mechanisms, and diamond morphology. The specimens consisted of single microparticles of sizes 3 to 40 micrometer, particle clusters, and continuous polycrystalline films of 3 to 8 micrometer thickness grown on silicon substrates. The interpretation of the results is based on the line shape, line width, and frequency position of the diamond line nominally at 1333/cm Raman shift, as well as on other characteristic Raman bands in the region 1300 to 1600/cm attributed to graphitic carbon components. Examined also are the relationship of the spectral background signal to the signal of the Raman features. Luminescence emissions arising from either structural imperfections or substitutional impurities in the diamond lattice are observed. A luminescence band centered around 738 nm (1.68 eV), attributed to either the neutral lattice vacancy in diamond, or possibly a silicon pair substitution in the diamond lattice, widely varied in intensity among the samples analyzed. The observation of this photoluminescence band is correlated with results from concurrent cathodoluminescence measurements.

200,903
PB93-135416 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Tribological Characteristics of Synthesized Diamond Films on Silicon Carbide.
Final rept.
S. Jahanmir, D. E. Deckman, L. K. Ives, A. Feldman, and E. Farabaugh. 1989, 5p
See also PB91-189530.
Pub. in Proceedings of Conference on Wear of Materials, Denver, CO., April 9-13, 1989, p375-379.

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, low friction materials for tribological applications. Silicon carbide specimens, in the form of small disks, were coated with diamond films using the hot filament 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 deposited 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 counterface undergoes tribochemical reactions with the air atmosphere producing hydrated silicates. Formation of this tribochemical reaction product cannot be responsible for low friction coefficients, 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 formation of a thin film of graphite at the real area of contact. Removal of these graphitic regions by wear would then produce a smooth wear surface.

Ceramics, Refractories, & Glass

200,904
AD-A244 582/3 Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD.
Effect of Green Density and the Role of Magnesium Oxide Additive on the Densification of Alumina Measured by Small-Angle Neutron Scattering.
G. G. Long, S. Krueger, and R. A. Page. Jul 91, 9p ARO-26123.3-MS
Contract MIPR-ARO-102-90, Grant DE-FG05-84ER45063
Availability: Pub. in Jnl. of the American Ceramic Society, v74 n7 p1578-1584 Jul 91. Available only to DTIC users. No copies furnished by NTIS.

Keywords: *Aluminum oxides, Additives, Density, Green(Color), Magnesium oxides, Microstructure, Neutron scattering, Porous materials, Sintering, Reprints, Alumina, Small angle scattering, Densification.

Small angle neutron scattering measurements were used to examine the effect of green density and the role of MgO additive on the evolution of the porous microstructure of alumina during intermediate- and final-stage sintering. It was found that the initial connectivity in the green state plays a dominant role in establishing the channel diameters during the intermediate stage of sintering, and contributes also to determining the onset density at which the final stage of sintering begins. The role of MgO as a sintering aid lies, at least in part, in prolonging the stability of intermediate stage sintering such that the body achieves greater density before the transition to final-stage sintering after which isolated pores are formed.

200,905
AD-A249 178/5 Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD.
Evolution of the Pore Size Distribution in Final-Stage Sintering of Alumina Measured by Small-Angle X-ray Scattering.
S. Krueger, G. G. Long, D. R. Black, D. Minor, P. R. Jemian, G. W. Nieman, and R. A. Page. 10 Oct 91, 11p ARO-26123.4-MS
Contract MIPR-ARO-102-90
Availability: Pub. in Jnl. of the American Ceramic Society, v74 n10 p2538-2546 Oct 91. Available only to DTIC users. No copies furnished by NTIS.

Keywords: *Aluminum oxides, *Sintering, *X-ray scattering, Magnesium oxides, Doping, Ceramic materials, High resolution, Density, Entropy, Neutron scattering, Reprints, *Pore size distribution, Alumina, Magnesia, Small angle.

Small-angle X-ray scattering was used to follow the evolution of the pore size distribution during final-stage sintering of alumina and of alumina doped with 0.25 wt% magnesia. The volume-weighted (Guinier) results indicate that the effective size of the largest pores increases as the body goes from 97% to more than 99% dense. The surface-area-weighted (Porod) results show that the median size of the smallest pores decreases slightly over the same density range. Taken together, these data indicate that the pore size distribution becomes broader as final-stage densification proceeds. This was confirmed by a maximum entropy analysis, which was used to derive pore size distributions directly from the data. Finally, the evolution of the pore size distributions in alumina, with and without sintering aid, were compared.

200,906
AD-A249 179/3 Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD.

Characterization of the Densification of Alumina by Multiple Small-Angle Neutron Scattering.
S. Krueger, G. G. Long, and R. A. Page. 1991, 10p
ARO-26123.2-MS
Contract MIPR-ARO-102-90, Grant DE-FG05-84ER45063
Availability: Pub. in Acta Crystallographica, vA47 p282-290 1991. Available only to DTIC users. No copies furnished 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-Al_2O_3 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 materials systems, without needing to increase the resolution of 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 densifies further, there is a transition region after which the effective pore radius grows rapidly to > or = 0.6 micrometers at 97.5% dense.

200,907
AD-A249 510/9 Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, 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, 11p ARO-26123.5-MS
Contract MIPR-ARO-102-90, Grant DE-FG05-84ER45063
Availability: Pub. in Jnl. Mater. Res., v6 n12 p2706-2715, Dec 91. Available to DTIC users only. No copies furnished by NTIS.

Keywords: *Neutron scattering, *Sintering, *Ceramic materials, Microstructure, Polycrystalline, Reprints, *Glassy silica, *Crystalline ceramics, Porosity, SANS(Small Angle Neutron Scattering).

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
AD-A255 729/6 PC **A04**/MF **A01**
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.
Fundamental Understanding of the Effects of Ceramic 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-120-89, MIPR-102-90
Sponsored in part by Army Research Office, Research Triangle Park, NC., under MIPR-118-91.

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 is the final report arising from our research program involving 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 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 program with the Army Research Office (ARO) has been to 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 Processing.

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, 1989, v1112 p68-73.

Keywords: *Zinc sulfides, *Sintering, Nickel sulfides, High pressure, Densification, 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 densification 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. Hardness and toughness were measured by 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, Toughness Curves and Mechanical Properties of Alumina Ceramics.
Final rept.
S. J. Bennison, J. Rodel, S. Lathabai, P. Chantikul, and B. R. Lawn. 1991, 25p
Pub. in Toughening Mechanisms in Quasi-Brittle Materials, p209-233 1991.

Keywords: *Aluminium oxides, *Ceramics, Microstructure, Mechanical properties, Fracture properties, Performance evaluation, Wear, Crack propagation, Structural engineering, Reprints.

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 grain-interlock 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. Finally, short-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 microstructural processing for specific properties.

200,911
PB92-154111 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Transition from Mild to Severe Wear in Alumina during Sliding.
Final rept.
S. J. Cho, H. Moon, B. J. Hockey, and S. M. Hsu. 1992, 8p
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in Acta Metall. Mater. 40, n1 p185-192 1992.

Keywords: *Aluminium oxides, *Wear tests, *Sliding friction, Fracture tests, Fatigue(Materials), Stresses, Cracking, Reprints.

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 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
PB92-154145 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.
Steady-State Creep Behavior of Si-SiC C-Rings.
Final rept.
T. J. Chuang, W. J. Liu, and S. M. Wiederhorn. 1991, 7p
Grant GRI-TPSU-NBS-1302-37922
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in Jnl. of the American Ceramic Society 74, n10 p2531-2537 Oct 91.

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 steady-state 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.

200,913
PB92-154384 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-102-90, DE-FG05-84ER45063
Sponsored by Army Research Office, Research Triangle Park, NC., and Department of Energy, Washington, DC.
Pub. in Jnl. of Materials Research 6, n12 p2706-2715 Dec 91.

Keywords: *Silica glass, *Aluminum oxide, *Ceramics, *Microstructure, *Sintering, Diffusion, Viscous flow, Polycrystals, Neutron scattering, Reprints.

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.

200,914
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.
Final rept.
S. G. Malghan, D. B. Minor, and L. S. H. Lum. 1991, 6p
Sponsored by Department of Energy, Washington, DC.
Pub. in Powder Technology 67, p201-206 1991.

Keywords: *Silicon nitrides, *Powders, Milling, Surface properties, Surface chemistry, Particle size distribution, Kinetics, Reprints, *Agitation ball milling.

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 examined 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 chemistry and impurity 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 milling 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.
Final rept.
G. D. Quinn. 1991, 14p
Pub. in Engineered Materials Handbook: Ceramics and Glasses, v4 p585-598 1991.

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 materials science and engineering perspectives. 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.
Design Data for Engineering Ceramics: A Review of the Flexure Test.
Final rept.
G. D. Quinn, and R. Morrell. 1991, 30p
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 by the well-known flexure strength test method. There is a risk that flexure data are not representative of the properties of fabricated components. Reliability estimates for components based upon 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
PB92-154756 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.
Final rept.
M. D. Vaudin, and W. C. Carter. 1991, 4p
Pub. in Proceedings of Meeting of Microbeam Analysis Society (25th Anniversary), San Jose, CA., August 5-9, 1991, p159-162.

Keywords: *Ceramics, *Crystal structure, *Electron diffraction, *Diffraction methods, Diffraction, Superconductors, Scanning electron microscopy, Backscattering, Composite materials, Silicon nitrides, Aluminum oxides, Ferroelectricity, Reprints.

Electron back scatter diffraction patterns (EBSP) have been recorded in the SEM from crystals as small as 0.2 microm. 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 to within 0.5 degrees and comparative dislocation density information can be obtained. In the paper, the application of the technique to ceramic systems is discussed. The particular difficulties encountered when studying ceramics, as compared to metals and semiconductors, arise because typical ceramics are often of relatively low symmetry and are usually poor electrical and thermal conductors. EBSP patterns from non-cubic materials cannot be indexed by inspection, and therefore an efficient algorithm for automatically indexing diffraction patterns from any crystal system has been developed. The accuracy of orientation determinations depends to a large degree on the uncertainty in the position of the electron source; a least squares algorithm has been developed to calculate the source position. In addition, the video camera introduces up to 5% distortion into the pattern so a method of calibrating the video camera has been developed. Problems associated with the poor thermal and electrical conductivities of ceramics are being solved by a variety of techniques including the careful application of very thin conducting films. The use of digital frame grabbers and processors has had a beneficial effect on most aspects on most of data acquisition aspects of the technique. Results from experiments on diverse ceramic materials such as high temperature superconductors, composites, silicon nitride, ferroelectrics and a number of alumina-based systems are briefly described.

200,918
PB92-159136 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.
Technique for Tensile Creep Testing of Ceramics.
Final rept.
D. F. Carroll, S. M. Wiederhorn, and D. E. Roberts. 1989, 5p
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 hot-grip design for the loading fixture, which provide 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
PB92-159409 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.
In-situ Imaging of Creep Cavities by Synchrotron Microradiography.
Final rept.
R. C. Dobbyn, T. J. Delph, J. Farris, R. J. Fields, and D. G. Harlow. 1989, 3p
Pub. in Scripta Metallurgica 23, n5 p621-623 1989.

Keywords: *Ceramics, *Cavities, *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 most polycrystalline metals and ceramics is creep cavitation. Small voids or cavities have been observed to nucleate and grow on stressed grain boundaries. Eventually, so many of the boundaries are covered by cavities that fracture occurs. Many theories have been proposed to predict the details of cavity nucleation and growth and this is still an area of current theoretical interest. Experiments designed to evaluate these theories have mainly compared predicted times-to-fracture with those observed in traditional polycrystalline creep 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 (IMSE), Gaithersburg, MD. Ceramics Div.
Diffusional Crack Growth in Alumina.
Final rept.
T. J. Chuang, and N. J. Tighe. 1989, 4p
Pub. in Proceedings of International Conference on Fundamentals of Fracture (3rd), Irsee, Germany, June 19-24, 1989, p129-132.

Keywords: *Aluminum oxide, *Crack propagation, *Diffusion coefficient, *Transmission electron microscopy, Creep tests, Metal oxides, Kinetics, Grain boundaries, High temperature tests, Stress analysis, Reprints.

A microcrack was observed via Transmission Electron Microscopy (TEM) to grow along a grain boundary at a speed of 1.94 nanometers/s near the tensile edge of a four-point bend alumina specimen crept under an applied stress of 61 MPa at 1661 C. The crack morphology fits the main features of the diffusional crack growth at steady state, i.e. a constant crack thickness and a characteristic tip shape developed by surface self-diffusion. No dislocation network around the void tip was detected, suggesting the diffusing species were accommodated by elastic deformation of the alumina matrix. Dislocational creep of matrix plays less significant role during diffusive crack growth in brittle ceramics than in metals or superalloys. The observed crack growth rate as a function of stress and test temperature agrees well with what was predicted based on Chuang and Rice model, suggesting the kinetics of growth is controlled by a process of coupled surface and grain boundary diffusion. The predicted diffusivities are also within the ranges of published results. In contrast to the wide scattering data obtained by existing measuring methods, the TEM technique seems to provide a more accurate means in acquiring both surface and grain boundary diffusivities.

200,921
PB92-166024 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Book Review 'Ceramic Hardness'.
Final rept.
G. Quinn. 1991, 1p
Pub. in Jnl. of Testing and Evaluation 19, n6 p497 Nov 91.

Keywords: *Ceramics, *Reviews, *Hardness, Mechanical properties, Materials tests, Reprints.

A review of the book 'Ceramic Hardness' by I. J. McColm for the Journal of Testing and Evaluation, an ASTM publication, is presented.

200,922
PB92-166149 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Materials Div.
Epoxy Impregnation of Hardened Cement for Microstructural Characterization.
Final rept.
L. Struble, and P. Stutzman. 1989, 3p
Contract AFOSR-ISSA87-0057
See also PB89-185573. Sponsored by Air Force Systems Command, Washington, DC.

Pub. in Jnl. of Materials Science Letters 8, n6 p632-634 1989.

Keywords: *Cements, *Microstructures, *Concrete-plastic composites, Construction materials, Scanning electron microscopy, Impregnation, Epoxides, Microcracks, Sampling, Reprints.

The work described here was undertaken to develop a procedure for impregnating hydrated cement with epoxy for microscopical examination that does not produce microcracks. The procedure described utilizes an ultra-low viscosity epoxy, and a sequential replacement of pore solution by ethanol followed by replacement of ethanol by epoxy. Samples are not dried during the impregnation process. After the epoxy is hardened, samples may be ground and polished for microscopical examination. Samples are shown to be free of microcracks associated with drying.

200,923
PB92-166263 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Creep of Two Phase Ceramics.
Final rept.
S. M. Wiederhorn, B. J. Hockey, and D. F. Carroll. 1990, 14p
Pub. in Ceramic Transactions 7, p492-505 1990.

Keywords: *Ceramics, *Creep tests, *Binary systems(Materials), Creep rupture tests, Compression tests, Stresses, Silicon carbide, Composite materials, Deformation, Tension tests, Reprints.

The creep of two phase ceramics is discussed with reference to experimental evidence that suggests that creep of these materials depends on the sign of the applied stress, creep occurring more easily in tension than in compression. To account for such creep asymmetry, one must either assume the existence of alternate pathways for creep deformation, or a creep mechanism that depends on the sign of the applied stress. From experimental data on a fine grain grade of siliconized silicon carbide, alternate pathways (silicon deformation in tension, silicon carbide deformation in compression) are suggested as the main cause of creep asymmetry. Other possible creep mechanisms that lead to creep asymmetry are also discussed. Mechanisms that depend on the sign of the applied stress (cavitation, dilation, sliding friction) are believed to play a secondary role for the siliconized silicon carbide at low stresses, but may be of prime importance for other composites.

200,924
PB92-171420 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Comminution.
Final rept.
S. G. Malghan. 1991, 8p
Pub. in Engineered Materials Handbook on Ceramics and Glasses, v4 p75-82 1991.

Keywords: *Comminution, *Ceramics, *Powder(Particles), Surface chemistry, Agitation, Dispersing, Reprints.

Comminution of powders is an integral unit operation in powder processing. In the paper, comminution of ceramic powders is described in terms of its objectives, mechanisms of size reduction, types of equipment, and capabilities and limitations of equipment. The major methods of comminution by tumbling, vibratory and agitation ball mills, and fluid energy mills to fine powders are presented. Since comminution of powders affects surface chemical properties, as well as phase composition, these effects are outlined. Finally, control of milling process is briefly noted.

200,925
PB92-171438 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Dispersion of Si3N4 Powders: Surface Chemical Interactions in Aqueous Media.
Final rept.
S. G. Malghan. 1992, 13p
Pub. in Colloids and Surfaces 62, p87-99 1992.

Keywords: *Silicon nitrides, *Powder(Particles), *Surface chemistry, *Aqueous solutions, *Dispersing, *Interfaces, Adsorption, Dissolving, Ions, Reprints.

The dispersion of submicron Si3N4 powders is a significant step in their processing to decrease defects and improve microstructural homogeneity. An analysis of subprocesses of dispersion such as wetting, breakup of agglomerates, and reagglomeration, is provided to identify critical steps involved in establishing thermodynamic feasibility and kinetic factors that control dispersion. Interparticle forces that are dominant in the aqueous suspensions of Si3N4 powders are described with reference to the electrical double layer charge development, which is responsible for promoting dispersion stability. Specific ions resulting from the surface dissolution of Si3N4 powders are identified, based on the surface and bulk interactions. The variabilities in the dispersion behavior of powders manufactured by different processes are explained in terms of differences in the specific and nonspecific adsorption of these ions.

200,926
PB92-171446 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Characterization of Ceramic Powders.
Final rept.
S. G. Malghan, and A. L. Dragoo. 1991, 10p
Pub. in Engineered Materials Handbook on Ceramics and Glasses, v4 p65-74 1991.

Keywords: *Ceramics, *Powder(Particles), Particle size distribution, Surface properties, Area, Bulk sampling, Porosity, Surface chemistry, Composition(Property), Reviews, Particle shape, Reprints.

The paper contains a review of the broad field of characterization of ceramic powders. The major subjects covered include particle size and size distribution, specific surface area, porosity, density, morphology, bulk chemical composition, X-ray diffraction and surface chemistry. Under these broad categories, each subject is divided based on measurement principles and associated techniques. The major techniques are described with respect to their principle of measurement, range of application and limitations of measurement. In addition, sample preparation is emphasized since the overall accuracy of measurement depends on the errors involved in obtaining the sample.

200,927
PB92-171453 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Analysis of Factors Affecting Particle-Size Distribution of Hydraulic Cements.
Final rept.
S. G. Malghan, and L. S. H. Lum. 1991, 6p
Pub. in Cement, Concrete, and Aggregates, v13 n2 p115-120 1991.

Keywords: *Hydraulic cements, *Particle size distribution, Light scattering, Dispersing, Solvents, Surfactants, Analysis of variance, Reprints.

Particle-size distribution of hydraulic cements plays an indispensable role in controlling the product quality and maintaining reliable performance in end applications. Selection of particle-size measurement methods is becoming increasingly complex due to the availability of a variety of instruments based on different measurement principles. The paper discusses the primary criteria to be met by a particle-size distribution analyzer for applications in hydraulic cement characterization. Among the several methods available for measuring the particle-size distribution, a light diffraction technique was utilized to examine the effect of dispersion solvents on the resulting size distribution. Distilled water, distilled water containing a polyacrylate surfactant, isopropyl alcohol, and a commercially available organic surfactant were used as dispersion solvents. The resulting data are analyzed with respect to variations due to the dispersion solvents and factors responsible for the observed variations.

200,928
PB92-171461 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Factors Affecting Interface Properties of Silicon Nitride Powders in Aqueous Environment.
Final rept.
S. G. Malghan, and L. Lum. 1990, 10p
Pub. in Ceramic Powder Science III, v12 p403-412 1990.

Keywords: *Silicon nitrides, *Powder(Particles), *Surface chemistry, *Aqueous solutions, *Dispersing, *Interfaces, Adsorption, Polyacrylates, Comminution, Electrolytes, Reprints, Electrokinetic sonic amplitude measurements.

Interface properties of three silicon nitride powders (Ube Industries) of different specific surface areas were studied in aqueous environment by measurement of electrokinetic sonic amplitude. The primary purpose of the study was to develop experimental conditions suitable for dispersion of these powders during milling. Two pertinent variables -- ionic strength of indifferent electrolyte and concentration of specifically adsorbing polyacrylate -- were studied. Results are discussed in relation to the differences in interface properties of the three silicon nitride powders, and likely effects of these properties on dispersion during milling.

200,929
PB92-171479 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Physical and Chemical Modifications in the High Energy Attrition Milling of Si3N4 Powder.
Final rept.
S. G. Malghan, D. B. Minor, and L. S. Lum. 1991, 8p
Pub. in Ceramic Powder Science IV, v22 p297-304 Jul 91.

Keywords: *Silicon nitrides, *Powder(Particles), *Surface chemistry, *Comminution, Particle size distribution, Particle shape, Electrokinetics, Reprints, *High energy agitation milling.

Milling is an integral part of Si3N4 powder processing. Though the primary objectives of milling are to produce a finer size distribution than that of the feed and/or to deagglomerate, the powder undergoes other modifications. In the study, high energy agitation ball milling of Si3N4 powder in an aqueous environment is examined with respect to the modification of physical and surface chemical changes. Specifically, morphology of particles, skewness of size distribution, and surface oxidation are measured as a function of milling parameters. The results are analyzed with respect to milling mechanisms.

200,930
PB92-175363 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Sintering of Ceramics.
Final rept.
C. A. Handwerker, J. E. Blendell, and R. L. Coble. 1989, 35p
Pub. in Science of Sintering: New Directions for Materials Processing and Microstructural Control, p3-37 1989.

Keywords: *Ceramic composites, *Sintering, Microstructure, Dielectric materials, Reviews, Reprints.

The primary goal of sintering research is the controlled manipulation of microstructure. Out of the entire range of microstructures which are theoretically possible, each material system will be able to achieve only a subset of them, depending on the intrinsic material properties. Within these material constraints, the aim is to produce microstructures which enhance specific properties. Ones understanding of the relationships among materials processing, microstructure, and properties is just beginning to emerge, and is producing unexpected results. In the review paper, the authors have examined the research in sintering science over the past five years which has advanced the goal of microstructure manipulation. The research surveyed is only from scientists in countries other than the USSR and the Eastern Block. In the same Conference Proceedings, a Soviet sinterer will review the literature that the authors have omitted.

200,931
PB92-175801 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD.
Crystal Regularity with High-Resolution Synchrotron X-Radiation Diffraction Imaging.
Final rept.
B. Steiner, and R. C. Dobbyn. 1991, 7p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Ceramic Bulletin 70, n6 p1017-1023 1991.

Keywords: *Crystal defects, *Ceramics, Synchrotron radiation, Monochromatic radiation, High resolution, Imaging techniques, X-ray diffraction, Single crystals, Polycrystalline, Reviews, Reprints.

The growing range of devices that process information with high quality crystals has stimulated interest in crystal regularity. The paper reviews the high resolution imaging of residual irregularities in high quality macroscopic single crystals by diffraction of specially prepared monochromatic synchrotron X-ray beams. As a result of recent progress, guidance is available for the formation and property optimization not only of single crystals but perhaps of polycrystalline ceramics as well.

200,932
PB92-197722 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Phase Equilibria in the Systems SrO-CuO and SrO-1/2Bi2O3.
Final rept.
N. M. Hwang, R. S. Roth, and C. J. Rawn. 1990, 3p
Pub. in Jnl. of the American Ceramic Society 73, n8 p2531-2533 1990.

Keywords: *Strontium oxides, *Copper oxides, *Bismuth oxides, Phase transformations, X ray diffraction, Superconductors, Reprints, Phase equilibrium, Strontium bismuthates, Strontium cuprates.

The phase equilibria relations in the systems SrO-CuO and SrO-1/2Bi2O3 were studied by X-ray diffraction analysis of powder prepared by the quenching method. SrCuO2 and Sr2CuO3 melt incongruently at 1085 C and 1225 C, respectively. The newly found compound Sr6Bi2O9 decomposes at 965 C into SrO and Sr3Bi2O6; Sr3Bi2O6 melts incongruently into SrO and liquid at 1210 C. SrBi2O4 undergoes a phase transition at around 825 C and although both are nonstoichiometric, the low temperature phase is slightly poorer in SrO with 33.5 at % SrO than that of the high temperature phase.

200,933
PB92-213511 PC **A06**/MF **A02**
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Ceramic Machining: Assessment of Current Practice and Research Needs in the United States.
Special pub. (Final).
S. Jahanmir, L. K. Ives, A. W. Ruff, and M. B. Peterson. Jun 92, 115p NIST/SP-834
Also available from Supt. of Docs. as SN003-003-03156-9.

Keywords: *Ceramics, *Machining, *Research and development, Assessments, Heat resistant materials, United States, Grinding machines(Tools), Wear resistance, Cost effectiveness, Structural engineering, *Advanced materials.

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 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 the assessment, an extensive literature search 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 different aspects of ceramic machining. The ultimate goal of the program is to further the utilization of advanced structural ceramics in industrial applications by increasing the cost-effectiveness of ceramic components. It is recommended that these projects be carried out jointly by government laboratories and industry to facilitate technology transfer, and that all research activities funded by the government be coordinated to minimize the possibility of duplication of effort.

200,934
PB92-222959 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
High-Temperature Flexure Fixture for Advanced Ceramics.
G. D. Quinn. Jun 92, 26p NISTIR-4864

Keywords: *Ceramics, *Test facilities, *Fixtures, *High temperature tests, Mechanical properties, Loads(Forces), Fracturing, Test methods, Flexural strength, Silicon carbides.

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
PB92-236397 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Transient Thermal Response of Plasma-Sprayed Zirconia Measured with Thin Film Thermocouples.
Final rept.
D. R. F. Burgess, M. Yust, and K. G. Kreider. 1990, 7p
Pub. in Sensors and Actuators A24, n2 p155-161 Jul 90.

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 transient thermal response of thin film thermocouples (TFTC's) was shown to obtain results for the temperature jump and temporal response which were consistent with those predicted employing a simple model. Some deviation from this model was obtained for the thinnest 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 experimental method is preferable to calculations of the thermal response of the TFTC's based on bulk thermal data. It should prove useful as a method employed to characterize in-situ TFTC's, which may vary from batch-to-batch.

200,936
PB92-237007 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 rept.
J. J. Kim, C. Park, D. Y. Kim, D. N. Yoon, and A. J. Shapiro. 1990, 5p
Pub. in Jnl. of the American Ceramic Society 73, n12 p3658-3662 1990.

Keywords: *Zirconium oxides, *Precipitates, *Boundary layer flow, Aging tests(Materials), Coarseness, Stress-strain relationships, Strain distribution, Chemical composition, Temperature effects, Stability, Reprints.

When partially stabilized zirconia with 6 mol% MgO and 4mol% CaO is aged at 1450 C, intergranular precipitation occurs and concurrently the boundaries between the grains migrate, forming a precipitate-free cubic phase and large tetragonal preciptates behind them. At these composition and temperature the 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 of 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
PB92-237122 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Fatigue Limits in Noncyclic Loading of Ceramics with Crack-Resistance Curves.
Final rept.
S. Lathabai, and B. R. Lawn. 1989, 9p
Pub. in Jnl. of Materials Science 24, n12 p4298-4306 Dec 89.

Keywords: *Ceramics, *Fatigue limit, *Loads(Forces), Cracking(Fracturing), 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 to the potential role of R-curves in the enhancement of fatigue limits. A numerical algorithm for solving the appropriate differential equations of rate-dependent failure is developed. Our formalism specifically incorporates a crack-size dependent toughness function, based on grain-localized interfacial bridging, and a hyperbolic-sine velocity function, representative of a fundamental activation process. In a case study, dynamic fatigue (constant stressing rate) and static fatigue (constant applied stress) data 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 deconvoluted. This intrinsic function is distinguished from the usual 'apparent', or 'shielded', (and demonstrably non-unique) function determined directly from the external load.

200,938
PB92-237130 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Fracture Mechanics Model for Subthreshold Indentation Flaws: 2. Nonequilibrium Fracture.
Final rept.
S. Lathabai, J. Rodel, T. Dabbs, and B. R. Lawn. 1991, 9p
See also PB91-236935.
Pub. in Jnl. Mater. Sci. 26, n9 p2313-2321 1991.

Keywords: *Glass, *Crack initiation, *Fatigue(Materials), Defects, Models, Residual stress, Crack propagation, Cracking(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 in chemically interactive environments. The 'calibrated' K-fields of Part I are combined with independently evaluated crack velocity functions to determine kinetic conditions for microcrack extension. The analysis enables evaluation of: (i) a time delay in radial 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 stressing-rate for silicate glasses in moist environments indicate that the analysis is capable of quantitative predictions of kinetic characteristics. In the strength data, the model accounts for the relatively high magnitudes, scatter and fatigue susceptibilities in the subthreshold region.

200,939
PB92-237171 Not available NTIS
National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.
Elastic Properties of Porous Ceramics.
Final rept.
H. M. Ledbetter, M. Lei, and S. K. Datta. 1989, 8p
Pub. in Mater. Res. Soc. Symp. Proc. Nondestr. Monit. Mater. Prop., v142 p275-282 1989.

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 -- Young modulus, shear modulus, bulk modulus, Poisson ratio -- we give relationships for both the forward and inverse cases: predicting the porous ceramic properties and estimating the pore-free ceramic properties. Following a suggestion by Hasselman and Fulrath that sintering or hot pressing can produce 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 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 pore aspect ratio, 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. Polymers 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, Reprints.

Physical aging studies were made using model epoxy network glasses. Nonlinear viscoelastic responses were measured after quenching the glasses to the temperature of interest. Here, we studied 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 a time-aging superposition principle for this epoxy network. Similar to many other physical aging studies, we observed that the double logarithmic shift rate decreases as the stress amplitude increases. Results showed that the time required to reach structural equilibrium did not change with the magnitude of applied stress; therefore, we argue that aging is not 'erased' by large mechanical stimuli. Furthermore, we compared the creep response after reaching equilibrium for the glass which was subjected to the repeated stresses 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.

200,941
PB92-237577 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
X-ray Powder Diffraction Characterization of Barium Rare Earth Copper Oxides (BaR2CuO5; R=Yttrium and the Lanthanides) and Related Compounds.
Final rept.
W. Wong-Ng, M. A. Kuchinski, H. F. McMurdie, and B. Paretzkin. 1989, 7p
Pub. in Powder Diffr. 4, n1 p2-8 1989.

Keywords: *X ray diffraction, *Ceramics, *Rare earth compounds, Superconductors, Standards, Molecular structure, Copper oxides, Barium oxides, Crystallography, Reprints.

A series of BaO:R(sub x)O(sub y):CuO materials, where R = Yttrium and lanthanides have been prepared and characterized by x-ray powder diffraction methods. All BaR2CuO5 phases, commonly referred to as the 'green phases', are orthorhombic with space group Pbcn and are isostructural to each other. These single phase materials could be prepared with most lanthanides, except for La, Ce, Pr, Nd and Tb. Possible reasons for the exception are discussed. Both La and Nd tend to form a brown solid solution of Ba(2-2x)R(4-x)Cu(2-x)OTb(10+x) with tetragonal space group P4/mbm. The major phases found in the Ce, Pr and Tb compositions are the pervoskite related structures BaRO3, and in the Pr case, Ba2PrCu3-O(6+x) as well. The cell parameters of the green phase materials increase progressively from the lutetium compound to the samarium compound. A correlation of the crystallographic data with the size of the R elements is given.

200,942
PB93-125243 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Ceramics Wear Maps: Concept and Method Development.
Final rept.
S. M. Hsu, D. S. Lim, Y. S. Wang, and R. G. Munro. 1991, 6p
See also PB91-189498. Sponsored by Gas Research Inst., Chicago, IL.
Pub. in Jnl. of the Society of Tribologists and Lubrication Engineers, p49-54 Jan 91.

Keywords: *Ceramics, *Wear, Wear tests, Tribology, Maps, Research and development, Design criteria, Friction, Feasibility studies, Wear resistance, Reprints.

Wear of a material is difficult to describe in definitive terms since it is a function of many variables. This paper discusses the basis for a proposed wear analysis method that graphically represents wear of a material sliding on itself in the form of three dimensional wear maps. These maps, properly utilized, can aid in the development of new materials, materials selection and design of components. To develop this concept, wear tests under constant load were conducted to generate the necessary data. It was found that the number of individual tests required to implement this method was large, hence impractical. Therefore, a step loading procedure was used to significantly reduce the number of necessary measurements. Comparisons of results from the two procedures suggest that the wear maps concept, coupled with the step loading procedure, is a feasible method for delineating the wear resistance characteristics of a material in a reasonable amount of time and effort.

200,943
PB93-125458 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Multiple Small Angle Neutron Scattering Characterization of the Densification of Ceramics: Application to Microporous Silica.
Final rept.
G. G. Long, and S. Krueger. 1989, 7p
See also PB93-125466.
Pub. in Jnl. of Applied Crystallography 22, p539-545 Dec 89.

Keywords: *Small angle scattering, *Silicon dioxide, *Porous materials, *Microstructure, Neutron scattering, Monte Carlo method, Densification, Heat treatment, Reprints.

Multiple small angle neutron scattering was used to characterize the microstructure evolution of porous silica as a function of thermal processing. This new technique offers a statistically significant determination of microstructure morphology in the 0.08 to 10 micrometer range, which was previously inaccessible without increasing the resolution of the currently available scattering spectroscopy beamlines. All of the scatterers, which in the present work are pores within ceramic bodies, are measured whether they are open or closed. Earlier mercury porosimetry and nitrogen desorption measurements of the microporous silica system suggested that there are two major populations of pores in this material, differing in pore size by approximately an order of magnitude. In this work, Monte Carlo simulations were carried out to complement the neutron scattering measurements, to predict the influence on the results of the bi-modal distribution, and to explore the sensitivity of the multiple scattering method.

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.
G. G. Long, S. Krueger, D. R. Black, J. P. Cline, and R. A. Gerhardt. 1990, 6p
See also PB91-203489 and PB93-125458.
Pub. in Proceedings of Materials Research Society Symposium Neutron Scattering for Materials Science, Boston, MA., November 27-30, 1989, p421-426 1990.

Keywords: *Silicon dioxide, *Small angle scattering, *Microstructure, *Porous materials, *Ceramics, Colloids, Particle size distribution, Physical properties, Sintering, Particle size, Sols, Gelation, Neutron scattering, X ray scattering, Reprints.

The microstructure of low-density porous silica precursor (unsintered) bodies was studied as a function of starting chemistry. The ratio of colloidal silica sol to potassium silicate is known to have a marked effect on the size distribution of pores in this material, which in turn has a major impact on the resultant physical properties of the sintered product. In the present research, the sizes and the size distributions of particles underlying 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.
Critical Evaluation of Silicon Nitride Powder Characterization and Its Effect on Injection Molding.
Final rept.
S. G. Malghan, and V. K. Pujari. 1990, 7p
Pub. in Proceedings of Symposium on Advanced Materials: Application of Mineral and Metallurgical Processing Principles, Salt Lake City, UT., February 26-March 1, 1989, p175-181 1990.

Keywords: *Silicon nitrides, *Powder metallurgy, *Injection molding, Ceramics, Structural engineering, Physical properties, Chemical properties, Microstructure, Surface chemistry, Manufacturing, Reprints, Advanced materials.

Silicon nitride powders of a range of physical and chemical characteristics are being used in a variety of ceramic components for structural applications. Detailed characterization of all the powder constituents during powder processing is necessary for the reproducible manufacture of ceramic components that will perform reliably in intended applications. In this paper, selected physical and surface 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 forming of ceramics, some of the major variables of injection molding are evaluated. Accurate 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 Vycor Glass.
Final rept.
E. A. Mendoza, D. Sunil, E. Wolkow, H. D. Gafney, M. H. Rafailovich, J. Sokolov, G. G. Long, P. R. Jemian, S. A. Schwartz, and B. J. Wilkens. 1990, 3p
Pub. in Applied Physics Letters 57, n3 p209-211 1990.

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 Vycor glass and examined before and after consolidation of the glass. Scanning electron microscopy reveals that the iron oxide particles are larger than the tin oxide particles. However, small angle x-ray scattering and Rutherford backscattering show that the glass consolidates about the iron oxide but not about the tin oxide. Photodeposition of tin oxide, which appears to chemically modify the glass surface and to prevent its 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
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in Computerization and Networking of Materials Databases: Second Volume, ASTM STP 1106, p259-267 1991.

Keywords: *Heat exchangers, *Ceramics, *Information systems, Structural engineering, Data base management, Materials, Chemical properties, Physical properties, Information transfer, Requirements, Reprints, *Structural Ceramics Database System.

The Structural Ceramics Database (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 materials property database in a highly user-friendly computerized format for use on personal computers. The system is designed to provide a consistent and attractive mechanism for communicating critical data to design engineers involved in product development. The development of the SCD is being guided by focusing attention on specific applications. Such focusing provides a more cost effective approach to database construction because the materials and the properties included in the system are determined and constrained by the needs of the application. The utility of the resulting data, however, extends well beyond the guiding application. The first phase of the development of the SCD is focused on the material, property, and information requirements that derive from the specific application of a materials property database to ceramic heat exchangers.

200,948
PB93-126068 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.
Final rept.
K. T. Wan, D. T. Smith, and B. R. Lawn. 1992, 10p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of the American Ceramic Society 75, n3 p667-676 Mar 92.

Keywords: *Mica, *Silicon dioxide, *Fractures(Materials), *Adhesion, *Charge transport, Surface chemistry, Interfaces, Dry methods, Wet methods, Crack propagation, Moisture, Mechanical properties, Brittleness, Reprints.

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 'healed' 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 contributors 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 screening of this attraction by condensed moisture from the atmosphere.

200,949
PB93-131423
(Order as PB93-131381, PC **A07**)
National Inst. of Standards and Technology, Gaithersburg, MD.
Fracture Toughness of Advanced Ceramics at Room Temperature.
G. D. Quinn, J. Salem, I. Bar-on, K. Cho, M. Foley, and H. Fang. 1992, 29p
Prepared in cooperation with National Aeronautics and Space Administration, Cleveland, OH. Lewis Research Center, Worcester Polytechnic Inst., MA., Saint-Gobain/Norton Industrial Ceramics Corp., Northboro, MA., and Allied-Signal Aerospace Co., Phoenix, AZ. Garrett Auxiliary Power Div.
Included in Jnl. of Research of the National Institute of Standards and Technology, n97 n5 p579-607 Sep/Oct 92.

Keywords: *Fracture strength, *Silicon nitrides, *Zirconium oxides, *Aluminum oxides, *Ceramic composites, Interlaboratory comparisons, Room temperature, Indentation hardness tests, Advanced materials, Round robins.

The report presents the results obtained by the five U.S. participating laboratories in the Versailles Advanced Materials and Standards (VAMAS) round-robin for fracture toughness of advanced ceramics. Three test methods were used: indentation fracture, indentation strength, and single-edge precracked 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. Interpretation of fracture toughness 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. Ceramics Div.
Phase Diagrams for Ceramics. Volume 8.
Final rept.
B. O. Mysen, H. F. McMurdie, and H. M. Ondik. 1990, 375p
Supplements seven previous collections. See also PB90-192550. Sponsored by National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Pub. in Phase Diagrams for Ceramists, v3 375p 1990.

Keywords: *Ceramics, *Phase diagrams, High pressure tests, Salts, Water, Oxides, Reprints.

The volume supplements the seven previous collections entitled Phase Diagrams for Ceramists. 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.

200,951
PB93-135564 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Relationship between Fractal Geometry and Fractography.
Final rept.
J. J. Mecholsky, and S. W. Freiman. 1991, 3p
See also AD-A240 835.
Pub. in Jnl. of the American Ceramic Society 74, n12 p3136-3138 Dec 91.

Keywords: *Fractography, *Fractals, *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 flaw-to-mirror size ratio and the fracture toughness. An experimental observation has shown that the fracture roughness is related to the elastic modulus through another structure parameter, b(o). 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 branching and is reflected in the features on the fracture surface.

Coatings, Colorants, & Finishes

200,952
AD-A253 729/8 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Moire-Fringe Images of Twin Boundaries in Chemical Vapor Deposited Diamond.
Interim rept.
D. Shechtman, A. Feldman, M. D. Vaudin, and J. L. Hutchison. 10 Jul 92, 12p NIST-TR-14
Contract N00014-90-F-0011
Supported in part by the Office of Naval Research, Arlington, VA.

Keywords: *Computer graphics, *Diamonds, Boundaries, Chemicals, Computers, Electron beams, Graphics, Hymenoptera, Images, Simulation, Vapors, Reprints, *Chemical vapor deposition.

Features in lattice image micrographs of chemical vapor deposited diamond can be interpreted as Moire fringes that occur when viewing twin boundaries that are inclined to the electron beam. The periodicities in images of inclined twin boundaries with Sigma=3 and Sigma=9 misorientations have been modeled by computer graphic simulation.

200,953
PB92-144989 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Building Materials Div.
Spectroscopic Technique for In-situ Measurement of Water at the Coating/Metal Interface.
Final rept.
T. Nguyen, W. E. Byrd, and C. Lin. 1991, 13p
See also PB89-235345.
Pub. in Jnl. of Adhesion Science and Technology 5, n9 p697-709 1991.

Keywords: *Fourier transform spectrometers, *Infrared spectroscopy, *Water analysis, *Interfaces, *Coatings, *Metals, Polymeric films, Exposure, Plastic coatings, In-situ processing, Construction materials, Thickness, Reprints, Multiple internal reflection spectroscopy.

A technique was developed based on Fourier transform infrared spectroscopy in the multiple internal reflection mode (FTIR-MIR) for measuring in situ water at the coating/metal interface. The technique requires a direct application of a transparent or opaque polymer coating of any thickness to a Ge internal reflection element (IRE). A water chamber was attached to the polymer-coated IRE and water was introduced through the chamber inlet. FTIR-MIR spectra were taken automatically at specified time intervals without realignment or readjustment of the ATR accessory and without disturbing the specimens or the conditions of the experiment. The intensities of the water bands increased and those of the coating bands decreased initially and then leveled off as the exposure times increased. Calculations are presented to demonstrate that the technique can provide information on water at the coating/metal interface. The method may also provide a convenient means for measuring the diffusion of water in polymer coatings on metals.

200,954
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.
Final rept.
T. Nguyen, W. E. Byrd, C. Lin, and D. Bentz. 1991, 10p
Pub. in Advanced Composite Materials 19, p1051-1060 1991.

Keywords: *Fourier transform spectrometers, *Infrared spectroscopy, *Water analysis, *Interfaces, *Coatings, *Metals, Polymeric films, Exposure, Plastic coatings, In-situ processing, Construction materials, Thickness, Reprints, Multiple internal reflection spectroscopy.

A technique was developed based on Fourier transform infrared spectroscopy - multiple internal reflection (MIR-FTIR) for measuring water in situ at the coating/metal interface. The method requires direct application of a transparent or opaque polymeric coating of 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. MIR-FTIR spectra were taken automatically at specified exposure time intervals without readjustment of the ATR accessory and without disturbing the specimens and 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.

200,955
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.
Final rept.
T. Nguyen, J. Hubbard, and G. B. McFadden. 1991, 10p
Pub. in Jnl. of Coatings Technology 63, n794 p43-52 Mar 91.

Keywords: *Mathematical models, *Corrosion, *Steels, *Protective coatings, Blistering, Electrolytes, Cations, Interfaces, Diffusion, Defects, Construction materials, Ion drift, Reprints.

A physical/mathematical model which describes blistering resulting from the corrosion of coated metals containing defects exposed to electrolytes has been developed. The model is based on the two-dimensional diffusion of cations through some arbitrary medium. Cations migrating along the coating/metal interface from the defect to the cathodic sites are assumed to be responsible for the formation of highly water-soluble corrosion products, leading to blistering. Solutions of the model were expressed in terms of dimensionless parameters. Concentration profiles between the blister and defect and cation flux into the blister as functions of time, blister size, distance between the blister and defect, ion diffusivity, and potential gradient were calculated. The predictions were related to available experimental data in the literature on cation uptakes and blistering rates for coated steel panels exposed to metal chloride solutions.

200,956
PB92-145010 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Building Materials Div.
In-situ Measurement of Chloride Ion at the Coating/Metal Interface.
Final rept.
T. Nguyen, and C. Lin. 1991, 12p
See also PB89-235345.
Pub. in Jnl. of Adhesion 33, p241-252 1991.

Keywords: *Corrosion, *Metals, *Protective coatings, *Interfaces, *Chlorine ions, *Electrodes, Ion-selective electrodes, Blistering, In-situ processing, Defects, Ion drift, Diffusion, Construction materials, Electrodes, Adhesion, Reprints.

One of the main reasons for the lack of a complete understanding of corrosion and adhesion failures of a coated metal is the lack of analytical instrumentation to probe the behaviors of corrosive agents at the coating/metal interface. The authors have developed a procedure based on microelectrodes for studying in situ the behavior of chloride ions at a coating/metal interface. The procedure requires an attachment of a double-barreled Cl(-) ion-selective microelectrode at the coating/metal interface, thus allowing direct measurements of Cl(-) concentration changes at localized areas under a coating. The procedure provided very useful information for mechanistic studies of corrosion under coatings, as well as for transport studies of Cl(-) ions through a coating. The procedure should also be useful for studying the roles of Cl(-) in localized corrosion.

200,957
PB92-153980 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Building Materials Div.
Thermographic Imaging of Surface Finish Defects in Coatings on Metal Substrates.
Final rept.
D. P. Bentz, and J. W. Martin. 1992, 11p
Pub. in Materials Evaluation 50, n2 p242-252 Feb 92.

Keywords: *Coating processes, *Surface defects, *Thermography, Heat treatment, Surface finishing, Nondestructive testing, Metals, Image processing, Reprints.

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 between the defect and nondefect areas. These thickness variations influence the thermal radiation emission/reflection/transmission properties of the coating system detected by the thermographic camera. The theory for a model coating system is presented and several application areas explored. Theoretical limitations on the use of this technique are discussed.

200,958
PB92-213370 PC **A03**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Lead Concentration in Consumer Paints: 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 effects, Sampling, X ray fluorescence, Lead paint poisoning, Public health, US HUD, Consumer Product Safety Commission Regulation.

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 paints. 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 usually measured and reported. Estimates of expected lead concentrations in new paint are needed in HUD's lead-paint abatement program. Thus, the objective of the pilot study was to determine whether the lead concentration in a small sampling of new paints tended to be near the regulatory limit. The lead concentration in each of 31 consumer paints was measured using laboratory x-ray fluorescence spectrometry. All 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 PC **A04**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Mathematical Model of Cathodic Delamination and Blistering Processes in Paint Films on Steel.
Technical note (Final).
J. Pommersheim, T. Nguyen, Z. Zhang, C. Lin, and J. Hubbard. May 92, 73p NIST/TN-1293
Also available from Supt. of Docs. as SN003-003-03165-8. See also PB83-115550. Prepared in cooperation with Bucknell Univ., Lewisburg, PA.

Keywords: *Mathematical models, *Paints, *Blistering, *Protective coatings, *Ionic mobility, Corrosion prevention, Steels, Cations, Diffusion, Electrolytes, Surface chemistry, Defects, Performance evaluation, Anodes, Cathodes, Electrochemistry, Metal surfaces, *Coating metal interactions.

Conceptual and mathematical models are developed for processes which describe blistering of defect-containing coating on coated 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 and concentrations along the interface and within the blister. Solutions of the models are expressed in terms of dimensionless parameters. Model variables include blister size, 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 model parameters. Model results indicate that large blisters subject to a potential gradient are more likely to grow than small ones because higher concentrations can build up within them. Implications of the conclusion 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 Div.
Thermal Properties of Non-Metallic Films by Means of Thermal Wave Techniques.
Final rept.
H. P. R. Frederikse, X. T. Ying, and A. Feldman. 1989, 6p
Pub. in Proceedings of Nondestructive Monitoring of Materials Properties Symposium, Boston, MA., November 28-30, 1988, p289-294 1989.

Keywords: *Nondestructive tests, *Thin films, *Thermodynamic properties, Conduction, Thermal diffusivity, Porosity, Voids, Wave propagation, Thermal conductivity, Oxide coatings, Heat transmission, Reprints, Thermal waves.

The propagation of a thermal wave into a thin film or coating depends on the thermal properties of the material. Consequently, thermal wave generation and detection can be used to obtain the heat conductivity of the material. The method is also useful because thermal wave propagation is sensitive to inhomogeneity, porosity, inclusions, voids and delaminations.

200,961
PB92-237254 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Materials Div.
Continuous Wet versus Cyclic Wet-Dry Salt Immersion Results for Scribed Coated Steel Panels.
Final rept.
J. W. Martin, T. Nguyen, M. E. McKnight, and E. Embree. 1989, 10p
Pub. in Jnl. of Coatings Technology 61, n772 p39-48 1989.

Keywords: *Aging tests(Materials), *Protective coatings, *Water immersion, *Corrosion environments, Weathering, Artificial weathering tests, Degradation, Deterioration, Artificial aging(Metallurgy), Alkyd resins, Exposure, Submerging, Cycles, Corrosion tests, Reprints.

Most accelerated aging tests subject coated panels to either a continuous wet or a cyclic wet-dry exposure. Proponents of cyclic exposures argue that cyclic 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.
Chromatographic Examination of Intaglio Inks, Resins and Varnishes.
Annual rept.
B. J. Bauer, B. Dickens, and W. R. Blair. Oct 92, 67p
NISTIR-4949
Sponsored by Bureau of Engraving and Printing, Washington, DC.

Keywords: *Printing inks, *Quality assurance, *Physical properties, *Standards, Chemical composition, Durability, Requirements, Performance standards, Gel permeation chromatography, Detectors, Mass transfer, Sampling, Comparison, *Intaglio inks.

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, are carried out only after full press runs. These tests determine whether a whole batch of currency is acceptable or not. A screening test is desirable to find unacceptable ink batches 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.
Final rept.
C. Lin, and T. Nguyen. 1989, 1p
Pub. in Abstracts of Papers of the American Chemical Society 198, p161 Sep 89.

Keywords: *Interfaces, *Coatings, *Surface chemistry, *Chlorine ions, *Metals, Transport properties, Electrodes, In-situ processing, Permeability, Corrosion protection, Adhesion, Protective coatings, Reprints.

Present knowledge on the movement of Cl(-) ion in a coated metal is derived mostly from its permeability through detached film, which may not be the same as those of an attached film. This paper describes a method to measure in situ (Cl(-)) at the coating metal interface. The method requires a preparation of a solid state double-barreled microelectrode (Cl(-) ion and reference electrodes in one body) and the insertion of it into a 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 about three hours after 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 add greatly in understanding the mechanisms of corrosion and adhesion failure of coated metals.

MATERIALS SCIENCES

Coatings, Colorants, & Finishes

200,964
PB93-126001 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.
Micropenetration Testing: Characterization of Surface Properties of Materials Including Wear.
Final rept.
A. W. Ruff, and R. S. Polvani. 1985, 8p
Pub. in Proceedings of International Conference on Surface Technology (3rd), Berlin, West Germany, October 7-9, 1985, pJ3,1-J3,8.

Keywords: *Penetration, *Surface properties, *Metal coatings, *Wear tests, Loads(Forces), Steels, Sliding friction, Impact loads, Nickel coatings, Loading rate, Wear, Microhardness, Mechanical properties, Hardness, Reprints, 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 P and 12 wt pct P. The microindenter system consisted of an electromagnetically driven diamond pyramid penetrator. The loading waveform was a cos sq function that was held at a constant maximum value for 15s, and then released. The output consisted of load versus displacement curves, and these were interpreted in terms of mechanical response of the material. Loads ranged from 0.5N to 4N. The entire loading system was computer controlled and the data were all digitally processed. The results of micropenetration testing and sliding wear testing on these coatings are compared.

Composite Materials

200,965
PB92-159524 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Monitoring Consolidation of Reinforcement Plies in Polymer Matrix Laminates.
Final rept.
B. Fanconi. 1989, 7p
Pub. in SAMPE (Society for the Advancement of Material and Process Engineers) Jnl. 25, n4 p35-41 Jul/Aug 89.

Keywords: *Detectors, *Optical fibers, *Composite materials, Laminates, Consolidation, Refractivity, Fluorescence, Reprints.

An assessment is made of the potential of optic fiber sensors to monitor consolidation of reinforcement plies in the manufacture of polymer matrix laminates. Sensor designs based on refractive index effects and on spectroscopy have been modeled for sensitivity to consolidation. A design in which the transmitted light intensity is modulated by changes in the refractive index and a spectroscopic technique which uses fluorescent probes were found to have advantages in terms of simplicity and good sensitivity throughout the range of consolidation.

200,966
PB92-165620 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Bond Strength Measurement in Composites: Analysis of Experimental Techniques.
Final rept.
P. J. Herrera-Franco, V. Rao, L. T. Drzal, and M. Y. M. Chiang. 1992, 15p
Pub. in Composites Engineering 2, n1 p31-45 1992.

Keywords: *Fiber composites, *Bonding strength, Shear stress, Crack propagation, Mechanical properties, Finite element method, Cracking(Fracturing), Photoelasticity, Loads(Forces), Composite materials, Bonding, Reprints.

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 finite element 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 fiber fragmentation 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 averages are considered. 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.

200,967
PB92-166131 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Influence of Water on the Mechanical Properties of a Glass-Epoxy Matrix Composite.
Final rept.
M. R. Stoudt, E. Escalante, and R. E. Ricker. 1991, 8p
Contract N00014-89-F-0072
See also AD-A231 778. Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Advanced Composite Materials Ceramic Transactions, v19 p993-1000 1991.

Keywords: *Reinforced plastics, *Mechanical properties, *Glass fiber reinforced plastics, *Epoxy matrix composites, *Water deprivation, Materials tests, Sampling, Exposure, Pressure effects, Degradation, Adsorption, Desorption, Yield strength, Stress analysis, Reprints.

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 of the glass fibers by the absorbed water. No significant difference was observed for samples exposed at the two pressures.

200,968
PB92-166313 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.
Interfacial Chemistry of Mullite-Mullite Composites.
Final rept.
O. Yeheskel, M. L. Balmer, and D. C. Cranmer. 1988, 8p
Contract ARPA-ORDER-6161
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Ceram. Eng. Sci. Proc. 9, n7-8 p687-694 1988.

Keywords: *Mullite, *Fiber composites, *Ceramic matrix composites, *Surface chemistry, Interfaces, Solid-solid interfaces, Scanning electron microscopy, Auger electron spectroscopy, Electron diffraction, X ray diffraction, Spectrum analysis, Reprints.

Interfacial chemistry of mullite fiber reinforced-mullite matrix composites was examined using SEM/EDX and scanning AES. All the fibers bonded strongly to the matrix and exhibited no sliding during a fiber push-in test. Excess Si over Al was found at the fiber-matrix interfaces. Auger results showed the carbon layer was non-uniform and in some cases less than 30 nm thick.

200,969
PB92-170877 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Fast Leaky Modes on Cylindrical Metal-Ceramic Interfaces.
Final rept.
E. Drescher-Krasicka, J. A. Simmons, and H. N. G. Wadley. 1990, 7p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v9A-9B p173-179 1990.

Keywords: *Nondestructive tests, *Composite materials, Ceramics, Ultrasonic radiation, Wave propagation, Interfaces, Defects, Mechanical properties, Physical properties, Leakage, Ultrasonic tests, Reprints.

The Quantitative Nondestructive Evaluation application of theoretically predicted and experimentally detected fast leaky modes propagating along cylindrical metal ceramic interfaces has been studied. Our approach utilizes the leakage of the acoustic energy out from the interface as valuable information on the mechanical and physical properties near the interface. Theoretically predicted sensitivity of the maximum phase velocity to the matrix density changes for these modes is discussed as a possibility of sensing the interface zone in metal-ceramic cylindrical geometries.

200,970
PB92-171362 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
VAMAS: A Forum for International Cooperation on the Development of Composite Standards.
Final rept.
D. Hunston, and H. Chai. 1988, 8p
Pub. in Proceedings of Annual Conference on Advanced Composites (4th) - How to Apply Advanced Composites Technology, Dearborn, MI., September 13-15, 1988, p173-180.

Keywords: *Composite materials, *International cooperation, *Standards, *Fatigue(Materials), Delaminating, Test methods, Fractures(Materials), Creep properties, Fracturing, Mechanical properties, Reprints.

In 1982 representatives and Heads of State from Europe, Japan, Canada, and the United States met in Versailles for the first Joint Economic Summit. One item addressed at that Meeting was the need to encourage international trade through technical collaboration. This led to the establishment of VAMAS, the Versailles Project on Advanced Materials and Standards. The VAMAS Steering Committee then established Technical Working Groups in specific areas such as composites. The goal of these Working Groups is to facilitate the development of the science and technology base to accelerate the generation of needed standards. This is certainly critical to the composites field where the lack of standardized tests for many of the important properties is a major handicap. The VAMAS Working Group on Composites is providing a forum for information exchange and international cooperation so the efforts of scientists addressing questions related to test methods can be encouraged. The focus in the VAMAS program is on the basic research that must precede the establishment of standards. By working closely with organizations such as ASTM, the time frame for establishing standards can therefore be shortened.

200,971
PB92-175371 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Thermodynamics and Kinetics of Reactions at Interfaces in Composites.
Final rept.
C. A. Handwerker, J. W. Cahn, and J. R. Manning. 1990, 17p
Pub. in Materials Science and Engineering A 126, p173-189 Jun 90.

Keywords: *Metal matrix composites, *Thermodynamics, *Reaction kinetics, *Interfaces, Composite materials, Diffusion, Phase transformations, Matrix materials, Thermodynamic equilibrium, Reprints.

Composites are complex engineering systems in which the constituent materials are not in thermodynamic equilibrium during initial fabrication, during production of components, or in use. Diffusion, phase transformations, and roughening at interfaces can occur at any of these stages. By the use of thermodynamic and kinetic concepts, changes in the interface morphology in composite systems can be predicted and, thus, controlled. Two features which govern interfacial reactions, compositions, phases, and structures are described: (1) surface energy effects at interfaces, including nucleation, and (2) stress effects accompanying diffusion at interfaces. Through both theory and experiment, small departures from equilibrium, even without the formation of new phases, are shown to cause large-scale changes in diffusion near the interface and interface morphology. These theoretical concepts are used to examine reactions in the Al-SiC system and control of phase formation and interface structure in Al2O3-Cr2O3-Cr metal composites.

200,972
PB92-181148 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Cryogenic 4.4 MN Mechanical Test System for Large Scale Tests of Composite Support Struts.
R. P. Walsh, R. P. Reed, J. D. McColskey, W. Fehringer, and J. R. Berger. Mar 92, 40p NISTIR-3966

Keywords: *Mechanical tests, *Fiber reinforced composites, *Struts, *Thermal cycling tests, Test facilities, Ultimate strength, Structural members, Reinforcing materials, Fiber composites, Fatigue tests, Mechanical properties, Compressive strength, Loads(Forces), Low temperature tests, Thermal fatigue.

The report details a large mechanical test program undertaken by the NIST Materials Reliability Division. These tests were intended to validate the full scale structural behavior of the composite support struts in a thermal and mechanical environment identical to actual service conditions. Two types of tests were performed: ultimate compressive strength and fatigue. Thermal conditions for the tests ranged from isothermal, room temperature tests to an imposed thermal gradient of cryogenic-to-room temperatures. The development of the unique facility necessary for the large scale cryogenic tests is detailed in the report.

200,973
PB92-182658 **PC$75.00**
Delaware Univ., Newark. Center for Composite Materials.
Opportunities for Innovation: Polymer Composites.
Final rept.
S. H. Munson-McGee. Aug 90, 185p NIST/GCR-90/577-1
Grant NANB9D0965
Supersedes PB91-107078. Sponsored by National Inst. of Standards and Technology (TS), Gaithersburg, MD. Office of Technology Evaluation and Assessment.

Keywords: *Polymer matrix composites, *Composite materials, Technology innovation, Molding, Thermoplastics, Compression, Pultrusion, Resin matrix composites, Reinforced plastics, Polymeric films, Filaments, Reinforcing fibers, Fiber orientation, Fiber composites.

The series of NIST monographs called 'Opportunities for Innovation' has been conceived with the small technology-based company in mind. Each chapter of the monograph, written by an expert in the field, focuses on those aspects of a specific technological discipline where new scientific advances hold promise of early translation into technological innovations. The first monograph in the series of 'Opportunities for Innovation' deals with polymer composites, a mature and yet fast evolving technology, finding wide applications in the automobile, aerospace, and consumer goods markets. To achieve this end, a spectrum of composites processing technologies was chosen representing a wide range of technological maturity. Some of the processes (contact/vacuum bag molding, compression molding, and injection molding), having been used for many decades, are more mature processes. Some of the processes (thermoplastic sheetforming) are at the other end of the maturity spectrum and are still in the development stages. Others are seeing a revolution in applications as new materials become available (thermoplastic filament winding and pultrusion) or as new concepts in design are realized (RTM, S-RIM). Thus, the potentials for invention also span a wide range of opportunities, from improving on existing technologies to developing entirely new ones.

200,974
PB92-197631 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Fabrication and Interface Debonding of Al2O3-Cr2O3-Cr Composites.
Final rept.
C. A. Handwerker, U. V. Deshmukh, and D. C. Cranmer. 1990, 9p
Pub. in Met. Ceram. Matrix Compos.: Process., Model. Mech., p457-465 1990.

Keywords: *Ceramic matrix composites, *Solid-solid interfaces, *Aluminum oxides, *Chromium oxides, *Hot pressing, Composite materials, Microstructure, Mechanical properties, Reinforcing fibers, Interfaces, Surface chemistry, Chemical bonds, Metal fibers, Reprints, *Debonding.

Composites composed of Al2O3-Cr2O3-Cr with controlled fiber roughness and volume fraction of reinforcing metal have been fabricated by hot pressing solid solution Al2O3-Cr2O3 particulate matrices with Al2O3 fibers in graphite dies. By exploiting features of the Al-Cr-O phase equilibria, the fiber/interface debonding strength can be tailored within large limits (30-750 MPa). Processing conditions, microstructures, and mechanical properties of the composites are presented.

200,975
PB92-198134 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Micromechanical Studies of Model Metal Matrix Composites.
Final rept.
H. N. G. Wadley, F. Biancaniello, and R. B. Clough. 1988, 10p
Pub. in Materials Research Society Symposia Proceedings, v120 p35-44 1988.

Keywords: *Metal matrix composites, *Fiber reinforced composites, *Single crystals, *Microstructure, *Mechanical properties, Monocrystals, Silicon carbides, Aluminum, Crystal growth, Interfaces, Fracture properties, Surface chemistry, Fibers, Reprints.

Monofilament single crystal composites composed of 140 micrometer diameter SiC fibers and aluminum matrices have been grown using a modified Bridgman crystal growth technique. These model composites have been subjected to axial loading and the micromechanisms of fiber fracture and interfacial failure begun to be explored. By varying the fiber surface composition, and the crystal growth rate, the authors have examined the role of interfacial reactions upon the strength of fibers and interfaces in Al-SiC composites.

200,976
PB92-198142 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Ultrasonic Propagation at Cylindrical Metal-Ceramic Interfaces in Composites.
Final rept.
H. N. G. Wadley, J. A. Simmons, and E. Drescher-Krasicka. 1988, 10p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Materials Research Society Symposia Proceedings, v120 p341-350 1988.

Keywords: *Metal matrix composites, *Ceramic fibers, *Interfaces, *Ultrasonic tests, Wave propagation, Materials tests, Reprints.

The nature of ultrasonic propagation at cylindrical interfaces is being explored as a potential method for inferring the modulus of the interface in metal matrix composites. In many metal matrix composite systems leaky interface waves have been found to propagate along the interface. The velocity of these waves depends sensitively upon the local moduli and provides a potential basis for measuring these quantities. The opportunity exists to exploit the leaky character of these waves for microscopic imaging at the interface.

200,977
PB92-236876 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Influence of Interfacial Structure on the Mechanical Properties of Liquid-Phase-Sintered Aluminum-Ceramic Composites.
Final rept.
G. M. Janowski, and B. J. Pletka. 1990, 12p
Pub. in Materials Science and Engineering A129, p65-76 1990.

Keywords: *Composite materials, *Metal matrix composites, *Mechanical properties, *Interfaces, *Surface chemistry, Powder metallurgy, Sintering, Chemical bonds, Aluminum oxides, Silicon carbides, Molecular structure, Reinforcing materials, Reprints.

The effect of interfacial structure on the mechanical properties of aluminum-ceramic composite materials fabricated by liquid phase sintering was studied. The composites were based on two matrix alloys (powder metallurgy alloys 201 and 601) reinforced with either Al2O3 or SiC particulate. Characterization of the interfacial regions demonstrated that the SiC-matrix interfaces were faceted whereas the Al2O3-matrix interfaces had an incomplete layer of a silicon-rich amorphous phase. Preferential attack of the particles during sintering is believed to cause the crystallographic facets to form on SiC. Locally high silicon concentrations near Al2O3 particles led to the formation of a glassy phase from the reduction of Al2O3. The difference in interfacial structure resulted in a higher particle-matrix bond strength and therefore improved composite mechanical properties in the SiC-reinforced materials compared with the Al2O3-reinforced materials.

200,978
PB92-237585 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Some Theoretical Results of Swelling in Fiber- or Particle-Filled Polymers.
Final rept.
W. L. Wu, and J. R. Prahinski. 1989, 5p
Pub. in Polym. Eng. Sci. 29, n4 p268-272 1989.

Keywords: *Composite materials, *Reinforced materials, *Polymers, *Swelling, *Numerical analysis, Crosslinking, Gaussian processes, Differential equations, Reprints, Flory-Huggins approximation.

The problem of inhomogeneous swelling of polymers around particles or fibers is treated analytically within the context of Gaussian statistics for polymer chains and the Flory-Huggins approximation for the interaction between polymer and solvent. The resulting differential equation for the displacement field around the inclusions is quite simple; it is composed of a homogeneous part and a nonlinear part. The nonlinear part of the differential equation is preceded by a parameter n(1-2 chi), where n is the molecular weight between crosslinks and chi is the Flory-Huggins interaction parameter. Accordingly, the displacement field for the case of theta solvent, i.e. chi equals 0.5, can be solved exactly. Whereas in good solvents, the problem can be treated as a perturbation of the theta solvent condition. The quantitative amount of deviation from the theta solvent case is obtained through numerical technique and the results are tabulated as a function of n(1-2 chi).

200,979
PB93-129294 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Debonding and Frictional Effects during fiber Pull-Out and Model SiC Fiber Reinforced Glass Composites in Relation to Resistance to Fracture.
Final rept.
E. T. Butler, T. R. Palamides, E. R. Fuller, and H. M. Chan. 1989, 10p
Sponsored by Department of Energy, Oak Ridge, TN. Fossil Energy Program.
Pub. in International Symposium on Advances in Processing of Ceramic and Metal Matrix Composites, p178-187 1989.

Keywords: *Ceramic composites, *Fiber composites, *Friction, *Fracture strength, Composite fabrication, Interfaces, Metal coatings, Toughness, Ductility, Chemical bonds, Silicon carbides, Surface chemistry, Reprints, *Debonding, *Single fiber pull-out test.

The influence of a ductile interfacial layer on the toughening effect that a SiC monofilament engenders to a brittle glass matrix was addressed. Micro-mechanical investigation of the fiber/nickel-coating/glass interfaces using the single fiber pull-out test indicated that the fiber/nickel interface was weaker than the glass/nickel interface and that the sliding friction was also lower. The fracture resistance of the nickel coated fiber composite was generally less than that of the composite reinforced with fibers in the as received condition. The fracture resistance decreased with increasing nickel thickness but gradually increased again up to the as received fiber composite level at a nickel thickness of 22 micrometers. However all thicknesses of nickel fiber coating enhanced the fracture resistance of the composite compared to the unreinforced glass matrix.

200,980
PB93-129583 Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Dynamic Young Modulus of a Ceramic-Aluminum Particle-Reinforced Composite: Measurement and Modeling.
Final rept.
H. Ledbetter, and C. Fortunko. 1991, 3p
Pub. in Proceedings of Ultrasonics Symposium, Lake Buena Vista, FL., December 8-11, 1991, p1065-1067.

Keywords: *Metal matrix composites, *Aluminum alloys, *Modulus of elasticity, *Ultrasonic tests, *Ceramic materials, Matrix materials, Composite materials, Reinforcing materials, 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 Al_2O_3 spheres with average sizes of 30, 45, and 100 micrometers. The measurement methods consisted of megahertz-frequency pulse-echo superposition and kilohertz-frequency standing-wave resonance. The modeling method consisted of taking the long-wavelength limit of the ensemble average of the sound velocity of plane waves scattered by a well-stirred distribution of spheres. Input to the model consists 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, show that particle size fails to affect E, and demonstrate a seventeen-percent negative departure (at $c = 0.30$) from a linear rule-of-mixture.

200,981
PB93-135457 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Stress Relaxation in Sintering of Fiber Reinforced Composites Through Fiber Coating.
Final rept.
C. P. Ostertag, and S. Malghan. 1989, 5p
Pub. in Ceramic Engineering and Science Proceedings, v10 n7-8 p730-734 1989.

Keywords: *Fiber composites, *Relaxation(Mechanics), *Coatings, *Stresses, Aluminum oxide, Silicon carbides, Creep properties, Densification, 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 enhances 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 (IMSE), Gaithersburg, MD. Polymers Div.
Modeling of Crack Chemistry in Cu-Au Alloys.
Final rept.
U. Bertocci. 1989, 6p
See also PB86-132594.
Pub. in Jnl. of the Electrochemical Society 1, p1887-1892 1989.

Keywords: *Stress corrosion, *Copper alloys, *Gold alloys, *Cracking(Fracturing), *Corrosion mechanisms, Electrode potentials, Electrochemistry, Oxidation reduction reactions, Solutions, Reprints.

The possibility of hydrogen discharge at the crack tip during transgranular stress corrosion cracking of Au-Cu alloys in chloride solutions was examined by modeling electrochemical reactions and transport losses 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(+2)/Fe(+3) and Cu(+1)/Cu(+2) on gold were measured, in order to provide values for the modeling, which are unavailable in the published literature. The results show that there is no possibility of hydrogen discharge, which rules out hydrogen embrittlement as the cause of the cracking.

200,983
PB92-145051 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Evaluation of the Environmentally Induced Fracture Resistance of Ductile Nickel Aluminide.
Final rept.
R. E. Ricker, U. Bertocci, J. L. Fink, and M. R. Stoudt. 1991, 13p
See also PB90-206970.
Pub. in Environmental Effects on Advanced Materials, p213-225 1991.

Keywords: *Stress corrosion, *Corrosion, *Hydrogen embrittlement, Electrochemistry, Nickel alloys, Aluminum containing alloys, Crack propagation, Ductility, Crack propagation, Fracture properties, Absorption, Acidification, Strain rate, Reprints, *Nickel aluminide.

Slow-strain-rate tensile tests and electrochemical experiments were performed in different aqueous solutions on ductile nickel aluminide, Ni_3Al+B, in order to evaluate the possibility of environmentally induced fracture of the material in neutral pH solutions as a result of hydrogen absorption. Two different processes were postulated that could lead to hydrogen absorption and embrittlement: (1) local acidification due to hydrolysis of the corrosion reaction products and (2) hydrogen reduction during the potential transient that accompanies film rupture and repair. Experiments were designed to evaluate each of these possibilities. First, slow strain rate tests were conducted in solutions with varying concentrations of metal ions and pH to determine the critical metal ion concentration and pH that result in hydrogen absorption and embrittlement of this material. Second, the potential transient that follows the mechanical rupture of the protective surface film in different solutions was measured and the minimum potential during the transient was compared to the potential that results in a hydrogen fugacity large enough to cause cracking. The results indicate that hydrogen reduction, absorption, and embrittlement are not to be expected in neutral solutions as a result of local acidification during crevice corrosion or film rupture during crack propagation or cyclic loading.

200,984
PB92-159474 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.
Corrosion Studies in MSW-Fired and Coal-Fired Boiler Systems.
Final rept.
E. Escalante. 1991, 13p
Pub. in Proceedings of International Conference on Incinerating Munic. Ind. Waste: Fireside Probl. Prospects Improv., p83-95 1991.

Keywords: *Corrosion, *Boilers, *Incinerators, Municipal wastes, Coal, Alloys, Pitting corrosion, Stainless steel, Heat exchanging, Reprints.

Five alloys, SA178, SA192, SA213-T11, SA213-T22, and type 304 stainless steel were evaluated on their resistance to pitting in a coal burning boiler and in a residential refuse burning incinerator. The materials were introduced into the vicinity of the boiler tubes using a probe whose temperature was controlled and monitored to simulate conditions of the boiler tubes. After three to six months, the probes were withdrawn and the alloy specimens removed for evaluation. The data indicate that the environment of the refuse burning incinerator was considerably more corrosive than that of the coal burning boiler. Chloride was found in practically all the pits formed in the refuse burning system, but no chloride was found in the coal burning boiler. The highest attack occurred during the period when lawn clippings, heavy with moisture, were burned, a condition aggravated by large temperature fluctuations. In general, type 304 stainless steel was the most resistant to pitting in the coal and refuse burning environments, but the SA213-T11 and T22 were less resistant to pitting than the lower alloy SA178 and SA192 in the refuse burning incinerator.

200,985
PB92-170638 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.
Computerization of Corrosion Data.
Final rept.
D. B. Anderson. 1990, 9p
See also PB91-111948.
Pub. in Corrosion Testing and Evaluation: Silver Anniversary Volume, ASTM STP 1000, p17-25 1990.

Keywords: *Corrosion, *Databases, Information systems, Data acquisition, Standards, Format, Artificial intelligence, Data integrity, Metals, Nonmetals, Corrosion resistance, Corrosion prevention, Corrosion mechanisms, Reprints.

Computerization of the wealth of available corrosion data facilitates both data access and interpretation to address specific user needs. Data collection and compilation can be enhanced by adoption of format standards which define guidelines for common terminology, documentation of performance measurement for both metals and nonmetals, data output and presentation, and for assessing data quality. Well-defined programs, using a variety of established computerization techniques, can serve as effective tools for selection of corrosion resistant materials, assessing material limitations, selection and design of corrosion control methods, and for gaining a better understanding of the significance and theoretical considerations relating to operative corrosion mechanisms.

200,986
PB92-170745 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Electrochemical Noise Analysis and Its Applications to Corrosion.
Final rept.
U. Bertocci. 1989, 11p
See also PB87-128195.
Pub. in Proceedings of Conference Corrosion '89, New Orleans, LA., April 17-21, 1989, p24/1-24/11.

Keywords: *Corrosion, *Electrochemistry, *Noise(Electrical and electromagnetic), Thermal noise, Noise temperature, Noise spectra, Noise measurement, Noise analyzers, Electrochemical corrosion, Reprints, *Electrochemical noise.

Random fluctuations of the electrical quantities (electrode potential and cell current) in electrochemical systems, are commonly 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 (MSEL), Gaithersburg, MD. Ceramics Div.
Extended Charles-Hilfig Theory for Stress Corrosion Cracking of Glass.
Final rept.
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 physical framework to the geometric change of 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.

200,988
PB93-129245 Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.

High Pressure DTA/TGA System for Studying the Oxidation of Metallic Materials.
Final rept.
J. W. Bransford, and J. A. Hurley. 1990, 14p
Pub. in NASA Conference Publication 3092, v1 p135-148 1990.

Keywords: *Oxidation, *Metals, *Thermogravimetry, Reduction(Chemistry), Ignition, Thermal analysis, Corrosion, Oxidizers, Gravimetric analysis, Measuring instruments, Reprints, *Differential Thermal Analysis/Thermogravimetric Analysis System.

Knowledge of the oxidation characteristics of alloys--such as transition temperature, ignition temperature, oxidation rate, etc.--is vital to the evaluation and thermal modeling of alloy behavior in high pressure oxidizing environments. In previous work, a CO2 laser was used to heat an alloy specimen that was fixtured in a low heat loss configuration and placed in a pressurized oxidizing environment. The data from these tests were sufficient to define and determine the temperatures for several ignition parameters, such as spontaneous ignition, as a function of oxygen pressure. However, information required for thermal modeling, such as oxidation rate, could not be obtained due to experimental problems. To address the need for data required for thermal modeling and also to acquire a more precise analytical tool, a high pressure Differential Thermal Analysis/Thermogravimetric Analysis (DTA/TGA) system has been designed and is being constructed. This system will provide data on oxidation rate and thermal effects over the temperature range from ambient to greater than 1700 K and over the pressure range from vacuum to 34.5 MPa. In addition the transition temperature and conservative ignition parameter temperatures can also be determined. This paper discusses the rationale for the system, the design and anticipated results.

Elastomers

200,989
PB92-144419 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Fluorescence Monitoring of Twin Screw Extrusion.
Final rept.
A. J. Bur, and F. M. Gallant. 1991, 7p
See also PB90-205907. Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Polymer Engineering and Science 31, n19 p1365-1371 Oct 91.

Keywords: *Fluorescence, *Extrusions, *Probes, *Elastomers, Polybutadiene, Mechanical twinning, Calcium carbonates, Polymer chemistry, Mixing, Excitation, Molecular energy levels, Measuring instruments, Reprints, *Twin screw processing.

An optical fiber probe has been constructed in order to obtain real-time measurements of fluorescence radiation during twin screw mixing and extrusion of plasticized polybutadiene and calcium carbonate particulate. The probe consists of an optical fiber bundle which was inserted along the axis of a half-inch sensor bolt, and it was used to transmit optical excitation energy to the processed material and to detect the subsequent fluorescence. The source of fluorescence radiation was a fluorescent dye which was doped into the processed ingredients at very low concentrations. Although most of the measurements were taken with the probe positioned close to the exit die, the sensor bolt can be placed in any instrumentation port along the extruder line. Experiments were carried out to measure residence time distribution, quality-of-mix, and mix concentrations as a function of processing conditions. Product mix changes in response to variations in material feed rates and screw RPM were also observed. Values of residence time were obtained by measuring the transit times for the dye to travel from an upstream injection port to the measurement probe, a distance of 63 cm. Flow instabilities, such as mat formation of the solids, were observed by noting the abrupt changes and discontinuities in the fluorescence signal.

200,990
PB92-175215 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Localization Model: Review and Extension to Swollen Rubber Elasticity.
Final rept.
J. Douglas, and G. McKenna. 1992, 25p
Pub. in Elastomeric Polymer Networks, Chapter 23, p327-351 1992.

Keywords: *Elastomers, *Elastic properties, *Swelling, *Natural rubber, Crosslinking, Vulcanization, Reprints, *Localization model.

The localization model of rubber elasticity is briefly reviewed and compared with torsional data for dicumyl peroxide crosslinked natural rubber. Assumptions implicit in the original version of the localization model limit its application to unswollen rubbers. The success of the localization model in describing the elastic properties of 'dry' rubber leads us to introduce an extension of the model to describe the elasticity of swollen networks. Predictions of the generalized model are compared to experimental studies on the elasticity of highly crosslinked and lightly crosslinked swollen rubbers.

200,991
PB93-125763 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Experiments on the Elasticity of Dry and Swollen Networks: Implications for the Frenkel-Flory-Rehner Hypothesis.
Final rept.
G. B. McKenna, K. M. Flynn, and Y. Chen. 1989, 6p
Pub. in Macromolecules 22, n12 p4507-4512 1989.

Keywords: *Natural rubber, *Swelling, *Crosslinking, *Elastic properties, Solvents, Strain energy methods, Plastic analysis, Vulcanizing, Elastomers, Deformation, Thermodynamics, Stress analysis, Torque, Reprints, Frenkel-Flory-Rehner hypothesis.

Torque and normal force measurements have been performed on cylindrical samples of dicumyl peroxide natural rubber with the purpose of obtaining the first derivative of the (elastic) strain energy density function of the dry rubber. Similar rubber samples were swollen to equilibrium in different solvents and tested in uniaxial compression in the swollen state. We find that the dry state properties can be used to predict the swollen state properties by assuming as did Frenkel, Flory and Rehner, that the elasticity of the swollen network is unaltered by the presence of the solvent other than by the chain deformation. We show that the isopiestic measurements of the dilatational modulus reported by Gee and co-workers support the finding we made previously that the Flory-Huggins interaction parameter is different in the crosslinked and uncrosslinked rubber. Our results are interpreted to imply that the Frenkel-Flory-Rehner hypothesis is incorrect due to changes in the thermodynamics of mixing during swelling of the rubber. The elasticity of the swollen network is described by the same strain energy function as is the dry network.

200,992
PB93-125771 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Swelling in Crosslinked Natural Rubber: Experimental Evidence of the Crosslink Density Dependence of chi.
Final rept.
G. B. McKenna, K. M. Flynn, and Y. Chen. 1990, 9p
Pub. in Polymer 31, n10 p1937-1945 1990.

Keywords: *Natural rubber, *Swelling, *Crosslinking, *Elastic properties, Solvents, Strain energy methods, Plastic analysis, Mechanical properties, Vulcanizing, Elastomers, Stress analysis, Reprints, Flory-Huggins interaction parameter.

Mechanical and swelling measurements were carried out on samples of dicumyl peroxide crosslinked natural rubber. The balance of the elastic free energy and the mixing free energy at swelling equilibrium was used to calculate the value of the Flory-Huggins X parameter for a series of crosslinked rubbers swollen in an excess of different solvents. The results show that X for the crosslinked rubber is greater than that of the uncrosslinked counterpart. Other evidence from the literature based on dilatational modulus measurements which supports this conclusion is discussed. We also find that the value of X in the crosslinked rubber is a linear function of the crosslink density. We examine these results in the context of the Freed and Pesci lattice model.

200,993
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.
Final rept.
J. R. Quay, Z. Sun, J. Blackwell, R. M. Briber, and E. L. Thomas. 1990, 5p
Pub. in Polymer 31, n6 p1003-1008 1990.

Keywords: *Polyurethane resins, *Elastomers, *Hardening(Materials), *X ray diffraction, *Electron diffraction, Crystal structure, Densitometers, Optical measurement, Reprints, Methane diisocyanate/diphenyl, 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 diisocyanate/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 displaced above and below the apparent layer lines, which points to inclination of the chain axis (c) away from the direction of the draw. Refinement 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. Gas and Particulate Science Div.
Problem of Visibility in Noisy Images.
Final rept.
D. S. Bright, E. B. Steel, and D. E. Newbury. 1989, 4p
Pub. in Microbeam Analysis - 1989, p377-380.

Keywords: *Scanning electron microscopy, *Fibers, Image 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 S > 5n(sup 0.5), for the minimum signal excursion required 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 levels of contrast and background noise. Examination of random image fields of fibers by 18 observers reveals a significant relaxation of the Rose criterion for long fibers (length > 10% of the image field). Additional studies will be necessary to define a robust measure of the visibility criterion.

Iron & Iron Alloys

200,995
PB92-145192 Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Charpy Impact Tests Near Absolute Zero.
Final rept.
R. L. Tobler, R. P. Reed, I. S. Hwang, M. M. Morra, R. G. Ballinger, H. Nakajima, and S. Shimamoto. 1991, 7p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Jnl. of Testing and Evaluation 19, n1 p34-40 Jan 91.

Keywords: *Charpy impact tests, *Austinitic 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 calibration, thermal behavior during the various stages of testing, and correlations between Charpy absorbed energy and quantitative toughness parameters. Because of the very low specific heats of metals near absolute zero, any surface condensation of gases, convective or conductive heat transfer, or plastic deformation during a test will cause the specimen temperature to rise rapidly. Consequently, valid impact tests of alloys at 4 K can not be performed according to the procedure outlined in ASTM Methods E 23-88. During Charpy tests, the temperature of austenitic steel specimens, initially at or near 4 K, may in fact rise 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 differently. 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 ductile steels, or rank them properly, using Charpy tests.

200,996
PB92-145200 Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Warm Precracking at 295 K and Its Effects on the 4-K Toughness of Austenitic Steels.
Final rept.
R. L. Tobler, and M. Shimada. 1991, 9p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Jnl. of Testing and Evaluation 19, n4 p312-320 Jul 91.

Keywords: *Austenitic stainless steels, *Cracking(Fracturing), *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 prestress. The authors demonstrate this for Fe-17Cr-3Ni-13Mn-0.33N steel specimens that were warm precracked at 295 K and then fractured in liquid helium at 4 K where failure occurs by slip-plane cracking. On the other hand, Fe-13Cr-5Ni-22Mn-0.21N steel with higher toughness and a ductile fracture mechanism at 4 K was not affected by similar warm precracking. Austenitic and ferritic steel behaviors are compared, and precracking procedures for 4 K fracture tests are discussed.

200,997
PB92-154343 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Characterization of 9Cr-1MoVNb Steel by Anomalous Small-Angle X-ray Scattering.
Final rept.
P. R. Jemian, J. R. Weertman, G. G. Long, and R. D. Spal. 1991, 11p
Contract DE-FG02-86ER45229
Sponsored by Department of Energy, Washington, DC.
Pub. in Acta Metallurgica Materials 39, n11 p2477-2487 1991.

Keywords: *Chromium carbides, *Ferritic stainless steels, *Precipitation(Chemistry), Temperature dependence, Particle size, Size determination, X-ray analysis, Phase transformations, 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. Size distributions 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 smallest and Cr23C6 number density is highest after aging at 811 K. Above 811 K, the mean diameter of the chromium carbides increases with increasing aging temperature.

200,998
PB92-159748 Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Measurement of HAZ Toughness in Steel Weldments.
Final rept.
H. I. McHenry, and R. M. Denys. 1990, 12p
Pub. in Proceedings of International Fracture Mechanics Summer School (5th): The Application of Fracture Mechanics to Life Estimation of Power Plant Components, Dubrovnik, Yugoslavia, June 1989, p211-222 1990.

Keywords: *Weldments, *Steels, *Toughness, *Nondestructive tests, Fracture properties, Brittleness, Microstructure, Test methods, Weld defects, Metallurgy, Metal plates, Reprints, Heat affected zone.

The toughness of heat affected zones (HAZs) in steel weldments is often governed by local brittle zones (LBZs) which are regions of brittle microstructure that can initiate brittle fracture at low toughness levels. The paper describes the metallurgical nature of LBZs and reviews the various test methods used to detect LBZs and to evaluate HAZ toughness. Toughness tests and their specific functions are: (1) For pre-production qualification of steel plates, CTOD tests evaluate the susceptibility of steels to the formation of LBZs, (2) For quality control of steel plates, drop weight NDT tests evaluate the tolerance for LBZs of the steels selected for the structures, (3) For qualification of welding materials and procedures, Charpy V-notch tests verify that the HAZ toughness exceeds the minimum toughness specified for the steel, and (4) For fitness for purpose evaluations, wide plate tests assess the significance of LBZs in existing structures.

200,999
PB92-164698 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Weld and Heat Affected Zone Crack Arrest Fracture Toughness of AAR TC128 Grade B Steel.
Research rept.
G. E. Hicho, and D. E. Harne. Feb 92, 25p NISTIR-4767, REPT-25
Contract DTRF53-90-X-0051
Sponsored by Federal Railroad Administration, Washington, DC.

Keywords: *Fracture mechanics, *Toughness, *Carbon steels, *Fracture strength, Tensile strength, Microstructure, Welding, Tank cars, Cracking(Fracturing), Specifications, Mechanical properties, Cracks, Crack propagation, Stress relaxation, Metal plates.

Weld and heat affected zone (HAZ) crack arrest fracture toughness were determined for welded plates of normalized AAR TC128 grade B steel, currently used in appropriate tank cars that carry hazardous materials. The plates were joined under laboratory conditions and stress relieved using the recommended Association of American Railroads (AAR) welding procedures. In the calculation of the crack arrest fracture toughness, the yield strength at the test temperature is required in the appropriate equations. Hence weld metal tensile specimens were prepared from the joined plates and tested at temperatures ranging from -51 C to -18 C. Weld and HAZ crack arrest fracture toughness specimens were prepared and tested at -51 C. Crack arrest fracture toughness results indicated that both the weld metal and the HAZ for the welded normalized and stress relieved AAR TC128 grade B steel were highly resistant to crack initiation and possessed the ability to arrest a propagating crack.

201,000
PB92-165190 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Fracture and Deformation Div.
Ultrasonic Measurement of Formability in Thin Ferritic Steel Sheet.
Final rept.
A. V. Clark, R. B. Thompson, G. V. Blessing, and D. Matlock. 1989, 8p
See also PB92-116615.
Pub. in Review of Progress in Nondestructive Evaluation, v8A p1031-1038 1989.

Keywords: *Steels, *Metal sheets, *Ultrasonic tests, Ductility, Metal rolling, Formability, Nondestructive testing, Metal working, Measurement, Texture, Reprints, R-values.

In the production of sheet steel, a parameter of interest is the r-value which characterizes the sheet drawability. For press-shop manufacture of e.g. automobile body panels, it is desirable to have small variations in r-value from specimen to specimen. We are considering ultrasonic methods of obtaining r-value. Our immediate goal is a technique having both accuracy and speed for off-line application; our long-term goal is r-value measurement as the sheet is being rolled. We have measured arrival times of various combinations of bulk and guided waves in ferritic steel sheet having a large range of r-values. A good correlation between ultrasonic measurement and the (destructive) r-values was obtained. For on-line application, non-contacting EMATs are the transducer of choice. We discuss some measurement problems arising with use of EMATs on ferromagnetic sheet, and means of solving these problems.

201,001
PB92-175082 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Fe-Pb (Iron-Lead) System.
Final rept.
B. Burton. 1991, 3p
Pub. in Jnl. of Phase Equilibria 12, n2 p200-202 1991.

Keywords: *Iron alloys, *Lead containing alloys, *Phase transformations, Solubility, Metallurgy, Reprints.

The system Fe-Pb is evaluated, particularly with respect to the solubility of Fe in liquid Pb.

201,002
PB92-175637 Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Quantifying the Embrittlement Due to Sensitization in an Austenitic Stainless Steel.
Final rept.
P. T. Purtscher. 1992, 4p
Pub. in Scripta Metallurgica et Materialia 26, p343-346 1992.

Keywords: *Austentic stainless steels, *Embrittlement, *Sensitivity, Fatigue tests, Triaxial stresses, Brittleness, Mechanical properties, Time temperature parameter, Brittle materials, Interfacial tension, Reprints.

The technical note describes a method that can quantify the embrittlement due to sensitization in an austenitic stainless steel. The stresses at the point of fracture in a uniaxial tension test are characterized by a critical interfacial stress that was derived by Argon and coworkers, the sum of the equivalent plastic flow stress and hydrostatic stress. For a typical austenitic stainless steel (AISI 316LN) that is used here as an example, the embrittlement can be related to the difference between the critical interfacial stress for the sensitized and annealed specimens. The results show that the maximum embrittlement occurs at a test temperature of 76K. The method of quantifying embrittlement is directly related to the physical process involved (void nucleation from closely spaced particles), and should make it possible to predict the degree of embrittlement in complex stress states.

201,003
PB92-198035 Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Fracture and Deformation Div.
Austenitic Steels with 9% Cr for Structures at Cryogenic Temperatures.
Final rept.
P. T. Purtscher, M. Austin, C. McCowan, R. P. Reed, R. P. Walsh, and J. Dunning. 1990, 8p
Sponsored by Department of Energy, Washington, DC.
Pub. in Advances in Cryogenic Engineering (Materials), v36 p87-94 1990.

Keywords: *Austenitic steels, *Cryogenic equipment, *Corrosion resistant steels, *Chromium steels, Fracture properties, Corrosion resistance, Cryogenics, Mechanical properties, Low temperature, Tensile properties, Toughness, Reprints.

Tensile and fracture toughness tests at 76 and 4 K are performed on austenitic steels containing 9% Cr. The results are comparable to similar data for AISI 304 and 316-type steels. Weight-loss experiments show that these steels will provide good resistance to rust formation. All of the data indicate that 9% Cr austenitic steels with appropriate alloy additions would be suitable for structural applications at cryogenic temperatures.

201,004
PB92-236439 Not available NTIS
National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.
Ultrasonic Characterization of Texture and Formability.
Final rept.
A. V. Clark. 1988, 3p
Pub. in MRS Bulletin 13, n4 p40-42 Apr 88.

Keywords: *Formability, *Texture, *Ultrasonic tests, *Steels, *Aluminum alloys, Surface properties, Nondestructive tests, Elastic properties, Mechanical properties, Velocity measurement, Wave propagation, Reprints.

Theories currently exist which predict the effect of texture on elastic properties, and hence on the velocities of bulk, surface, and guided ultrasonic waves. Furthermore, there is a relation between texture and formability. These relationships can potentially be exploited to make ultrasonic measurements of formability. In addition, partial pole figures can be made with ultrasonic techniques. We present results of various ultrasonic measurements which have been made to characterize formability of rolled steel and aluminum alloy sheet. In general, there is a good correlation of ultrasonic velocity measurements with formability. Furthermore, there is a good possibility of on-line formability measurement using a noncontacting ultrasonic transducer.

201,005
PB92-236835 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Effects of Varying Austenitizing Temperature and Cooling Rate on the Ability of HSLA-80 Steel to Achieve Impact Properties Comparable to HSLA-100 Steel.
Final rept.
G. E. Hicho, and R. J. Fields. 1990, 7p
Sponsored by David Taylor Research Center, Annapolis, MD.
Pub. in Jnl. of Heat Treating 8, n2 p101-107 1990.

Keywords: *Austenitizing, *Impact tests, *Temperature effects, *Cooling rate, *Austenitic steels, Hardening(Materials), Precipitation hardening steels, Impact strength, Precipitation heat treatment, Precipitation hardening, Heat treatment, Reprints, *HSLA-80 steel, *HSLA-100 steel.

Heat treating experiments, where the austenitizing temperatures were varied, were conducted on HSLA-80 in order to determine if the impact properties could be increased to those of HSLA-100. The tests were conducted only at -17.8 C and -84 C. The impact strength was found to decrease as the austenitizing temperature increased. Impact tests were also conducted on specimens that were double austenitized. The impact properties were found to be dependent upon plate thickness. Only the selected heat treatments for the 19 mm and 32 mm thick plates produced acceptable results, that is both the impact properties and yield strength satisfied the requirements for HSLA-100 steel. Impact tests conducted on the 51 mm thick plates revealed that only those specimens tested at -17.8 C were acceptable. The desired yield strength was never attained for the 51 mm thick plates. The effects of epsilon-copper and niobium carbide precipitates on the impact strength are discussed.

201,006
PB92-236934 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Al-Fe (Aluminum-Iron).
Final rept.
U. R. Kattner. 1990, 3p
Pub. in Binary Alloy Phase Diagrams, v1 p147-149 1990.

Keywords: *Binary alloy systems, *Phase diagrams, Iron aluminide, Iron alloys, Reprints.

The binary Fe-Al system has been evaluated.

201,007
PB92-237395 Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Ferrite Number Prediction for Stainless Steel Welds.
Final rept.
T. A. Siewert, C. N. McCowan, and D. L. Olson. 1992, 18p
Sponsored by Welding Research Council, New York.
Pub. in Key Engineering Materials, v69-70 p149-166 1992.

Keywords: *Ferritic stainless steels, *Weld metal, *Reviews, Weldments, Predictions, Ferrite, Iron alloys, Welded joints, Concentration(Composition), Reprints, *Ferrite number.

The review article summarizes progress in the prediction of the ferrite content (as Ferrite Number) in stainless steel welds.

201,008
PB93-125995 Not available NTIS
National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.
Effect of Void Nucleation on Fracture Toughness of High-Strength Austenitic Steels.
Final rept.
P. T. Purtzcher, R. P. Reed, and D. T. Reed. 1989, 14p
Sponsored by Department of Energy, Washington, DC.
Pub. in Fracture Mechanics: Perspectives and Directions, ASTM STP 1020, p433-446 1989.

Keywords: *Voids, *Fracture strength, *Austenitic stainless steels, *Low temperature tests, Nucleation, Nitrogen, High strength steels, Ductility, Yield strength, Fracture mechanics, Stress analysis, Reprints.

The fracture of seven austenitic stainless steels with varying nickel and nitrogen contents were studied at 4 K. Smooth, 6-mm-diameter tension specimens and 22-mm-thick compact specimens were used. Nitrogen content controlled the yield strength and influenced fracture toughness by its effect on yield strength. Increasing the nickel content increased the fracture toughness at a constant nitrogen content. Observations of the fracture surfaces and polished cross sections through the fracture surfaces of test specimens showed that nucleation controlled the dimpled rupture fracture process. A critical stress criterion for nucleation that depends on both the applied stress and strain was developed and applied to the fracture toughness test. This fracture criterion explained the increase in fracture toughness with increasing nickel and the decrease in fracture toughness with increasing yield strength for strengths over 600 MPa.

201,009
PB93-126019 Not available NTIS
National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.
Improved Strain Gauge Method for Measuring K(sub ID) for a Propagating Crack.
Final rept.
R. J. Sanford, J. W. Dally, and J. R. Berger. 1990, 7p
Sponsored by National Science Foundation, Washington,. DC., Naval Air Development Center, Johnsville, PA., and Oak Ridge National Lab., TN.
Pub. in Jnl. of Strain Analysis 25, n3 p177-183 1990.

Keywords: *Crack propagation, *Strain gages, *Alloy steels, Cracks, Cracking(Fracturing), Stress concentration, Stresses, Strain measurement, Strains, Cleavage, Stress intensity factors, Reprints.

An improved strain gauge method for measuring the dynamic stress intensity factor of a running crack is described. By orienting the gauge relative to the crack propagation path the gauge response is optimized for the analysis. Higher order terms in the dynamic strain field representation are demonstrated to be important in the analysis. An application of the method is illustrated in the measurement of the stress intensity factor for a very hard alloy steel, 4340, with a crack propagating at 656 m/s.

201,010
PB93-129567 Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Joining of Austenitic Stainless Steels for Cryogenic Applications.
Final rept.
T. A. Siewert, and C. N. McCowan. 1992, 7p
Sponsored by Department of Energy, Washington, DC.
Pub. in Advances in Cryogenic Engineering (Materials), v38 p109-115 1992.

Keywords: *Austenitic stainless steels, *Welded joints, *Cryogenics, *Fracture properties, Gas metal arc welding, Fracture strength, Fractures(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 means that the critical fracture path in these structures could be through the welds. For many applications the welds may never be stressed to critical levels, but for very aggressive 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 properties. We 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 factors and discusses the interactions between them. For example, the cryogenic strength is influenced most by the composition, with the strength being increased strongly by N addition. The toughness is decreased by residual delta ferrite (FN) and inclusions, 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 ever measured at 4 K in our laboratory. Changes in the inclusion fraction are the primary cause of differences in mechanical properties between welds produced by the various welding processes. A secondary cause of differences is a nonuniform distribution of elements in the microstructure.

201,011
PB93-135341 Not available NTIS
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Robot Systems Div.
Tribological Behavior of 440C Martensitic Stainless Steel from 184C to 750C.
Final rept.
A. J. Slifka, R. Compos, T. J. Morgan, and J. D. Siegwarth. 1991, 8p
Pub. in International Cryogenic Materials Conference, Advances in Cryogenic Engineering Materials, v38 ptA p323-330 1991.

Keywords: *Friction, *Wear, *Martensitic stainless steels, *Rocket engines, Cryogenics, Turbopumps, Oxidation, Bearings, Tribology, Space shuttle main engine, Liquid oxygen, Reprints.

Characterization of the coefficient of friction and wear rate of 440C stainless steel is needed to understand the effects of frictional heating in the bearings of the High Pressure Oxygen Turbopump of the Space Shuttle Main Engine. The coefficient of friction and wear rate have been measured over a range of temperature varying from liquid oxygen temperature (-184 C to 750 C). The normal load has also been varied resulting in a variation of Hertzian stress from 0.915 to 3.660 GPa while the surface velocity has been varied from 0.5 to 2.0 m/s.

Lubricants & Hydraulic Fluids

201,012
PB92-144690 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Boundary Lubrication of Materials.
Final rept.
S. M. Hsu. 1991, 5p
Sponsored by Department of Energy, Washington, DC. Energy Conversion and Utilization Technologies Div.
Pub. in MRS Bulletin XVI, n10 p54-58 Oct 91.

Keywords: *Lubricants, *Boundary lubrication, *Ceramics, *Surface chemistry, Chemical reactions, Friction tests, Wear tests, Reprints, Chemical reaction mechanisms.

The ability to control friction and wear is oftentimes crucial to the introduction of new materials into products. A critical issue is friction and wear under the combination of high stress and slow speed, under which the surfaces interact. Boundary lubricating films formed by chemical reactions between the lubricant and the surface are crucial to the successful control of friction and wear. Recent advances aided by the increasing 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 boundary lubrication and identifies knowledge gaps for advanced materials.

Materials Degradation & Fouling

201,013
PB92-144500 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Wear Mechanisms of alpha-Alumina Lubricated with a Paraffin Oil.
Final rept.
D. E. Deckman, S. Jahanmir, and S. M. Hsu. 1991, 14p
Sponsored by Department of Energy, Washington, DC.
Pub. in Wear 149, p155-168 1991.

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.

201,014
PB92-159169 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Three-Dimensional Fracture Analysis of Thin-Film Debonding.
Final rept.
H. Chai. 1990, 20p
Pub. in International Jnl. of Fracture 46, n4 p237-256, 15 Dec 90.

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. Membrane and bending stresses 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 'jump' 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 bioaxial-compression stress field in which the loading 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.
Results of the VAMAS Interlaboratory Study on Wear Test Methods.
Final rept.
H. Czichos, and A. W. Ruff. 1987, 5p
Pub. in VAMAS (Versailles Project on Advanced Materials and Standards) Bulletin, n5 p1-5 Jan 87.

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 objectives of the project were identified in the first meeting of the working party held in April 1985 in Vancouver, Canada, which involved 16 participants. These objectives were to organize 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 materials. The multilaboratory interlaboratory 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.

201,016
PB92-197680 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Quantitative Wear Maps as a Visualization of Wear Mechanism Transitions in Ceramic Materials.
Final rept.
S. M. Hsu, R. G. Munro, and Y. S. Wang. 1989, 11p
Pub. in Wear 134, n1 p1-11 1989.

Keywords: *Ceramics, *Wear tests, *Materials tests, Tribology, Design criteria, Three-dimensional calculations, Structural design, Engines, Reprints, *Advanced materials, *Wear maps.

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 properties and the availability of appropriate design criteria. The paper describes a new methodology for the wear testing of ceramics that is intended to enable materials screening and designing to be based on laboratory results. The methodology prescribes a systematic effort to measure and represent the wear characteristics of ceramics 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 three 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.

201,017
PB93-129591 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Materials Div.
Accelerated versus Natural Weathering of Coatings and Other Polymeric Materials: A State of the Art.
Final rept.
J. W. Martin. 1989, 18p
Pub. in Proceedings of TNO Symposium on Accelerated versus Natural Weathering of Coatings and Other Polymeric Materials, Amsterdam, May 24-25, 1989, 18p.

Keywords: *Acceleration tests, *Weathering, *Coatings, *Polymers, *Aging tests(Materials), *Service life, State of the art, Exposure, Performance standards, Experimental design, Life(Durability), Reliability, Quality assurance, Study estimates, Reprints.

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 accentuated by perceived deficiencies in the current accelerated aging tests. An in-depth investigation of the coatings' 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, having an inadequate experimental design, and basing the experimental design on the incorrect premise; i.e., the presumption that outdoor exposure results qualify as the de facto standard of performance. A reliability-based service life prediction program is proposed for alleviating these deficiencies and for providing a means of relating outdoor and accelerated aging results. Examples of the successful application of reliability techniques to the coatings' service life prediction problem are presented.

201,018
PB93-129658 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Materials Div.
Accelerated Aging Test Design for Coating Systems.
Final rept.
J. W. Martin. 1989, 17p
Pub. in Proceedings of International Conference (15th) in Organic Coatings Science and Technology, Athens, Greece, July 11-14, 1989, p237-253.

Keywords: *Coatings, *Accelerated tests, *Aging tests(Materials), *Service life, Probability theory, Exposure, Weathering, Life(Durability), Reprints.

Due to deficiencies in the present accelerated aging test practice, 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

201,019
DE92015116 PC A02/MF A01
Air-Conditioning and Refrigeration Technology Inst., Inc. Arlington, VA.
Materials Compatibility and Lubricants Research on CFC-Refrigerant Substitutes: Thermophysical Properties. Quarterly Report, 1 January 1992--31 March 1992.
Progress rept.
R. F. Kayser. Apr 92, 9p DOE/CE/23810-2A
Contract DE-FG02-91CE23810
Sponsored by Department of Energy, Washington, DC.

Keywords: *Chlorofluorocarbons, *Lubricants, *Refrigerants, Compatibility, Fluids, Physical Properties, Progress Report, Specific Heat, Thermal Conductivity, Vapor Pressure, Viscosity, *Environmental chemical substitutes, *Thermophysical properties, EDB/360606.

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 and optimize equipment to be reliable and energy efficient. The objective of this project is to provide highly accurate, selected thermophysical properties data for Refrigerants 32, 123, 124, and 125, and to use these data to fit simple and complex equations of state and detailed transport property models. The new data will fill in 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-month project, which was initiated in late January, 1992.

201,020
PB92-144872 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Thermophysics Div.
Dipole Moments of Seven Refrigerants.
Final rept.
C. W. Meyer, and G. Morrison. 1991, 5p
See also PB91-195131.
Pub. in Jnl. of Chemical and Engineering Data 36, n4 p409-413 Oct 91.

Keywords: *Dipole moments, *Refrigerants, *Fluorinated alphatic hydrocarbons, *Gases, Dielectric properties, Temperature dependence, Molecular rotation, Refractivity, Polarizability, Reprints, Freons.

Dielectric constant measurements have been performed on 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 (CH2C12CHF3), R141b (CH2C12CH3F), R22 (CHC1F2), and R32 (CH2F2). Two refrigerants have conformer-dependent moments, making their time-averaged moments temperature dependent: R114 (CH2Cl2CF4) and E134 (bis(difluoromethyl)ether). One refrigerant, R123a (CH2Cl2CHF3), has a moment that in principle could be temperature-dependent, but in fact is temperature-independent. Accurate determination of a molecule's temperature-dependent dipole moment requires an independent determination of its electronic polarizability; this determination has been made from index of refraction measurements. Where possible, the present results are compared with earlier determinations of dipole moments.

201,021
PB92-149814 PC **A05**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Performance of Chlorine-Free Binary Zeotropic Refrigerant Mixtures in a Heat Pump.
J. Pannock, and D. A. Didion. Dec 91, 88p NISTIR-4748, EPA/600/R-92/017
See also PB87-104410. Sponsored by Electric Power Research Inst., Palo Alto, CA., and Environmental Protection Agency, Research Triangle Park, NC. Air and Energy Engineering Research Lab.

Keywords: *Refrigerants, *Heat pumps, Heat transfer, Chlorine, Binary mixtures, Heat exchangers, Thermodynamic properties, Computerized simulation, Cooling, Temperature, Performance evaluation, Test methods, Test facilities, *Zeotropic refrigerant mixtures.

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. The report investigates possible replacement refrigerants for R22, where the replacements are binary zeotropic mixtures of the following hydrofluorocarbons (HFCs): R23, R32, R125, R134a, and R152a. The method, that was chosen, is based on three steps: (1) determining possible mixture components, (2) evaluating all fifteen 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 the confidence that this time saving combination of simulation and testing is a very powerful engineering tool.

201,022
PB92-159623 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Tribochemical and Thermochemical Reactions of Stearic Acid on Copper Surfaces Studied by Infrared Microspectroscopy.
Final rept.
Z. S. Hu, S. M. Hsu, and P. S. Wang. 1991, 5p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of STLE (Society of Tribologists and Lubrication Engineers) Annual Meeting (46th), Montreal, Quebec, Canada, April 29-May 2, 1991, p1-5.

Keywords: *Wear resistance, *Copper, *Stearic acid, *Thin films, *Surface chemistry, Lubricating properties, Tribology, Thermochemistry, Reprints, Copper stearate, Fourier transform infrared spectroscopy.

The tribochemistry of copper with stearic acid was studied using a pin-on-disc wear tester under boundary lubrication conditions. Wear, as measured by surface profilometry, indicated that stearic acid was able to reduce the wear fourfold. Surface analysis by Fourier Transform Infrared (FTIR) microspectroscopy revealed that cupric stearate was formed during the rubbing process by tribochemical reactions. The reaction product was 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 140 C - 160 C. The affinity between the chemisorbed stearic acid and bidentate copper stearate complex is believed to be responsible for the formation of a protective film on the copper surfaces to reduce the wear from further propagation.

201,023
PB92-165737 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Environment Div.
Mixing Rule for Liquid Viscosities of Refrigerant Mixtures.
Final rept.
D. S. Jung, and D. Didion. 1990, 5p
Pub. in International Jnl. of Refrigeration 13, n4 p243-247 1990.

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 refrigeration industry are not valid universally for all mixtures considered.

201,024
PB92-170836 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Environment Div.
Role of Refrigerant Mixtures as Alternatives.
Final rept.
D. A. Didion, and D. B. Bivens. 1989, 13p
Pub. in Proceedings of ASHRAE's CFC Technology Conference. CFCs: Today's Options - Tomorrow's Solutions, Gaithersburg, MD., September 27-28, 1989, p57-69.

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 zeotropes are discussed separately as to their advantages as a refrigerant system working fluid and as to their requirements for adaptation. It may be possible to find azeotropes and near-azeotropes which could be candidates for alternatives for existing systems as well as new systems with little or no change in system performance. 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' development are likely to have impact on the immediate ozone depletion crisis, the development will take longer but will be necessary for the greenhouse warming crisis.

201,025
PB92-175678 Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.
Monitoring Rapidly Changing Temperatures of the Oscillating Working Fluid in a Regenerative Refrigerator.
Final rept.
W. Rawlins, R. Radebaugh, and K. D. Timmerhaus. 1991, 13p
Sponsored by National Aeronautics and Space Administration, Moffett Field, CA. Ames Research Center.
Pub. in Applications of Cryogenic Technology, v10 p71-83 1991.

Keywords: *Temperature measurement, *Working fluids, *Cryogenic cooling, *Regenerators, Refrigerators, Regenerative cooling, Thermometers, Cryogenic fluids, Refrigerating machinery, Thermocouples, Reprints.

Characterization of an orifice pulse tube refrigerator requires measurements of the instantaneous gas temperatures at various locations in the refrigerator. This presents several challenges. The temperature probe has to fit inside a 3 mm diameter tube with minimum disturbance to the flow. Void volumes, introduced by placement of a temperature probe into the system, have to be 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. It also must have 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-foil thermocouples and fine-wire resistance thermometers. A 4 micrometer diameter tungsten wire was found to satisfy these diverse requirements.

201,026
PB93-120756 PC **A04**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Simultaneous Visual and Calorimetric Measurements of R11, R123, and R123/Alkylbenzene Nucleate Flow Boiling.
M. A. Kedzierski. Oct 92, 54p NISTIR-4948
Sponsored by Department of Energy, Washington, DC. Building Equipment Div.

Keywords: *Refrigerants, *Environmental chemical substitutes, *Air pollution abatement, *Nucleate boiling, Mixtures, Performance standards, Lubricants, Freons, Chlorohydrocarbons, Fluorohydrocarbons, Benzenes, Heat measurement, Visual inspection, *Ethane/dichloro-trifluoro, R11, R123.

The paper presents a comparison of calorimetric and visual measurements 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.

201,027
PB93-130383 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Building Environment Div.
Simplified Cycle Simulation Model for the Performance Rating of Refrigerants and Refrigerant Mixtures.
Final rept.
P. A. Domanski, and M. O. McLinden. 1990, 10p
Sponsored by Environmental Protection Agency, Washington, DC., and Electric Power Research Inst., Palo Alto, CA.
Pub. in ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers)-Purdue CFC Conference, West Lafayette, IN., July 17-20, 1990, 10p.

Keywords: *Refrigerants, *Thermodynamic cycles, *Cooling systems, *Computerized simulation, Mixtures, Thermodynamic properties, Compressible flow, Heat exchangers, Refrigerating machinery, Refrigerant compressors, Mathematical models, Heat transfer, Reprints.

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 cycles are prescribed in terms of the temperatures of the external heat transfer fluids with the heat exchangers generalized by their average effective temperature differences. The isenthalpic expansion process is assumed. The program includes a rudimentary model of a compressor and a representation of the suction line and liquid line heat exchange. Refrigerant 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. An example of simulation results stresses the need for careful application of simplified models and consideration for the involved assumptions.

Nonferrous Metals & Alloys

201,028

PB92-144112 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Effects of Convection on Ostwald Ripening in Solid-Liquid Mixtures.
Final rept.
N. Akaiwa, S. C. Hardy, and P. W. Voorhees. 1991, 12p
See also PB86-201746.
Pub. in Acta Metall. Mater. 39, n11 p2931-2942 1991.

Keywords: *Rapid solidification, *Liquid-solid interfaces, *Curing, Metallurgy, Solid phases, Convection, Heat transfer, Kinetics, Fluid flow, Reprints, *Ostwald ripening, Lead tin 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 fraction solid. 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 experiments 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 0.37. 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 very 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 Peclet 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 not exist when the particles move in the fluid with either 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.
Formation of Ordered omega-Related Phases in Alloys of Composition Ti4Al3Nb.
Final rept.
L. A. Bendersky, W. J. Boettinger, B. P. Burton, F. S. Biancaniello, and C. B. Shoemaker. 1990, 13p
Pub. in Acta Metallurgica et Materialia 38, n6 p931-943 Jun 90.

Keywords: *Titanium intermetallics, *Niobium intermetallics, *Crystal-phase transformations, Phase diagrams, Reprints, *Aluminum intermetallics.

In alloys of composition Ti4Al3Nb that are cooled from B2 phase field at 1400 or 1100 C, a metastable trigonal (P3m1) omega phase, designated omega double prime, was observed. The phase exhibits collapse of 111 planes and reordering relative to its B2 parent. An apparently equilibrium low temperature phase with the B8(2) structure was formed after 30 days of annealing at 700 C. Both the omega double prime and B8(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 path, B2 -> omega double prime -> B8(2), includes strongly coupled chemical and displacive order-disorder transitions. It 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.
Crystalline Aggregate with Icosahedral Symmetry, Implication for the Crystallography of Twinning and Grain Boundaries.
Final rept.
L. A. Bendersky, and J. W. Cahn. 1989, 18p
Pub. in Philosophical Magazine B 60, n6 p837-854 Dec 89.

Keywords: Aluminum manganese alloys, Iron alloys, Silicon alloys, Grain boundaries, Twinning, Reprints, *Quasicrystals, Icosahedral phase.

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,tau,O> axes, only five orientations occur among hundreds of crystals. This is a special orientation relationship, but there is neither a coincidence or twin lattice (S = Sigma = infinity). The concepts of twinning and special grain boundaries are reexamined, and a new definition of special orientations (Macles) based on the reduction of the number of arithmetically independent lattice vectors is proposed. It includes both old and new special orientations and can be easily interpreted in terms of quasilattices.

201,031

PB92-144260 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Anomalous Hydrogen Dynamics in Rare Earth Metals.
Final rept.
N. F. Berk, J. J. Rush, T. J. Udovic, and I. S. Anderson. 1991, 13p
Pub. in Jnl. of the Less-Common Metals 172-174, p496-508 1991.

Keywords: *Hydrogen, Yttrium hydrides, Scandium hydrides, Neutron scattering, Inelastic 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 a rich variety of phenomena of basic importance to the understanding of hydrogen in metals. In the paper the authors review their recent measurements of hydrogen vibrations in yttrium using inelastic neutron scattering and their very recent investigations of hydrogen local hopping in scandium and yttrium using quasielastic neutron scattering. Using simple models, the authors attempt to provide a straight-forward but fairly comprehensive picture of the way extended hydrogen short range order, observed directly in diffuse neutron scattering experiments, influences these measurements. The authors show, for example, how the vibrational peak splitting measured in alpha YH(x) can be interpreted in terms of temperature- and concentration-dependent effects of the chain-like pairing order. 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.
Flow Visualization Study of Supersonic Inert Gas Metal Atomization.
Final rept.
F. S. Biancaniello, S. D. Ridder, G. E. Mattingly, and P. I. Espina. 1989, 8p
Pub. in Materials Science and Engineering A 119, p161-168 Nov 89.

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, and metastable phases. The primary factor that determines these features is solidification rate, which, for powder processing, depends on the degree to which the metal droplets undercool prior to solidification (which is inversely related to particle size). Particle size, in turn, depends upon the process that produces these powders. One such process - Supersonic Inert Gas Metal Atomization - has been found to be particularly efficient in producing these powders for a wide range of alloys. For a selected atomizer configuration, the gas and metal flows have been studied to characterize the salient features so that design changes leading to increased process efficiency can be realized. Using flow visualization techniques, flow fields in gas and liquid streams have been studied. Emphasis has been placed on showing how aspiration conditions in the liquid delivery nozzle combine with the design of the inner bore of this same nozzle to promote liquid stream instability and, consequently, improve atomization efficiency.

201,033

PB92-144336 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Theory for the Trapping of Disorder and Solute in Intermetallic Phases by Rapid Solidification.
Final rept.
W. J. Boettinger, and M. J. Aziz. 1989, 13p
Pub. in Acta Metallurgica 37, n12 p3379-3391 1989.

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 during rapid crystal growth. The theory extends the solute trapping theory of Aziz to a solid phase consisting of two sublattices. The engulgment of atoms randomly on the two sublattices by the rapidly moving interface is balanced against the interdiffusion across the liquid-solid interface which attempts to restore local equilibrium. With increasing 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 decrease of order parameter with increasing interface velocity may be continuous or discontinuous and that transitions to solute trapping and to disorder trapping can occur at different growth rates.

201,034

PB92-144476 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Instability during Directional Solidification: Gravitational Effects.
Final rept.
S. R. Coriell, and G. B. McFadden. 1990, 16p
See also PB91-158550. Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Low-Gravity Fluid Dynamics and Transport Phenomena, p369-384 1990.

Keywords: *Binary alloys, Gravitational effects, Crystal growth, Lead alloys, Tin alloys, 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 solidified material. 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

PB92-153964 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.
Icosahedral Crystalline Aggregates in Al-(Fe,Mn)-Si Alloys.
Final rept.
L. A. Bendersky, J. W. Cahn, and D. Gratias. 1989, 19p
Pub. in Proceedings of International Conference on Quasicrystals (3rd), Mexico, May 29-June 2, 1989, p337-355.

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 five fold rotation about irrational (1, tau, 0) axes, only five orientations occur among hundreds of crystals. This is a special orientation relationship, but there is neither a coincidence or twin lattice (S = Sigma = infinity). The concept of twinning and special grain boundaries are reexamined, and a new definition of special orientations based on the reduction of the number of arithmetically independent lattice vectors is proposed. Approach of a facetting of an irrational planar slice of a 6D lattice and its projection onto real space is also discussed.

201,036
PB92-154327 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Tribochemical and Thermochemical Reactions of Stearic Acid on Copper Surfaces Studied by Infrared Microspectroscopy.
Final rept.
Z. S. Hu, S. M. Hsu, and P. S. Wang. 1992, 5p
Sponsored by Department of Energy, Washington, DC.
Pub. in Tribology Transactions 35, n1 p189-193 1992.

Keywords: *Copper, *Surface chemistry, *Tribology, *Stearic acid, *Thermochemistry, Wear resistance, Fourier transform spectrometers, Infrared spectroscopy, Chermisorption, Protective coatings, Films, Chemical reactions, Reprints.

The tribochemistry of copper with stearic acid was studied using a pin-on-disc wear tester under boundary lubrication conditions. Wear, as measured by surface profilometry, indicated that stearic acid was able to reduce the wear fourfold. Surface analysis by Fourier Transform Infrared (FTIR) microspectroscopy revealed that cupric stearate was formed during the rubbing process by tribochemical reactions. The reaction product was 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 140 C-160 C. The affinity between the chemisorbed stearic acid and dibentate copper stearate complex is believed to be responsible for the formation of a protective film on the copper surfaces to reduce the wear from further propagation.

201,037
PB92-159029 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.
Solidification and Phase Transformation in Liquid Quenched Al-Fe-Si Alloys.
Final rept.
L. Bendersky. 1990, 8p
Pub. in Proceedings of International Workshop on the Effect of Iron and Silicon in Aluminum and Its Alloys, Balatonfured, Hungary, May 1989, p127-134 1990.

Keywords: *Aluminum alloys, Silicon containing alloys, Iron alloys, Transmission electron microscopy, Phase transformations, Metastable state, Amorphous state, Microstructure, Annealing, Reprints, Rapid quenching(Metallurgy).

Al-based Al-Fe-Si alloys (with addition to some transition metals) when rapidly solidified and consolidated show a microstructure of fine, slow coarsening dispersoids, with properties very suitable for high temperature application. The focus of the work is a TEM study of the rapidly solidified microstructure of these alloys, as well as the microstructural evolution during subsequent annealing. The main feature of the rapidly solidified microstructure is the presence of an isotropic 'amorphous' type phase. Depending on the concentration of iron and silicon the phase appears either as an intercellular constituent or as a primary phase with globular morphology. The globular morphology of the 'amorphous' phase suggests the possibility of a metastable liquid miscibility gap, however, there is no thermodynamic evidence to support this. Another possibility suggests crystallization of the phase, which is structurally different from liquid, but at the same time being neither crystalline nor quasi-crystalline.

201,038
PB92-159037 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Investigation of B2 and Related Phases in the Ti-Al-Nb Ternary System.
Final rept.
L. A. Bendersky, and W. J. Boettinger. 1989, 6p
See also AD-A186 367.
Pub. in Materials Research Society Symposium Proceedings High-Temperature Ordered Intermetallic Alloys III, p45-50 1989.

Keywords: *Titanium intermetallics, Aluminum intermetallics, Niobium intermetallics, Ternary compounds, BCC lattices, Aluminides, Reprints, Phase equilibrium, Omega phase.

Alloy compositions near Ti2AlNb were studied to establish phase equilibria and transformations during cooling from 1100 and 1400 C. In addition to general results obtained on a wide range of compositions which include evidence for a broad B2 phase field, transformation of bcc Ti4Al3Nb to a single phase with an omega-type structure is reported. Detailed analysis indicates that this phase has the B8(2) structure.

201,039
PB92-165067 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.
Omega-Related Phases in a Ti-Al-Nb Alloy.
Final rept.
L. A. Bendersky, and W. J. Boettinger. 1989, 2p
Contract DARPA-6065
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Proceedings of Annual Meeting of the Electron Microscopy Society of America (47th), San Antonio, TX., August 1989, p324-325.

Keywords: Transmission electron microscopy, Aluminum containing alloys, Niobium containing alloys, Reprints, *Titanium alloy 37.5Al 12.5Nb, Omega phase, Phase equilibrium.

Study of phase equilibria in the Ti-Al-Nb system is often complicated by the possibility of rapid ordering reactions of a chemical or displacive type during cooling from high temperatures. In the present study we have investigated the decomposition of the high temperature B2 phase of composition Ti-37.5at%Al-12.5at%Nb into 'omega-type' phases during either cooling or low temperature annealing.

201,040
PB92-165570 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Measurement and Analysis of Grain Boundary Grooving by Volume Diffusion.
Final rept.
S. C. Hardy, G. B. McFadden, S. R. Coriell, P. W. Voorhees, and R. F. Sekerka. 1991, 14p
Pub. in Jnl. of Crystal Growth 114, p467-480 1991.

Keywords: *Grain boundaries, *Tin, Tin alloys, Lead alloys, Boundary integral method, Grooving, Bicrystals, Diffusion coefficient, Reprints.

Experimental measurements of isothermal grain boundary grooving 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 a temporal exponent of 1/3, and measurement of the associated rate constant allows the determination of the product of the liquid diffusion coefficient D and the capillarity length Gamma associated with the interfacial free energy of the crystal-melt interface. We generalize the small-slope theory of Mullins to the entire range of dihedral angles by using a boundary integral formulation of the associated free boundary problem, and obtain excellent agreement with experimental groove shapes. By using the diffusivity measured by Jordon and Hunt, we deduce that our measured values of Gamma agree to within 5% with the values obtained from experiments by Gunduz and Hunt on grain boundary grooving in a temperature gradient.

201,041
PB92-165992 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Microbial Metabolites as Agents for Reduction of Metal Compounds to Pure Metals.
Final rept.
G. J. Olson, F. E. Brinckman, K. L. Jewett, and J. S. Thayer. 1989, 6p
Pub. in Biotechnology in Minerals and Metal Processing, Chapter 6, p39-44 1989.

Keywords: *Metals, *Materials recovery, *Biological treatment, *Bioconversion, Separation processes, Ore processing, Biotechnology, Gold, Platinum, Palladium, Microorganisms, Purification, Dissolution, Precipitation(Chemistry), Metal compounds, Catalysis, Reprints.

Interest and research in biorecovery of metals has focused mainly on cell-based metal leaching and precipitation. However, production of non-enzymatic metabolic products by microorganisms related to metals bioprocessing also deserves attention. For example, it is well known that biogenic inorganic (e.g. H2SO4) and organic acids play a role in metal dissolution. There are other metabolic products of microorganisms which can catalyze useful metals transformations. These include methylated metabolites such as alkyl halides which can dissolve metals from ores and also reduce certain metal ions in solution to pure metallic particles. The paper describes some of the authors' research on metal dissolution and precipitation by such metabolites. Examples include the production of high purity elemental metal particles of gold, platinum and palladium by volatile metabolic products.

201,042
PB92-166123 Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Development of an SMA Electrode to Match Type 316LN Base Metal Cryogenic Properties.
Final rept.
T. A. Siewert, and C. N. McCowan. 1991, 5p
Sponsored by Princeton Univ., NJ. Plasma Physics Lab.
Pub. in Cryogenics 31, p775-779 Sep 91.

Keywords: *Electrodes, *Cryogenics, *Welded joints, *Mechanical properties, *Manganese alloys, Additives, Nickel additions, Nitrogen additions, Molybdenum additions, Strength, Reprints, *Shielded metal arc electrodes.

A series of shielded metal arc electrodes was fabricated and the mechanical properties of the resultant welds were measured. The compositions are based on a high Mn, high N version of a type 308 electrode, to which additional Mn, N, Ni and Mo were added. The strength was measured at 4, 76 and 298 K, and the Charpy V-notch absorbed energy was measured at 76 K. The strength of the welds matched or exceeded that strength of the base metal, but fell short of the Charpy V-notch absorbed energy.

201,043
PB92-171222 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Natural Aging and Reversion Behavior of Al-Cu-Li-Ag-Mg Alloy Weldalite 049.
Final rept.
F. W. Gayle, F. H. Heubaum, and J. R. Pickens. 1989, 10p
See also N91-24405.
Pub. in Aluminum - Lithium Alloys, p701-710 Mar 89.

Keywords: *Aging(Metallurgy), *Aluminum alloys, *Copper alloys, *Lithium alloys, Precipitation hardening, Microstructure, Precipitation hardening alloys, Mechanical properties, Room temperature, Tempering, Reprints.

The Al-Cu-Li-Ag-Mg alloy known as Weldalite 049 exhibits a strong aging response at room temperature, both with (T3) and without (T4) prior cold work. Reversion for short periods at 180 C results in a strength decrease. With room temperature re-aging, the strength returns to the T4 level after an extended incubation period. This behavior has been characterized through mechanical property measurements and TEM analysis of microstructures. The high strength in the T4 and re-aged tempers is shown to arise from a combination of Guinier-Preston zones and Al3Li(delta'), each of which may assume several different morphologies in a single microstructure.

201,044
PB92-171230 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Structure and Properties during Aging of an Ultra-High Strength Al-Cu-Li-Ag-Mg Alloy.
Final rept.
F. W. Gayle, F. H. Heubaum, and J. R. Pickens. 1990, 6p
See also N91-24406.
Pub. in Scripta Metallurgica et Materialia 24, n1 p79-84 Jan 90.

Keywords: *High strength alloys, *Aluminum alloys, *Aging(Metallurgy), Copper alloys, Lithium alloys, Magnesium alloys, Silver alloys, Mechanical properties, Microstructure, Reprints, *Weldalite 049.

An Al-Cu-Li-Mg-Ag alloy Weldalite (TM)049 was recently introduced as an ultra-high strength alloy (700 MPa yield strength in artificially aged tempers) with good weldability. In addition the alloy exhibits an extraordinary natural aging response, 440 MPa yield strength (YS) in the unstretched (T4) condition, and a high ductility reversion condition which may be useful as a cold-forming temper. In contrast to other Al-Li alloys, these properties can essentially be obtained with or without a stretch or other coldworking operation prior to aging. The present study has identified strengthening phases responsible for the alloy's mechanical properties. The natural aging response is due to precipitation of GP zones and Al3Li, or delta'. Reversion coarsens the zones and dissolves the delta'. Extended re-aging at room temperature, however, re-precipitates both phases on a fine scale and restores the original T4 hardness. There are several strengthening phases in the peak strength condition, including S', theta', and T1. In addition there is evidence of a fourth, previously unidentified precipitate.

201,045
PB92-171511 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Thermophysics Div.
Measurement of the Heat of Fusion of Titanium and a Titanium Alloy (90Ti-6Al-4V) by a Microsecond-Resolution Transient Technique.
Final rept.
J. L. McClure, and A. Cezairliyan. 1992, 7p
See also PB90-271537. Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in International Jnl. of Thermophysics 13, n1 p75-81 Jan 92.

Keywords: *Heat of fusion, *Titanium, High temperature, Pulse heating, Melting, Transients, Reprints, *Titanium alloy 6Al 4V.

A microsecond-resolution pulse heating technique was used for the measurement of the heat of fusion of titanium and a titanium alloy (90Ti-6Al-4V). The method is based on rapid (50- to 100-microsec) resistive self-heating of the specimen by a high-current pulse from a capacitor discharge system and measuring, as functions of time, current through the specimen, 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 melting yields the heat of fusion. The values obtained for heat of fusion were 272 J/g (13.0 kJ/mol) for titanium and 286 J/g for the alloy 90Ti-6Al-4V, with an estimated maximum uncertainty of + or - 6% in each value.

201,046
PB92-172477 PC **A04**/MF **A01**
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Aluminum-Lithium Alloys: Surface-Cracked Tension Fracture Tests and Physical and Thermal Properties at Cryogenic Temperatures.
P. T. Purtscher, M. Austin, S. Kim, and D. Rule. Mar 92, 72p NISTIR-3986
See also AD-A229 231. Sponsored by Astronautics Lab. (AFSC), Edwards AFB, CA.

Keywords: *Aluminum alloys, *Lithium Alloys, *Fracture properties, *Very low temperature, Elastic properties, High strength alloys, Thermal conductivity, Thermal expansion, Mechanical properties, Toughness, Thermodynamic properties.

Surface-cracked tension fracture tests were conducted in the T-S orientation at 295, 76, and 4 K on two plate alloys (X2095-T851, plate thickness of 12.7 mm and 2090-T81, 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 significantly lower tensile properties near the surface of rolled plate than in the center of the plate. The physical properties of seven plate specimens were measured from liquid helium to room temperature. Three variations in chemical composition of alloy X2095, three different samples of alloy 2090, and a single sample of alloy 2219-T87 were included. Thermal expansion between 4 and 320 K was measured on the same seven plate specimens included in the physical properties study. The thermal conductivity of alloy X2095 (4%Cu-1%Li) was determined over the temperature range 4.2 to 300 K using a steady-state apparatus.

201,047
PB92-172766 PC **A99**/MF **E08**
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Properties of Copper and Copper Alloys at Cryogenic Temperatures.
Final rept.
N. J. Simon, E. S. Drexler, and R. P. Reed. Feb 92, 855p NIST/MONO-177
Also available from Supt. of Docs. as SN003-003-03140-2. Sponsored by International Copper Association, Ltd., New York.

Keywords: *Copper, *Copper alloys, *Mechanical properties, *Physical properties, Nuclear fusion, Cryogenic temperature, Metallurgy, Superconducting magnetics, Magnetic energy storage, Thermal properties.

The mechanical and physical properties at cryogenic temperatures for selected coppers and copper alloys have been compiled, reviewed, and analyzed. Tables, figures, and regression equations are included. The materials are: the oxygen-free coppers (C10100-C10700), beryllium coppers (C17000-C17510), and the phosphor bronzes (C50500-C52400). The temperature range for the property data is from 4 to 295 K. Mechanical properties include tensile, toughness, fatigue, and creep; physical properties include elastic constants, specific heat, thermal conductivity and expansion, and electrical resistivity. In many cases, these properties are a strong function of metallurgical variables, such as cold work and grain size. Regression analyses have been performed in cases where there are sufficient data to ensure reasonable statistical portrayal of the effect of these variables on specific properties. The original program of data review was sponsored by the Office of Fusion Energy of the U.S. Department of Energy. Its purpose was to assemble and to evaluate property data useful to magnet designers for fusion plasma confinement. Both normal-metal, high-field magnets (using cold-worked C10700 and C17510 alloys) and NbTi and Nb3Sn superconducting magnets (using C10400 and copper-tin or phosphor bronze alloys) are currently in design or development stages. The review has been re-edited and expanded for those more generally interested in the low-temperature properties of copper and selected copper alloys, under the sponsorship of the International Copper Association, Ltd.

201,048
PB92-175728 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Effect of Layer Spacing on Wear of Ni/Cu Multilayer Alloys.
Final rept.
A. W. Ruff, and D. S. Lashmore. 1991, 9p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Wear 151, p245-253 1991.

Keywords: *Wear, *Nickel alloys, *Copper alloys, Electrodeposition, Coatings, Wear inhibitors, Friction, Wear tests, Abrasion, Hardness tests, Reprints.

Alloys consisting of multiple alternate layers of nickel and copper have been prepared by electrodeposition and studied in sliding wear. Most recently a multilayer alloy with a layer spacing of 3.8 nm was studied, to complement earlier studies of multilayer alloys with layer spacings of 10 and 100 nm. In order to determine wear characteristics, the alloys were tested in unlubricated sliding against type 52100 steel in a crossed-cylinder geometry at various loads. It was found that the most wear-resistant alloy was the one having the smallest layer spacing, 3.8 nm. Further, all the multilayer alloys showed less wear than either copper or nickel deposited from the same solution and tested under the same conditions. The multilayer structure in these alloys is thought to provide internal barriers to wear which occurred by plastic deformation processes. The data suggest that the individual layer spacing determines the level of stress necessary to initiate severe wear.

201,049
PB92-236298 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.
Phase Transformation during Annealing of Rapidly Solidified Al-Rich Al-Fe-Si Alloys.
Final rept.
L. A. Bendersky, A. J. McAlister, and F. S. Biancaniello. 1988, 8p
Pub. in Metallurgical Transactions 19A, n12 p2893-2900 Dec 88.

Keywords: *Phase transformations, *Annealing, *Aluminum alloys, *Solidification, Transmission electron microscopy, Microstructure, Crystallography, Phase equilibrium, Electron diffraction, Differential thermal analysis, Reprints, *Aluminum iron silicides.

Thermal decomposition of rapidly solidified microstructure of three Al-Fe-Si alloys (Al-10, 12, 14Fe-2Si wt%) has been studied by DTA and TEM. The results are the following: amorphous phase formed by solidification first transforms to metastable alpha cubic phase (Im3, a = 1.25 nm). At higher temperature the alpha phase transforms by ordering to trigonal phase (two modifications, alpha prime, and alpha double prime, were found). Crystallography of the alpha prime and alpha double prime phases is analyzed using convergent electron beam diffraction technique. At higher temperature 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 Contributions of Field Electron Emission Microscopy.
Final rept.
A. Ciszewski, and A. J. Melmed. 1989, 38p
Pub. in Progress in Surface Science 32, n2 p173-210 1989.

Keywords: *Surface chemistry, *Metals, *Epitaxy, *Crystal growth, Electron microscopy, Electron emission, Crystallography, Nucleation, Substrates, Reprints.

The contributions to the literature on the epitaxial growth of metals on metal substrates made by research 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 of 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.
Final rept.
S. R. Coriell, and G. B. McFadden. 1989, 9p
See also PB91-158550.
Pub. in Jnl. of Crystal Growth 94, n2 p513-521 1989.

Keywords: *Buoyancy, *Stability, *Binary alloys, *Directional solidification(Crystals), Liquid metals, Liquid-solid interfaces, Convection, Linear systems, Morphology, Thermal conductivity, Reprints.

The onset of morphological instability during the directional 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 heavier solute is rejected at the solidifying interface, and study the effect of convection on the critical concentration for the onset of instability. For tin containing lead 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 as the variation of density with solute concentration is reduced, and in the limit of neutrally-dense solute, there is a long wavelength instability for which the critical solute concentration is several orders of magnitude lower than that predicted by the Mullins and Sekerka analysis in the absence of convection. For the neutrally-dense solute, a simplified analysis indicated the roles played by the temperature, solute, and flow fields in promoting the instability. In particular, the destabilization is very sensitive to the ratio of crystal and melt thermal conductivities.

201,052
PB92-236546 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.

Effect of an Electric Field on the Morphological Stability of the Crystal-Melt Interface of a Binary Alloy. 2. Joule Heating and Thermoelectric Effects.
Final rept.
S. R. Coriell, G. B. McFadden, A. A. Wheeler, and D. T. J. Hurle. 1989, 3p
See also Part 1, PB90-193541 and Part 3, PB91-195743.
Pub. in Jnl. of Crystal Growth 94, n2 p334-346 1989.

Keywords: *Binary alloys, *Interfaces, *Electric fields, Electromigration, Electroresistivity, Thermoelectricity, Solidification, Morphology, Gallium alloys, Tin alloys, Bismuth alloys, Reprints.

We performed a fully 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 latter two 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 Peltier 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
PB92-236942 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Al-Nb (Aluminum-Niobium).
Final rept.
U. R. Kattner. 1990, 3p
Pub. in Binary Alloy Phase Diagrams, v1 p179-181 1990.

Keywords: *Binary alloy systems, *Phase diagrams, Aluminum alloys, Reprints, Aluminum niobium.

The binary Nb-Al system has been evaluated.

201,054
PB92-236959 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Al-Ta (Aluminum-Tantalum).
Final rept.
U. R. Kattner. 1990, 3p
Pub. in Binary Alloy Phase Diagrams, v1 p218-220 1990.

Keywords: *Binary alloy systems, *Phase diagrams, Aluminum alloys, Reprints, Aluminum tantalum.

The binary Ta-Al system has been evaluated.

201,055
PB92-236967 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Ga-Te (Gallium-Tellurium).
Final rept.
U. R. Kattner. 1990, 2p
Pub. in Binary Alloy Phase Diagrams, v2 p1864-1865 1990.

Keywords: *Binary alloy systems, *Phase diagrams, Gallium tellurides, Gallium alloys, Reprints.

The binary Ga-Te system has been evaluated.

201,056
PB92-237114 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Electrodeposited Metallic Superlattices.
Final rept.
D. S. Lashmore, R. R. Oberle, M. Dariel, L. H. Bennett, and L. J. Swartzendruber. 1989, 6p
Pub. in Mater. Res. Soc. Symp. Proc. Multicompon. Ultrafine Microstruct., v132 p219-224 1989.

Keywords: *Electrodeposited coatings, *Electrodeposition, *Superlattices, Copper alloys, Nickel alloys, Metal films, Thin films, Magnetic properties, Reprints.

Electrochemical deposition of artificial compositionally modulated superlattices is described. It is shown that the quality of these alloys is comparable or superior to materials produced by vapor deposition or sputtering. The ambient temperature process described by Yahalom (U.S. Pat. 4,653,348 (1987)) has been 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 nm and suggests that magnetic properties of thin nickel layers are comparable with bulk nickel. Alloys of other types whose properties can be tailored on a near atomic scale will also be discussed along with potential applications.

201,057
PB92-237288 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Bioaccumulation of Metals from Solution: New Technology for Recovery, Recycling and Processing.
Final rept.
G. J. Olson, F. E. Brinckman, T. K. Trout, and D. Johnsonbaugh. 1988, 11p
Pub. in Proceedings of International Symposium on Metallurgical Processes for the Year 2000 and Beyond, Las Vegas, NV., February 27-March 3, 1989, p427-437.

Keywords: *Biotechnology, *Metals, *Materials recovery, *Microorganisms, *Biological treatment, Bioaccumulation, Leaching, Waste recycling, Ore processing, Oxidation, Yttrium, Gallium, Extractive metallurgy, Reprints.

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 metal products in specified forms and oxidation states. 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 grade. 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
PB92-237312 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Evidence for Film-Induced Cleavage in Rhodium Plated Nickel.
Final rept.
R. E. Ricker, J. L. Fink, J. S. Harris, and A. J. Shapiro. 1992, 5p
Pub. in Scripta Metallurgica et Materialia 26, p1019-1023 1992.

Keywords: *Crack propagation, *Rhodium, *Nickel, *Transgranular corrosion, Fracturing, Cracking(Fracturing), Cleavage, Dissolving, Crystallography, Stress corrosion, Reprints, *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 cleavage because: propagation occurs on flat crystallographic facets, steps or ledges exist between the flat facets forming river patterns, these facets and ledges match precisely 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 two groups based on whether they assume that dissolution or mechanical fracture is responsible for crack growth.

201,059
PB92-237445 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Examination of the Influence of Lithium on the Repassivation Rate of Aluminum Alloys.
Final rept.
M. R. Stoudt, A. K. Vasudevan, and R. E. Ricker. 1992, 18p
Pub. in New Methods for Corrosion Testing of Aluminum Alloy, ASTM STP 1134, p196-213 1992.

Keywords: *Aluminum alloys, *Corrosion testing, *Passivity, *Lithium, Corrosion resistance, Stress corrosion, Cracking(Fracturing), Test methods, Stress corrosion resistance, Corrosion mechanisms, Reprints.

The influence of lithium on the rate of repassivation of aluminum alloys was studied by conducting scratch-repassivation experiments on samples with differing lithium and copper contents and with differing heat treatments in a buffer solution containing either 0.5M sodium sulfate or 0.5M sodium chloride. The 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 generate the bare surface at a constant rate. A constant bare surface generation rate allowed for determination of the bare surface current density from the slope of the rise transient rather than from the maximum current observed as done by previous investigators. The bare surface current density determined in this manner was always greater than that calculated from the maximum current. Lithium in solid solution was found to slightly increase the bare surface current density but it did not significantly alter the rate of repassivation over the range of lithium concentrations studied. The precipitation of lithium phases altered the repassivation of behavior but the nature of the observed changes depended on the type of precipitate.

201,060
PB92-237460 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Manufacturing Engineering.
Technology and Workforce of Manufacturing and the Metals Industry in Post-Industrial America.
Final rept.
D. A. Swyt. 1989, 6p
Pub. in Proceedings of International Symposium (21st) Applications of Computers and Operations Research in the Mineral Industry, Littleton, CO., February 27-March 2, 1989, p3-8.

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-professionalization of U.S. manufacturing sectors, the paper looks briefly at the workforce of the U.S. metals industry.

201,061
PB93-114155 PC **A04**/MF **A01**
National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Applied and Computational Mathematics Div.
Phase-Field Model of Solute Trapping during Solidification.
A. A. Wheeler, W. J. Boettinger, and G. B. McFadden. Sep 92, 55p NISTIR-4922

Keywords: *Binary alloys, *Solidification, Mathematical models, Liquid-solid interfaces, Surface tension, Asymptotic methods, Copper nickel alloys, *Solute trapping, Directional solidification, Aziz 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 steady-state solutions exhibit a reduction in 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 situations are commonly observed experimentally.

201,062
PB93-125284 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Ultrasonic Relaxation of Interstitial Aluminum in Irradiated Silicon.
Final rept.
W. L. Johnson, and A. V. Granato. 1991, 6p
Contract DE-AC02-76ER01198
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review B 43, n12 p9728-9733, 15 Apr 91.

Keywords: *Aluminum, *Silicon, *Spin lattice relaxation, *Electron irradiation, Ultrasonic agitation, Interstitials, Molecular relaxation, Attenuation, Crystal defects, Point defects, Ultrasonic radiation, Reprints.

An ultrasonic relaxation arising from a nonequilibrium charge state of interstitial aluminum is observed in aluminum-doped silicon irradiated with electrons at 10 K. This relaxation is present in the C' shear mode while the sample is exposed to white light, electron irradiation, or gamma rays. The thermally activated reorientation rate of the defect is 7.7 x 10(sup 10)exp((-5.1 meV)/kT)/sec. Based on the mode dependence of the relaxation, a defect model is suggested which follows naturally from the known structure of lower charge states of interstitial aluminum. This model has the defect electrically neutral, with the aluminum atom on the site which is tetrahedral in the perfect lattice and with the surrounding silicon atoms displaced into a tetragonal configuration.

201,063
PB93-125474 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Reflection X-ray Absorption Fine Structure Study of the Passive Films on Cast and Rapidly-Solidified Mg Alloys.
Final rept.
G. G. Long, J. Kruger, D. K. Tanaka, and Z. Zhang. 1992, 8p
Pub. in Proceedings of Symposium on X-Ray Methods in Corrosion and Interfacial Electrochemistry p298-305 1992.

Keywords: *Magnesium alloys, *Thin films, Magnesium oxides, Magnesium hydroxides, Surface properties, X ray analysis, Reflectivity, Reprints.

Passive films on cast and rapidly-solidified Mg alloys were studied using a surface reflectivity technique that enabled the determination of the structure of the thin oxide films on Mg and Mg alloys in the neighborhood of the oxygen atoms. The surface films appeared to contain both MgO-like and Mg(OH)2-like structure, with one or the other predominating, depending on the alloy.

201,064
PB93-129427 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Materials Reliability Div.
Tensile, Fracture, and Fatigue Properties of Notched Aluminum Alloy Sheets at Liquid Nitrogen Temperatures.
Final rept.
R. L. Tobler, J. K. Han, L. Ma, R. P. Walsh, and R. P. Reed. 1990, 10p
Sponsored by Universities Research Association, Berkeley, CA. Superconducting Super Collider Central Design Group.
Pub. in Proceedings of Conference on Aluminum Alloys-5, Williamsburg, VA., March 27-31, 1989, p1115-1124 Mar 90.

Keywords: *Aluminum alloys, *Low temperature tests, *Mechanical properties, Tensile properties, Fracture properties, Fatigue notch factor, Cryogenics, Liquid nitrogen, Notch tests, Metal sheets, Superconducting, Reprints.

Notched sheet specimens of four high strength aluminum alloys were tested to evaluate their potential for a Superconducting Super Collider application. Alloys 7075-T6, 7475-T761, 2219-T87, and 2090-T8E41 were tested in liquid nitrogen at 76 K, in tension-tension fatigue, at a stress ratio of 0.1. The alloys are compared in terms of their static tensile and fracture properties, and fatigue resistance for a life of 40,000 cycles.

Plastics

201,065
PB92-181080 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD.
Studies on the Melt Flow Rate of the SRM 1473: A Low Density Polyethylene Resin.
J. R. Maurey, and C. M. Guttman. Apr 92, 20p
NISTIR-4627
See also PB90-207275.

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, 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 on samples with a standard deviation of a single measurement of 0.020 g/10 min. A small but measurable drift from the first timed extrudate to the third timed extrudate was observed.

201,066
PB92-209519 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Thermal and Mechanical Properties of Polyurethane Foams at Cryogenic Temperatures. Annual Report, January-December 1981.
L. L. Sparks. Jan 82, 58p GRI-81/0043
Contract GRI-5081-352-0425
See also PB85-187367 and PB87-197950. Sponsored by Gas Research Inst., Chicago, IL.

Keywords: *Polyurethane resins, *Foam, *Thermal properties, *Mechanical properties, *Insulation, Low temperature tests, Liquefied natural gas, Cryogenics, LNG plants, Compression strength, Thermal conductivity, Thermal expansion, Measuring instruments.

Expanded plastics, foams, are used extensively to provide thermal insulation for liquefied fuel facilities. Analytical models of the low-temperature thermal and mechanical properties of these materials are needed. The foam system being studied is rigid, closed cell polyurethane and the temperature range of interest is 76 to 320 K. Specific properties reported are: thermal conductivity (32 kg/cu m, CCl3F), tensile and compressive Young's moduli, proportional limit, yield strength, ultimate strength, and shear strength for compression and tension (32 and 64 kg/cu m, parallel and perpendicular to cell rise direction). Characterization of the specimens is critical to the modeling effort; the optical characterization of the 32 and 64 kg/cu m materials is discussed. An apparatus used to determine expansion characteristics of anisotropic materials is being developed; the system is described.

201,067
PB92-236389 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Design of a Velocity Sensor for Polymer Processing Based on Fluorescence Photobleaching.
Final rept.
A. J. Bur. 1989, 3p
Pub. in Proceedings of Annual Technical Conference of Society of Plastics Engineers (47th), New York, NY., May 1-4, 1989, p1086-1088.

Keywords: *Sensors, *Velocity measurement, *Plastics processing, Fiber optics, Polymers, Slip flow, Laminar flow, Size determination, Slip velocity, Reprints, *Fluorescence photobleaching.

A sensor has been designed for the purpose of measuring 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 flush with the inside wall. 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 development, the probed sample volume is assumed to be a cone at the end of the fiber, its size 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 chromophore which is photobleachable, that laminar flow near the wall can be described by a linear velocity gradient, and that diffusion of the chromophore can be neglected during the time of the measurement. The model calculation shows that wall slip is easily distinguished from laminar flow and that, for laminar flow, both velocity and velocity gradient can be determined.

201,068
PB92-236454 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Thermophysics Div.
Crystallization and Fibril Formation in Polymers.
Final rept.
E. J. Clark, and J. D. Hoffman. 1990, 13p
Pub. in International Jnl. of Thermophysics 11, n1 p225-237 1990.

Keywords: *Polymers, *Crystallization, Fibers, Polyethylene fibers, Crystals, Solidification, Polyethylene, Crystal growth, Strains, Crystallography, Reprints, *Fibrils.

Solutions of crystallizable polymers subjected to orientation crystallize in a fibrillar morphology if the polymer is solidified rapidly. The central core of the polymer fibers consists of thin, extended chain crystallites interspersed with disordered regions. The extended chain crystals are small fibrils having diameters generally less than a few hundred Angstroms, while the lengths 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. Hoffman's theory 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 slides 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.

201,069
PB92-236462 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Rheological Properties of Atactic Polystyrene/Carbon Disulfide Gels.
Final rept.
J. C. Clark, W. G. Miller, and S. T. Wellinghoff. 1988, 3p
Pub. in Polymer Communications 29, n8 p220-222 Aug 88.

Keywords: *Rheology, *Gels, *Aging tests(Materials), *Polystyrene, Experimental designs, Carbon disulfide, Molecular weight, Agglomeration, Degradation, Isothermal treatment, Reprints.

Isothermal aging experiments were performed on semidilute 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 from fluid behavior to a rubbery network over the course of several hours. Slow aggregation appears to be responsible for the eventual network formation. High molecular weight solutions and highly concentrated solutions aged more slowly than did low molecular weight or low concentration solutions. Steady shearing of solutions degraded the network. After the cessation of steady shear, the network gradually reformed. The reformation process was much faster than the original formation process, leading to the conclusion that connectivity was destroyed during the shearing process while aggregate structures, responsible for the physical crosslinking, were not.

201,070
PB92-236561 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.

Effect of Processing on Uniaxial Creep Behavior and Environmental Stress Crack Resistance of a Linear Low Density Polyethylene.
Final rept.
J. M. Crissman. 1989, 6p
Pub. in Polymer Engineering and Science 29, n22 p1598-1603 Nov 89.

Keywords: *Polyethylene, *Creep properties, *Stress corrosion cracking, Joints(Junctions), Injection molding, Polymers, Mechanical properties, Crack propagation, Polyether resins, Flow velocity, Reprints.

The paper describes characterizations performed on two types of polyethylene T-joints as well 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 joints. 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.
Final rept.
J. M. Crissman, and L. J. Zapas. 1989, 6p
Pub. in Polymer 30, n3 p447-452 1989.

Keywords: *Polymers, *Nonlinear systems, *Stress relaxation, Creep properties, Plastic flow, Strains, Shear properties, Approximation, Stress analysis, Reprints.

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 observed behavior at the early times. In 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, Kearsley, 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 polythylene copolymer under conditions of a varied step time, 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.
Final rept.
E. J. Dormier, J. M. Brady, W. H. Chang, S. D. Schregenberger, and J. D. Barnes. 1989, 6p
Pub. in Proceedings of Annual Technical Conference of SPE (47th), New York, NY., May 1-4, 1989, p696-701.

Keywords: *Thin films, *Polyethylene, *Tear strength, Mechanical properties, Molecular weight, Reprints, *Blown films.

The paper investigates the relationships among properties, fabrication conditions, and morphology for blown films from high-molecular weight polyethylenes with broad or bimodal molecular weight distributions. A high stalk 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
PB93-135366 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Relationships between Failure and Other Time Dependent Processes in Polymeric Materials.
Final rept.
G. B. McKenna, J. M. Crissman, and A. Lee. 1988, 2p
Pub. in Polymer Preprints, v29 n2 p128-129 1988.

Keywords: *Polymers, *Glass, *Viscoelasticity, *Failure, *Time dependence, *PMMA, Creep properties, Epoxy, Loads(Forces), Mechanical properties, Aging, Fracture strength, Reprints.

We outline results obtained in this laboratory showing correlations and relationships which we have observed between the failure behavior of polymeric glasses and other time dependent processes in these materials such as physical aging and non-linear viscoelasticity. We review early work in which cumulative damage rules were used to describe fatigue failure behavior in PMMA. This is followed by consideration of the relationship between the creep behavior of PMMA and its failure under constant loading conditions. Finally we show how physical aging impacts the creep and failure of a PMMA glass and the fracture toughness of a network glass.

201,074
PB93-135382 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Measurements of the Recoverable Compliance of Ring-Like Polystyrenes.
Final rept.
G. B. McKenna, and D. J. Plazek. 1989, 2p
Pub. in Polymer Preprints, v30 n1 p75-76 1989.

Keywords: *Polystyrene, *Viscoelasticity, *Rheological properties, Polymers, Viscosity, Styrene copolymers, Viscoelastic theory, Molecular structure, Reprints, *Recoverable compliance.

In past work we have reported on the zero shear viscosity of narrow fractions of polystyrene ring molecules and 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 cyclic polystyrene which show that the cycles behave much as do their linear counterparts except that both the plateau compliance and the steady state recoverable compliance are twice what they are for their linear counterparts of the same molecular weight. This appears to be true over the entire range of molecular weights for which we have made measurements.

Refractory Metals & Alloys

201,075
PB92-159763 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Thermophysics Div.
Interferometric Technique for the Subsecond Measurement of Thermal Expansion at High Temperatures: Applications to Refractory Metals.
Final rept.
A. P. Miiller, and A. Cezairliyan. 1991, 14p
Pub. in International Jnl. of Thermophysics 12, n4 p643-656 Jul 91.

Keywords: *Refractory metals, *Thermal expansion, *Interferometry, Phase transformations, Helium neon lasers, Michelson interferometers, High temperature, Pulse heating, Molybdenum, Niobium, Tantalum, Tungsten, Iron, Reprints.

A high-speed interferometric technique has been developed at the National Institute of Standards and Technology to measure thermal expansion of metals between room temperature and temperatures primarily in the range 1500 K to near their melting points. The basic method involves resistively heating the specimen from room temperature up to and through the temperature range of interest in less than 1 s by passing an electrical current pulse through it and simultaneously measuring, with submillisecond resolution, the specimen temperature by means of a high-speed photoelectric pyrometer and the shift in the fringe pattern produced by a Michelson-type interferometer. The technique is capable of measuring linear thermal expansion with a maximum estimated uncertainty which ranges from about 1% at 2000 K to approximately 2% at 3600 K. Measurements have been performed on the refractory metals, niobium, molybdenum, tantalum, and tungsten, yielding thermal expansion data in the temperature range 1500 K up to near their respective melting points. Also, the technique has been used to follow the rapid dimensional changes that occur during solid-solid phase transformations; in particular, the alpha -> gamma transformation in iron has been studied.

Wood & Paper Products

201,076
PB92-236926 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Fire Science and Engineering Div.
Global Kinetic Constants for Thermal Oxidative Degradation of a Cellulosic Paper.
Final rept.
T. Kashiwagi, and H. Nambu. 1992, 24p
Sponsored by National Aeronautics and Space Administration, Washington, DC. Microgravity Science and Applications Div.
Pub. in Combustion and Flame 88, p345-368 1992.

Keywords: *Thermodynamic properties, *Pyrolysis, *Oxidation, *Papers, Cellulosic resins, Degradation, Thermogravimetry, Combustion products, Carbon dioxide, Hydrocarbons, Gravimetric analysis, Combustion, Burning rate, Calorific value, Reprints, *Thermal oxidative degradation.

Values of global kinetic constants for pyrolysis, thermal oxidative degradation, and char oxidation of a cellulosic paper were determined by a derivative thermal gravimetric study. The study was conducted at heating rates of 0.5, 1, 1.5, 3, and 5 C/min in ambient atmospheres of nitrogen, 0.28%, 1.08%, 5.2% oxygen concentrations, and air. Sample weight loss rate, concentrations of CO, CO2, H2O in the degradation products, and oxygen consumption were continuously measured during the experiment. Values of activation energy, pre-exponential factor, orders of reaction, and yields of CO, CO2, H2O, total hydrocarbons, and char for each degradation reaction were derived from the results. Heat of reaction for each reaction was determined by differential scanning calorimetry. A comparison of the calculated CO, CO2, H2O, total hydrocarbons, sample weight loss rate, and oxygen consumption was made with the measured results using the derived kinetic constants and accuracy of the values of kinetic constants was discussed.

General

201,077
PB92-144773 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Strain Invariants Expressed as Average Stretches.
Final rept.
E. A. Kearsley. 1989, 4p
Pub. in Jnl. of Rheology 33, n5 p757-760 1989.

Keywords: Stretching, Tetrahedrons, Reprints, *Strain invariants, Deformation invariants.

The first strain invariant is shown to be three times the mean square of the average linear stretch ratio, while the second invariant is shown to be three times the square of the average areal stretch ratio. A useful law of cosines for tetrahedra is displayed.

201,078
PB93-129641 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.

MATERIALS SCIENCES

General

Expert System and Materials Property Databases.
Final rept.
D. B. Anderson. 1992, 8p
Pub. in Computerization and Networking of Materials Database: ASTM STP 1140, v3 8p 1992.

Keywords: *Materials science, *Properties, *Expert systems, *Data bases, Knowledge bases(Artificial intelligence), User needs, Requirements, Interactive systems, Man computer interface, Reprints.

The incorporation of interactive interfaces with databases to simulate those found in expert systems and the induction of rules from data are promising approaches toward facilitating the retrieval and interpretation of materials property data, thus combining the benefits of expert system and traditional database technologies. The hybrid system concept of utilizing data as facts and knowledge as rules is described in the context of addressing the need for expanding database utility to meet a broader range of user requirements.

MATHEMATICAL SCIENCES

Algebra, Analysis, Geometry, & Mathematical Logic

201,079
PB92-154087 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Subordinated Holomorphic Semigroups.
Final rept.
A. S. Carasso, and T. Kato. 1991, 12p
Contract N00014-88-F-0005
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Transactions of the American Mathematical Society 327, n2 p867-878 Oct 91.

Keywords: *Semigroup theory, *Analytic functions, Laplace transformation, Markov processes, Reprints, Subordinated semigroups.

If (e(sup-tA)) is a uniformly bounded C (sub 0) semigroup on a complex Banach space X, then -A (sup alpha), 0 < alpha < 1, generates a holomorphic semigroup on X, and (e(sup-tA sup(alpha))) is subordinated to (e(sup-tA)) through the Levy stable density function. This was proved by Yosida in 1960, by suitably deforming the contour in an inverse Laplace transform representation. Using other methods, the authors exhibit a large class of probability measures such that the subordinated semigroups are always holomorphic, and obtain a necessary condition on the measure's Laplace transform for that to be the case. They then construct probability measures that do not have this property.

201,080
PB92-197540 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Ionizing Radiation Div.
Some Expansions Related to the Hubbell Rectangular-Source Integral.
Final rept.
B. Gabutti, S. L. Kalla, and J. H. Hubbell. 1991, 13p
Pub. in Jnl. of Computational and Applied Mathematics 37, p273-285 1991.

Keywords: Hypergeometric functions, Series expansion, Error analysis, Reprints, *Hubbel integral.

Four series expansions are presented and examined for the Hubbell rectangular-source integral f(a, b) = the integral from 0 to b of arctan(a/(square root of (1 + x(squared)))(square root of (1 + x(squared))))(sup -1)dx for the extremal situations when one or both of the parameters a, b tend to zero or infinity.

201,081
PB92-237148 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Scientific Computing Div.
Polytope Volume Computation.
Final rept.
J. F. Lawrence. 1991, 13p
See also PB90-129982.
Pub. in Mathematics of Computation 57, n195 p259-271 Jul 91.

Keywords: *Volume, *Computation, Algorithms, Simplex method, Formulas(Mathematics), Reprints, *Polytopes, Grams relation.

A combinatorial form of Gram's relation of convex polytopes can be adapted for use in computing polytope volume. The author presents an algorithm for volume computation based on this observation. This algorithm is useful in finding the volume of a polytope given as the solution set to a system of linear inequalities, P = (x is an element of R(sup n) : A x < or = b). As an example of the application of this method the author computes a formula for the volume of a projective image of the n-cube. From this formula he deduces that, when A and b have rational entries (so that the volume of P is also a rational number), the number of binary digits in the denominator of the volume (when written as a reduced fraction) is not bounded by a polynomial in the total number of digits in the numerators and denominators of entries of A and b. This settles a question posed by Dyer and Frieze.

201,082
PB93-125755 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Scientific Computing Div.
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, *Orr-Sommerfeld equation, Computational fluid dynamics, Modification, Hydrodynamics, Eigenvalues, Stability, Reprints, *Chebyshev tau method.

Spectral methods have been used to great advantage in hydrodynamic stability calculations; the concepts are described in Orszag's seminal application of the Chebyshev tau method to the Orr-Sommerfeld equation for plane Poiseuille flow in 1971. Orszag discusses both the Chebyshev Galerkin and the Chebyshev tau methods, but presents results for the tau method, which is easier to implement than the Galerkin method. The tau method has the disadvantage that two unstable eigenvalues are produced that are artifacts of the discretization. In this note we present an extremely simple modification to the Chebyshev tau method which eliminates the spurious eigenvalues. We first study a simplified model of the Orr-Sommerfeld equation discussed by Gottlieb and Orszag. We consider the Chebyshev tau method, which has two spurious eigenvalues, and then describe a modification which eliminates them. Finally, we consider results for the Orr-Sommerfeld equation, where our modified tau method also eliminates the spurious eigenvalues. The simplicity of the modification makes it a convenient alternative to other approaches to the problem.

201,083
PB93-129468 Not available NTIS
National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Applied and Computational Mathematics Div.
Survey of Existing Multidimensional Quadrature Routines.
Final rept.
D. K. Kahaner. 1991, 14p
See also PB83-142976.
Pub. in Contemporary Mathematics 115, p9-22 1991.

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 described. This paper was presented at the American Mathematical Society Workshop on Statistical Multiple Integration.

Operations Research

201,084
PB92-226299 PC **A03**/MF **A01**
National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Applied and Computational Mathematics Div.
Truncated SQP Algorithm for Large Scale Nonlinear Programming Problems.
P. T. Boggs, J. W. 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 when it is terminated, 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.

201,085
PB92-236801 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Manufacturing Engineering.
Operations Research: Some Trends and Issues for the Future.
Final rept.
C. M. Harris, and R. H. F. Jackson. 1989, 16p
Pub. in Jnl. of the Washington Academy of Sciences 79, n2 p70-85 Jun 89.

Keywords: *Operations research, Computer science, Computer applications, Trends, Computation, Manufacturing, Productivity, Reprints.

As computers and computing have come of age in the decade of the 1980s, operations research (OR) has begun to flourish as never before. In a certain sense, it has become the computational science, and its future is therefore intimately tied to the computer and what computing will look like in the years to come. The paper highlights the importance of this relationship, and particularly some of the major issues that the OR/computer science interface brings forth. These include the emerging importance of computational experimentation, especially in the use of OR software; the role of OR in the search for computer-aided improvements in manufacturing productivity; and the change that computers have and are bringing about in the modeling processes under uncertainty.

Statistical Analysis

201,086
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 Asymmetry for Polarized Beam Studies.
K. J. Coakley. 1992, 4p
This article is from 'Computing Science and Statistics: Proceedings of the Symposium on the Interface (23rd) Critical Applications of Scientific Computing: Biology, Engineering, Medicine, Speech Held in Seattle, Washington on 21-24 April 1991,' AD-A252 938, p301-304.

Keywords: *Estimates, *Statistics, Additives, Asymmetry, Background, Measurement, Parameters, Rates, Ratios, Scattering, Signals, Component Reports.

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 conservative 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 **A03**/MF **A01**
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Applied and Computational Mathematics Div.
Confidence Intervals for Discrete Approximations to Ill-Posed Problems.
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, Chebychev inequality, Gamma ray spectra, Spectra unfolding, Approximation, Estimating, Ill posed problems, Burrus 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. The errors are assumed to have zero means and known variances. The authors consider the problem of estimating confidence intervals for linear functions of the solution vector. For such problems, the least squares solution is a highly unstable function of the measurements, and the classical confidence intervals are too wide to be useful. The 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 (NEL), Gaithersburg, MD. Statistical Engineering Div.
Taguchi's Fixed-Element Arrays Are Fractional Factorials.
Final rept.
R. N. Kacker, E. S. Lagergren, and J. J. Filliben. 1991, 10p
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, *Orthogonal arrays, *Taguchi arrays.

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 fractionated 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
PB92-154368 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Statistical Engineering Div.
Estimators for Type-II Censored (Log) Normal Samples.
Final rept.
J. A. Lechner. 1991, 6p
See also PB91-203414.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Reliability 40, n5 p547-552 Dec 91.

Keywords: *Normal distribution, Maximum likelihood estimation, Life tests, Reprints, *Lognormal distribution, Parameter estimation.

The paper presents an evaluation, 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 recommendations are included. The estimators are also applicable to right-censored samples from the (two-parameter) lognormal distribution, which was the motive for the study.

201,090
PB92-213420 PC **A06**/MF **A02**
National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Applied and Computational Mathematics Div.
User's Reference Guide for ODRPACK Version 2.01: Software for Weighted Orthogonal Distance Regression.
P. T. Boggs, R. H. Byrd, J. E. Rogers, and R. B. Schnabel. Jun 92, 115p NISTIR-4834
See also PB89-229066. Prepared in cooperation with Colorado Univ. at Boulder. Dept. of Computer Science.

Keywords: Programming manuals, Least squares method, Regression analysis, Error analysis, Nonlinear analysis, Iteration, Subroutines, Algorithms, Curve fitting, *Orthogonal distance regression, ODRPACK system, Fortran 77 programming language, Jacobi matrices.

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 also be used to solve the nonlinear ordinary least squares problem. The procedure has application to curve and surface fitting, and to measurement error models in statistics. ODRPACK can handle both explicit and implicit models, and will easily accommodate complex and other types of multiresponse data. The algorithm implemented is an efficient and stable trust region Levenberg-Marquardt procedure that exploits the structure of the problem so that the computational cost per iteration is equal to that for the same type of algorithm applied to the nonlinear ordinary least squares problem. The package allows a general weighting scheme, provides for finite difference derivatives, and contains extensive error checking and report generating facilities.

MEDICINE & BIOLOGY

Biochemistry

201,091
PB92-144161 Not available NTIS
National Inst. of Standards and Technology (NML), 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.

Keywords: *Leaves(Botany), *Trace elements, Neutron activation analysis, Homogeneity, Evaluation, Reprints, *Certified reference materials, *Standard reference materials.

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 on both leaf materials for five elements to date to better than 1.5 percent (1s) 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. Robertson, and R. D. Astumian. 1992, 4p
Pub. in Biochemistry 31, n1 p138-141, 14 Jan 92.

Keywords: *Enzymes, *Membranes, *Adenosine triphosphatase, *Electric fields, Oscillations, Mathematical models, Relaxation time, Frequency dependence, Catalysis, Reprints.

Theoretical expressions for the frequency and amplitude dependence of the rate of a catalyzed reaction are fitted to the data of Graziana et al. (1990) (Graziana, A., Ranjeva, R., and Teissie, J. (1990) Biochemistry 29, 8313-8318) for Ca(2+) uptake by carrot 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 fit gives 20 ms and 33 microsec 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.
Effect of Different Phospholipid-Cholesterol Membrane Compositions on Liposome-Mediated Formation of Calcium Phosphates.
Final rept.
D. Skrtic, and E. D. Eanes. 1992, 8p
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Calcif. Tissue Int. 50, p253-260 1992.

Keywords: *Membrane lipids, *Phospholipids, *Cholesterol, *Liposomes, *Calcium phosphates, pH, Fatty acids, Biological transport, Kinetics, Solutions, Reprints.

The present report compares the effects of different membrane phospholipid (PL)-cholesterol compositions on the kinetics of liposome-mediated formation of calcium phosphates 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:X mixtures of phosphatidylcholine (PC), neutral or acidic phospholipids, and cholesterol (Chol, X = 0, 10, 35, or 50 mol%). The neutral phospholipids (NPL) examined, in addition to PC, were phosphatidylethanolamine (PE) and sphingomyelin (Sph), and the acidic phospholipids (APL) examined were dicetylphosphate (DCP), dioleolylphosphatidylglycerol (DOPG), dioleolylphosphatidic acid (DOPA), phosphatidylserine (PS) and phosphatidylinositol (PI).

201,094
PB92-154673 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Effect of Membrane Cholesterol on Calcium Phosphate Formation in Aqueous Suspensions of Anionic Liposomes.
Final rept.
D. Skrtic, and E. D. Eanes. 1992, 6p
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Calcif. Tissue Int. 50, p55-60 1992.

Keywords: *Membrane lipids, *Cholesterol, *Liposomes, *Calcium phosphates, Divalent cations, Ionophores, Phosphatidylcholines, Biological transport, Reprints, Diacetylphosphate.

The present study examined the effect of membrane cholesterol on liposome-mediated calcium phosphate precipitation in metastable aqueous solutions (2.25 mM Ca(sup 2+) and 1.5 mM inorganic phosphate) at 22 C, pH 7.4 and 240 mOsm. The liposomes were prepared from 7:2:X molar mixtures of phosphatidylcholine, dicetylphosphate, and cholesterol (x = 0, 1, 5, or 9) and contained either 0 or 50 mM encapsulated phosphate. The membranes were made permeable to Ca(sup 2+) by addition of the cationophore, X-537A. Without encapsulated phosphate, 7:2:X liposomes (with or without ionophore) induced no precipitation. With 50 mM encapsulated phosphate and in the presence of ionophore, precipitation significantly depended on the cholesterol level in the membrane. At 0 and 10 mole% cholesterol, precipitate developed rapidly 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.

201,095
PB92-154731 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Process Measurements Div.
Electron-Transfer Reaction of Cytochrome c Adsorbed on Carboxylic Acid Terminated Alkanethiol Monolayer Electrodes.
Final rept.
M. Tarlov, and E. F. Bowden. 1991, 3p
Pub. in Jnl. of the American Chemical Society 113, n5 p1847-1849 1991.

Keywords: *Cytochrome C, *Electron transfer, *Monomolecular films, Thiols, Electrodes, Carboxylic acids, Voltametry, Reaction kinetics, Reprints.

The use of self-assembled alkanethiol monolayer modified electrodes for investigating diffusionless electron transfer (ET) reactions of proteins is described. Self-assembly of 16-mercaptohexadecanoic acid (HS(CH2)15COOH) on gold electrodes resulted in compact monolayers terminated by surface carboxylic acid groups. These surfaces were capable of irreversibly adsorbing cytochrome c at near-monolayer coverage in pH 7, low ionic strength phosphate solution. The adsorbed cytochrome c appeared to be native, exhibiting a surface formal potential of +0.19 V vs NHE, which is close to the value observed for cytochrome c adsorbed on mitochondrial membranes. An apparent ET rate constant of 0.1 per second, determined at zero overpotential using cyclic voltammetry, indicated an extremely non-adiabatic reaction. The ET distance was estimated to be ca. 30A from analysis of either the ET kinetics or the molecular structures. The implications of the work for probing protein ET kinetics and for developing membrane analogues are addressed.

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 Phenoxyl Radical Dimerization.
Final rept.
E. P. L. Hunter, M. F. Desrosiers, and M. G. Simic. 1989, 5p
Pub. in Free Radical Biology and Medicine 6, p581-585 1989.

Keywords: *Free radicals, *Reaction kinetics, *Chemical reactivity, Tyrosine, Antioxidants, Oxygen, Fluorescence, Radiolysis, pH, Reprints, *Tyrosine phenoxy radicals, Bityrosine.

Dimerization of tyrosine phenoxyl radical yields bityrosine (BT) which can easily be monitored by its characteristic fluorescence at 400 nm. The reactivity of tyrosine phenoxyl 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 0.72 mM). In addition, oxygen uptake by the phenoxyl radical was measured directly with an oxygen electrode. It was determined by the technique that oxygen does not react with the phenoxyl radical with a rate constant greater than 1000 per molar per sec. Tyrosine phenoxyl radical 'repair' by superoxide and physiological antioxidants was examined by BT fluorescence quenching as well as pulse radiolysis. Implications of these results as to the fate of tyrosine phenoxyl radicals produced in biological systems is discussed.

201,097
PB92-170786 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Organic Analytical Research Div.
Separation and Relative Distribution of All-trans-beta-Carotene and Its cis Isomers in beta-Carotene Preparations.
Final rept.
N. Craft, L. Sander, and H. Pierson. 1990, 13p
Contract NCI-Y01-CN-80655
Sponsored by National Cancer Inst., Bethesda, MD.
Pub. in Jnl. of Micronutrient Analysis 8, p209-221 1990.

Keywords: *Isomerization, *Carotene, Purification, High pressure liquid chromatography, Carotenoids, Spectrophotometry, Reprints.

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 (LC). The purity of five lots of beta-carotene evaluated by comparison of spectrophotometric to gravimetric determinations was found to range from 7.1 to 82.9%. Reversed-phase LC was then used to measure the impurities due to other carotenoids and geometric isomers of beta-carotene which also absorb in the 450 nm region. Five different reversed-phase C(sub 18) columns were examined for their ability to resolve the geometric isomers of beta-carotene which contribute to the apparent concentration of trans-beta-carotene standard solutions. The columns packed with wide-pore, C(sub 18) polymerically-modified silica exhibited adequate selectivity to separate the geometric isomers from all-trans-beta-carotene. Impurities separated by LC accounted for 16-75% of the absorbance of commercial beta-carotene preparations at 450 nm. Based on these observations, all-trans-beta-carotene measurements could potentially be only 1/50 of reported values.

201,098
PB92-170919 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Physico-Chemical Principles of Biomineralization.
Final rept.
E. D. Eanes. 1990, 13p
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in NATO ASI Ser. A, v184 p1-13 1990.

Keywords: *Physiologic calcification, Calcium phosphates, Collagen, In vivo analysis, Crystallography, Extracellular matrix, Dentistry, Reprints.

The paper reviews the physico-chemical aspects of calcium phosphate mineral deposition in skeletal tissues. Topics include: relevant principles of nucleation and crystal growth, general features of mineral formation in vivo, matrix vesicle calcification, and collagen calcification. Particular emphasis is placed on how the application of physico-chemical principles of nucleation and growth, together with current knowledge of the crystallographic and ultrastructural properties of skeletal mineral, can provide valuable insight into the cellular and bioorganic matrix factors which initiate and regulate the mineral deposition processes in vivo.

201,099
PB92-171321 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Neutron Activation Analysis of Biological Samples with a Pre-Irradiation Chemical Separation.
Final rept.
R. R. Greenberg, H. M. Kingston, R. Zeisler, and J. Woittiez. 1990, 9p
Pub. in Biological Trace Element Research 26-27, p17-25 Jul 90.

Keywords: *Neutron activation analysis, *Blood serum, *Irradiation, Reprints, Standard reference materials.

A pre-irradiation separation procedure has been developed to separate Al, Cu, Mn, and V from biological materials. Chelex-100 resin is used as the separation media and the resin is irradiated directly. Three NIST biological Standard Reference Materials, and five samples of uncontaminated human blood-serum have been analyzed by NAA following the separation.

201,100
PB92-236777 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Neutron Scattering Study of the Hydration Hull of DNA by H2O/D2O-Exchange.
Final rept.
H. Grimm, A. Rupprecht, H. Stiller, and C. F. Majkrzak. 1989, 4p
See also DE88016731.
Pub. in Physica B 156, p464-467 Jan 89.

Keywords: *Neutron scattering, *Deoxyribonucleic acids, *Water, *Hydration, Molecular structure, Films, Heavy water, Deuterium compounds, Exchanging, Nucleotides, Reprints.

Films of highly oriented DNA (A-, B-, and C-conformation) were investigated by neutron scattering. Diffuse sheets corresponding to a one-dimensionally periodic 'water-DNA' structure are identified close to the intersection of the helix direction with the structure factor maximum of bulk water. The correlation length in this structure is strongly influenced by its commensurability with the axial translation H per nucleotide. The fiber or lateral chain interaction is enhanced in the commensurate case.

201,101
PB93-125391 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Activation of Sodium and Potassium Pumping Modes of Sodium-Potassium ATPase by an Oscillating Electric Field.
Final rept.
D. S. Liu, R. D. Astumian, and T. Y. Tsong. 1990, 8p
Pub. in Jnl. of Biological Chemistry 265, n13 p7260-7267 1990.

Keywords: *Ion channels, *Sodium potassium adenosine triphosphatase, *Electric fields, *Transport properties, Erythrocytes, Catalysis, Activation, Reprints, *Sodium pumps, *Potassium pumps.

We report here the activation of the Na(+)-pump with an oscillating electric field of the same strength as previously used (20 V/cm) but at a much higher frequency (1.0 MHz). 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 ranged between 10 and 20 amole/RBC-hr, and Na(+) efflux between 15 and 30 amole/RBC-hr, 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 MHz, 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, (Na,K)-ATPase 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.

201,102
PB93-125540 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Organic Analytical Research Div.
Determination of Retinol, alpha-Tocopherol, and beta-Carotene in Serum by Liquid Chromatography.
Final rept.
W. A. MacCrehan. 1990, 10p
See also PB88-120928.
Pub. in Methods Enzymol. 189, p172-181 1990.

Keywords: *Blood chemical analysis, *Vitamin E, *Vitamin A, *Carotene, Liquid chromatography, Electrochemistry, Ultraviolet spectroscopy, Isomerization, Reprints.

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 analytes from their major geometric isomers and from serum constituents. UV/visible absorbance and electrochemical detectors are used.

Clinical Chemistry

201,103
PB92-154442 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Organic Analytical Research Div.
Ascorbic and Dehydroascorbic Acid Measurement in Human Serum and Plasma.
Final rept.
S. A. Margolis, R. Zeigler, and K. J. Helzlsouer. 1991, 4p
Pub. in American Jnl. of Clinical Nutrition 54, p1315S-1318S 1991.

Keywords: *Ascorbic acid, *Dehydroascorbic acid, *Blood chemical analysis, *Blood plasma, *Blood serum, Reprints.

Plasma supplemented with ascorbic acid was prepared; the stability of the samples was characterized and the accuracy of the supplementation was established. Studies on the accuracy, precision, and sources of methodological bias in the measurement of ascorbic acid were summarized. Measurements of the ratio of ascorbic acid to dehydroascorbic acid in clinical samples was evaluated and was shown to be relatively constant in plasma taken from blood stored at 12 C for 6 h. The results imply that whole blood has the capacity to maintain a constant ascorbic-dehydroascorbic acid ratio and suggest that this ratio may be of physiological significance.

201,104
PB92-165380 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Organic Analytical Research Div.
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.
Final rept.
P. Ellerbe, G. L. Myers, G. R. Cooper, H. S. Hertz, L. T. Sniegoski, M. J. Welch, and E. V. White. 1990, 6p
Pub. in Clin. Chem. 36, n2 p370-375 Feb 90.

Keywords: *Cholesterol, *Blood serum, *Clinical chemistry, Comparison, Reference standards, Freezing, Reprints.

Cholesterol is an important clinical analyte. There has been much discussion about its measurement in human serum. This paper presents a comparison between the reference method and the definitive method for measurement of cholesterol. On pure cholesterol solutions, the reference method values agree with the definitive method values. The reference method values are on average 1.6% higher than the definitive method values for fresh, frozen, or freeze-dried serum. The only explanation which cannot be ruled out is that there is an undetected interference in the reference method.

Clinical Medicine

201,105
PB92-159557 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Chemical Technology.
In vivo Brain Water Determination by T1 Measurements: Effect of Total Water Content, Hydration Fraction, and Field Strength.
Final rept.
P. P. Fatouros, A. Marmarou, K. A. Kraft, S. Inao, and F. P. Schwarz. 1991, 12p
Pub. in Magnetic Resonance in Medicine 17, n2 p402-413 1991.

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 edematous brain and longitudinal 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(sub 1) and 1/W. A scheme is presented and experimentally verified at 1 T for deducing the exact relationship of 1/T(sub 1) vs 1/W at any frequency. Knowledge of this relationship along with precise measurements of 1/T(sub 1) at a given field strength permit quantitative in vivo measures of brain water content to be obtained with an uncertainty of less than 1%. It is concluded that routine, accurate and noninvasive brain water 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.
Urinary Biomarkers in Radiation Therapy of Cancer.
Final rept.
D. S. Bergtold, C. D. Berg, and M. G. Simic. 1990, 6p
Pub. in Antioxidants in Therapy and Preventive Medicine, p311-316 1990.

Keywords: *Radiotherapy, *Biological markers, Deoxyribonucleic acids, Ionizing radiation, Reprints.

Radiolytic biomarkers in the urine of radiation therapy patients were measured before and 24 hours after irradiation and found to increase significantly beyond experimental error. This is the first observation of enhanced excretion of oxidative DNA base products in humans exposed to ionizing radiation as part of cancer therapy.

201,107
PB92-237429 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Ionizing Radiation Div.
Method for the Calibration of Concave (90)Sr+(90)Y Ophthalmic Applicators.
Final rept.
C. G. Soares. 1992, 3p
Pub. in Phys. Med. Biol. 37, n4 p1005-1007 1992.

Keywords: *Ophthalmology, *Radiation doses, *Calibration, Beta particles, Strontium 90, Yttrium 90, Measurement, Reprints, *Ophthalmic applicators, Radiochromic foils.

Measurement of the absorbed-dose rate at the surface of beta-particle emitting ophthalmic applicators is ordinarily performed using the extrapolation ionization chamber technique. For the case of concave surface applicators however, this is not possible due to their shape. A method is described for such measurements employing small (5-mm diameter) radiochromic foil disks. The foils are sandwiched between the source and a plastic sphere of the same radius as the radii of curvature of the source. The response of the irradiated films is compared to the response of similar films irradiated using a planar applicator which has been calibrated using an extrapolation chamber. From the response ratio, and the dose rate of the planar source, surface dose rate is determined for the curved applicator. Results of two such calibrations are presented, as well as a comparison with the results of an alternative method using a scintillator probe.

201,108
PB93-125441 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Ionizing Radiation Div.
Role of the Water Calorimeter in High-Energy Medical Radiation Dosimetry.
Final rept.
R. Loevinger. 1988, 7p
Pub. in Proceedings of NRC Workshop on Water Calorimetry, Ottawa, Canada, June 6-7, 1988, p1-7.

Keywords: *Radiotherapy dosage, Tissues(Biology), High-energy radiotherapy, Reprints, *Water calorimeters.

The water calorimeter is a direct, energy-independent method of measuring absorbed dosage in tissue-like material. It is proposed that the roles of the water calorimeter are to stimulate research, and to provide a reliable primary standard and convenient secondary standard of water absorbed dose for high-energy radiation.

Cytology, Genetics, & Molecular Biology

201,109
PB92-154012 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Biotechnology Div.
Substrate Specificity of the Escherichia coli Fpg Protein (Formamidopyrimidine-DNA Glycosylase): Excision of Purine Lesions in DNA Produced by Ionizing Radiation or Photosensitization.
Final rept.
S. Boiteux, E. Gajewski, J. Laval, and M. Dizdaroglu. 1992, 5p
Pub. in Biochemistry 31, n1 p106-110 1992.

Keywords: *DNA damage, *Escherichia coli, *Bacterial proteins, *Ionizing radiation, Mass fragmentography, Purines, DNA repair, Free radicals, Oxygen, Reprints, *Fpg protein, 8-hydroxyguanine, 8-hydroxyadenine, Diaminohydroxyformamidopyrimidine, Diaminoformamidopyrimidine.

A study investigated the excision of a variety of modified bases from DNA by the Escherichia coli Fpg protein. DNA used as a substrate was modified either by exposure to ionizing radiation or by photosensitization using visible light in the presence of methylene blue (MB). The technique of gas chromatography/mass spectrometry, which can unambiguously identify and quantitate pyrimidine- and purine-derived lesions in DNA, was used for analysis of hydrolyzed and derivatized DNA samples. Thirteen products resulting from pyrimidines and purines were detected in gamma-irradiated DNA, whereas only the formation of 2,6-diamino-4-hydroxy-5-formamidopyrimidine (FapyGua) and 8-hydroxyguanine (8-OH-Gua) was observed in visible light/MB-treated DNA. Analysis of gamma-irradiated DNA after incubation with the Fpg protein followed by precipitation revealed that the Fpg protein significantly excised 4,6-diamino-5-formamidopyrimidine (FapyAde), FapyGua, and 8-OH-Gua. The results suggest that one of the biological roles of the Fpg protein, which is present in bacteria as well as in mammalian cells, is the repair of DNA damage caused by free radicals or by other oxygen-derived species such as singlet oxygen. The Fpg protein appears to be specific for recognition of imidazole ring opened purines and 8-hydroxypurines in DNA and may complement pyrimidine-specific enzymes in repair of DNA damage in vivo.

201,110
PB92-160027 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Chemical Engineering Science Div.
Comparison of Methods of Preparative Cell Electrophoresis.
Final rept.
P. Todd. 1991, 40p
Sponsored by National Aeronautics and Space Administration, Washington, DC., and Public Health Service, Rockville, MD.
Pub. in Cell Separation Science and Technology, Chapter 15, p216-255 1991.

Keywords: *Cells(Biology), *Electrophoresis, Isoelectric focusing, Cell survival, Solutions, Cost analysis, Reprints.

Quantitative characteristics of methods of cell electrophoresis are as follows: separation (resolution), purity, capacity, product viability, convenience and capital cost. Thirteen different methods of electrophoretic cell separation were compared on the basis of these six criteria using a relative scale of 0 to 4. The methods compared were free zone electrophoresis, density gradient electrophoresis, ascending vertical electrophoresis, re-orienting density gradient electrophoresis, free-flow electrophoresis, agarose sol electrophoresis, low-gravity electrophoresis, continuous flow low-gravity electrophoresis, rotating annular electrophoresis, density-gradient isoelectric focusing, free flow isoelectric focusing, stable flow free boundary electrophoresis, and continuous magnetic belt electrophoresis.

201,111
PB92-165349 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Biotechnology Div.
Purification of Polypeptide Samples by Ion-Exchange Chromatography on Silica-Based Supports.
Final rept.
M. Dizdaroglu. 1990, 16p
Pub. in High Performance Liquid Chromatography in Biotechnology, Chapter 11, p263-278 1990.

Keywords: *Peptides, *Ion exchange chromatography, High pressure liquid chromatography, Biotechnology, Reprints.

Since its introduction by Moore and Stein, ion-exchange liquid chromatography has played an important role in the separation and purification of peptides. This technique has been used extensively for 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 resins have been used as stationary phases. Most of these ion-exchangers have been prepared from divinylbenzene crosslinked 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 this 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 improvement of peptide separations by liquid chromatography. The purpose of the 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 (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Electroconformational Coupling (ECC): An Electric Field Induced Enzyme Oscillation for Cellular Energy and Signal Transductions.
Final rept.
T. Y. Tsong, A. Gaigalas, R. D. Astumian, F. Chauvin, and D. S. Liu. 1989, 13p
Pub. in Bioelectrochemistry and Bioenergetics 21, n3 p319-331 1989.

Keywords: *Electric fields, *Signal transduction, *Cells(Biology), *Adenosine triphosphatase, Oscillations, Adenine nucleotides, Kinetics, Energy, Catalysis, Reprints, *Electroconformational coupling.

Previous work has shown that membrane ATPases can extract free energy from applied oscillating electric fields for doing chemical work, e.g. to synthesize ATP from ADP and Pi or to transport Rb and Na ions against their respective electrochemical gradient. 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 mechanism reproduces many experimental features. It is shown that a Coulombic interaction between an enzyme and an alternating electric field (a.c.) can cause the enzyme to oscillate between different conformational states. If the frequency of the applied field matches the kinetic characteristics of the system and the amplitude matches the energy level required for inducing productive catalytic cycling a phenomenological resonance between catalytic reaction and the periodic field is generated. A characteristic necessary for achieving resonance is the kinetic bias arising from the binding energy of ligand. Analysis indicates that only dynamic electric fields, i.e. 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 (NML), Gaithersburg, MD. Center for Chemical Technology.
Three-Dimensional Structure of Recombinant Bovine Chymosin at 2.3 A Resolution.
Final rept.
G. L. Gilliland, E. L. Winborne, J. Nachman, and A. Wlodawer. 1990, 20p
Pub. in Proteins: Structure, Function, and Genetics 8, n1 p82-101 1990.

Keywords: *Protein conformation, *Chymosin, Renin, Amino 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 was cloned and expressed in Escherichia 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 I222 with unit cell dimensions a=72.7A, b=80.3A, and c=114.8A. 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 few short alpha-helices. The enzyme can be subdivided into N- and C-terminal domains which are separated by a deep cleft containing the active aspartate 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
PB92-171313 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Biotechnology Div.
Characterization of Adsorbed Protein Layers on Thin Nylon Films with Fluorescence Energy Transfer between Protein and Nylon: A Method for Biosensor Analysis.
Final rept.
E. S. Grabbe, and D. J. Reeder. 1991, 2p
Pub. in Proceedings of European Conference on the Spectroscopy of Biological Molecules (4th), York, England, September 1-6, 1991, p321-322.

Keywords: *Proteins, *Fluorescence, *Energy transfer, *Bioinstrumentation, *Nylon fibers, Adsorption, IgG, Fluorescein-5-isothiocyanate, 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 bioinactivity, nonspecific adsorption and evenness of coverage to be directly addressed. Total internal reflection fluorescence is used to characterize layers of adsorbed IgG on thin nylon films. Fluorescence techniques used to probe the immunoglobulin G (IgG)/nylon interface include: (1) energy transfer between adsorbed fluorescein isothiocyanate (FITC) tagged IgG and tetramethylrhodamine isothiocyanate (TRITC) tagged nylon, (2) binding activity, measured using TRITC labelled antigens, 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-Mediated Hydride Shift Mechanism for Xylose Isomerase Based on the 1.6 A Streptomyces Rubiginosus Structures with Xylitol and D-Xylose.
Final rept.
M. Whitlow, A. Howard, B. C. Finzel, T. L. Poulos, E. Winborne, and G. Gilliland. 1991, 21p
Pub. in Proteins: Structure, Function, and Genetics 9, p153-173 1991.

Keywords: *Metals, *Xylitol, *Xylose, X-ray diffraction, Protein conformation, Divalent cations, Active site, Reprints, *Streptomyces rubiginosus, *Xylose isomerase.

The crystal structure of recombinant Streptomyces rubiginosus D-xylose isomerase (D-xylose keto-isomerase, EC 5.3.1.5) solved by the multiple isomorphous replacement technique has been refined to R=0.16 at 1.64 A resolution. A detailed mechanism for D-xylose isomerase is proposed. Upon binding of cyclic alpha-D-xylose to xylose isomerase, His-54 acts as the catalytic base in a ring opening reaction. The ring opening step is followed by binding of D-xylose, involving two divalent cations, in an extended conformation. The isomerization of D-xylose to D-xylulose 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 PEG-Salt Two-Phase Extraction.
Final rept.
K. D. Cole. 1991, 7p
Pub. in BioTechniques 11, n1 p18-24 1991.

Keywords: *Plasmids, *Deoxyribonucleic acids, Polyethylene glycols, Nucleic acids, Proteins, Protein denaturation, Reprints.

A method for the rapid preparation of DNA is described. The method utilizes a polymer (polyethylene glycol) and salt solution to form a two-phase system. The method describes the conditions of the two-phase systems that are important for the separation of nucleic acids and proteins. The 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.
Final rept.
A. K. Gaigalas, J. B. Hubbard, M. McCurley, and S. Woo. 1992, 5p
Pub. in Jnl. of Physical Chemistry 96, n5 p2355-2359, 5 Mar 92.

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 which account for the screened Coulomb interaction 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 data. Although the measured and calculated values of the diffusion coefficient are in general agreement, significant discrepancies are observed. No single theoretical model seems capable of accurate predictions for all ranges of ionic strength and protein concentration.

201,118
PB92-175827 Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.
Further Analyses of Human Kidney Cell Populations Separated on the Space Shuttle.
Final rept.
R. M. Stewart, P. Todd, K. D. Cole, and D. R. Morrison. 1992, 7p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Advanced Space Research 12, n5 p(5)223-(5)229 1992.

Keywords: *Cells(Biology), *Kidney, *Exobiology, Humans, Electrophoresis, Plasminogen activators, Space shuttle mission 31-D, Reprints.

Cultured human embryonic kidney cells were separated into electrophoretic subpopulations in laboratory experiments and in two separation experiments on the STS-8 (Challenger) Space Shuttle flight using the mid-deck Continuous Flow Electrophoretic Separator (CFES). Populations of cells from each fraction were cultured for the lifetime of the cells, and supernatant medium was withdrawn and replaced at 4-day intervals. Withdrawn medium was frozen at -120 C for subsequent analysis. Enzyme assays, antibodies and gel electrophoresis were used as analytical tools for the detection and quantitation of plasminogen activators in these samples. These assays of frozen culture supernatant fluids confirmed the electrophoretic separation of plasminogen-activator producing cells from nonproducing cells, the isolation of cells capable of sustained production, and the separation of cells that produce different plasminogen activators from one another.

201,119
PB92-197888 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Chemical Technology.
Crystallization of the 'Bacillus Subtilis' Histidine-Containing Phosphocarrier Protein Hpr and of Some of Its Site-Directed Mutants.
Final rept.
G. Kapadia, J. Reizer, S. L. Sutrina, M. H. Saier, P. Reddy, and O. Herzberg. 1990, 2p
Pub. in Jnl. of Molecular Biology 212, n1 p1-2 1990.

Keywords: *Bacillus subtilis, *Histidine, *Phosphoproteins, *Site-directed mutagenesis, *Carrier proteins, X-ray diffraction, Crystallization, Reprints.

The histidine-containing phosphocarrier protein (HPr) from B. subtilis has been crystallized. Two of the site-directed mutants aimed at the probing function produce crystals suitable for x-ray studies. The mutant in which His 15 is substituted by an alanyl residue crystallizes from ammonium sulfate solution in space group P3(sub 1)21 or P3(sub 2)21, with unit cell dimensions: a=b=47.3 A; c=61.5 A. These crystals diffract to at least 1.8 A resolution. The mutant in which Ser 46 is substituted by an aspartyl residue crystallizes from polyethylene glycol 4000 solution in space group P2(sub 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
PB92-198076 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Materials Div.
Quantitative Determination of Proteins Using Polyacrylamide Gel Electrophoresis and Neutron Activation.
Final rept.
S. F. Stone, R. Zeisler, and G. E. Gordon. 1988, 10p
Pub. in Trace Element Analytical Chemistry in Medicine and Biology, v5 p157-166 1988.

Keywords: *Proteins, *Polyacrylamide gel electrophoresis, *Neutron activation analysis, Phosphoproteins, Autoradiography, Trace elements, Selenium, Reprints.

A combination of powerful and sensitive methods for separation and element determination is evaluated to accomplish trace element speciation. Polyacrylamide gel electrophoresis (PAGE) and neutron activation analysis (NAA) have been combined to determine the phosphorus associated with separated phosphoproteins by autoradiography and densitometry. 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 being studied. A quantitation limit of 0.25 nmole Se has been achieved.

Dentistry

201,121
PB92-144302 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Time Dependence of 2.5% Nitric Acid Solution as an Etchant on Human Dentin and Enamel.
Final rept.
R. L. Blosser. 1990, 5p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Dental Materials 6, n2 p83-87 1990.

Keywords: *Dental materials, *Acid bonded reaction cements, *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. Extracted 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 blown with air for 10 sec. Duplicate pairs of dentin and enamel samples were treated with a drop of 2.5% HNO3. Application periods varied by 10 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 micrographs 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 enamel and dentin for optimum tag formation 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
PB92-154137 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Deposition of Fluoride on Tooth Surfaces by a Two-Solution Mouthrinse In vitro.
Final rept.
L. C. Chow, and S. Takagi. 1991, 5p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Caries Research 25, p397-401 1991.

Keywords: *Fluorides, *Teeth, *Surfaces, *Deposition, Oral cavity, Dental caries, In vitro analysis, Reprints, *Mouthrinses, *Topical fluoride application.

A constant-composition fluoride (F) titration method was used to measure the amount of leachable F deposited on tooth surfaces in vitro by a 1-min rinse with a 228-ppm F solution (12 mmol/l sodium fluoride). The mean F uptake was 0.23 + or - (SE) 0.07 microgram/sq cm, corresponding to less than 0.2% of the F contained 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 4.36 + or - 0.16 microgram/sq cm, which was approximately 19 times greater than that produced by the sodium F rinse with the same F content. 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.
Permselectivity of Sound and Carious Human Dental Enamel as Measured by Membrane Potential.
Final rept.
C. M. Carey, G. L. Vogel, and L. C. Chow. 1991, 7p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 70, n12 p1479-1485 Dec 91.

Keywords: *Dental enamel, *Dental caries, *Membrane potential, Diffusion, Ions, Dental plaque, Reprints, *Permselectivity.

A microwell technique was used for determination of the permselectivities of sound and carious enamel in the same slice of tooth. The permselectivity determination was accomplished by drilling microwells in the enamel and filling them with a simulated plaque fluid containing lactate, carbonate, and inorganic ions at concentrations similar to those in resting plaque fluid, but with different concentrations of KCl. The electrical potentials developed across the enamel membrane were measured with microreference electrodes placed in the wells or in the solution outside the tooth. The results showed that the membrane potential was a function of the composition of the solutions separated by the enamel membrane and was independent of the composition of the solutions in the adjacent wells. The enamel was found to be cation-permselective, and sound enamel was more permselective than carious enamel.

Immunology

201,124
PB92-154129 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Organic Analytical Research Div.
Planar Waveguide Immunosensor with Fluorescent Liposome Amplification.
Final rept.
S. Choquette, L. Locascio-Brown, and R. Durst. 1992, 6p
See also PB91-174565.
Pub. in Analytical Chemistry 64, n1 p55-60 1992.

Keywords: *Theophylline, *Immunoassay, *Waveguides, *Detectors, Liposomes, Fluorescence, Reprints, *Immunosensors.

A regenerable planar waveguide immunosensor for the clinical analyte theophylline has been developed. Regeneration is accomplished under flow conditions using a moderate affinity antibody, and multiple analyses can be performed with a single waveguide sensor. Sensors capable of more than 15 sequential measurements have demonstrated better than 10% precision. The use of theophylline-labeled liposomes in the competitive immunoassay provides 1 order of magnitude greater signal enhancement over theophylline derivatized with fluorescein.

201,125
PB93-130433 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Biotechnology Div.
Studies on Antigen-Antibody Reactions Using Light Scattering from Antigen Coated Colloidal Particles.
Final rept.
H. H. Weetall, and A. K. Gaigalas. 1992, 15p
Pub. in Analytical Letters 25, n6 p1039-1053 1992.

Keywords: *Antigen antibody reactions, *Light scattering, *Colloids, Spectrum analysis, Immunochemistry, Bovine serum albumin, Antigens, Antibodies, Serology, Reprints, Autocorrelation spectrum, Ferrofluids.

Studies are presented of dynamic light scattering from colloidal suspensions of fractionated ferrofluid particles (40-60 nm average diameter) coated with bovine serum albumin (BSA) and subjected to BSA antibodies and soluble BSA in a competitive binding mode. The observed slowly decaying component in the authocorrelation spectrum originates from the motion of BSA coated colloidal 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
PB92-144898 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
In vitro Exposure Parameters with Linearly and Circularly Polarized ELF Magnetic Fields.
Final rept.
M. Misakian. 1991, 5p
See also PB91-118414.
Pub. in Bioelectromagnetics 12, p377-381 1991.

Keywords: *Magnetic fields, *Extremely low frequencies, *Polarization, *Dosimetry, Exposure, In vitro analysis, Culture media, Reprints.

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 rept.
M. Dizdaroglu. 1992, 9p
Sponsored by Department of Energy, Washington, DC.
Pub. in International Jnl. of Radiation Biology 61, n2 p175-183 1992.

Keywords: *DNA damage, *Ionizing radiation, Ions, Mass fragmentography, Crosslinking, Carcinogenesis, Chromatin, Free radicals, Reprints.

Chemical characterization and quantitation 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 selected-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 without the 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 for chemical determination of free radical-induced DNA damage in DNA as well as in mammalian chromatin under a vast variety of conditions of free radical production.

201,128
PB92-171347 Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD. Occupational Health and Safety Div.
Performance Testing a New Thermoluminescent Dosimetry System.
Final rept.
T. G. Hobbs, and B. L. Frey. 1988, 8p
Pub. in Proceedings of Annual Topical Midyear Meeting of the Health Physics Society on Instrumentation (22nd), San Antonio, TX., December 4-8, 1988, 8p.

Keywords: *Thermoluminescent dosimetry, *Health physics, Lithium fluorides, Reproducibility, Tests, Reprints.

Before authorizing a new thermoluminescent dosimetry system for use in the Health Physics support program at NIST (formerly NBS), a series of tests was performed. The tests were designed to assure that the system is reliable, to establish that assessment results are credible, to provide an operational familiarity with the system, and to select acceptable handling techniques for the dosimeter elements and for the resulting data. Among the tests were reproducibility, sensitivity, and linearity, annealing procedures, and data reduction variations. The results showed that with natural lithium fluoride the instrument is reliable, that assessments could be made between at least 0.2 mR and 100 R, that operational familiarity is easily acquired, that acceptable handling techniques for dosimeters are no different from those normally employed, and that appropriate data reduction for applications measurements involves neither tedious nor lengthy calculations.

201,129
PB92-175991 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Ionizing Radiation Div.
Why Change the X-Ray Conversion Factors in ANSI N13.11.
Final rept.
G. H. Zeman, C. Soares, and R. T. Devine. 1991, 12p
Pub. in Proceedings of Conference on Radiation Protection and Dosimetry (3rd), Orlando, FL., October 21-24, 1991, p19-30.

Keywords: *X-ray dosimetry, *Personnel dosimetry, Dose equivalents, Reprints, *ANSI N13.11, *Conversion factors.

The conversion factors relating X-ray exposure to dose equivalent have substantially changed in the 1990 draft revision of the ANSI standard dealing with personnel dosimetry performance testing. ANSI standard N13.11 forms the basis for the NVLAP testing program which is mandatory under 10 CFR 20 for dosimetry processors serving a large fraction of U.S. radiation workers. The original 1983 version of ANSI N13.11 set down procedures which were widely adopted, and which significantly enhanced the reliability and consistency of personnel dosimetry processing on a national scale. Changes to the X-ray conversion factors are necessary at this time because of new developments. Note: conversion factors for testing at non-perpendicular angles are not covered in the paper: see accompanying paper.

201,130
PB93-135523 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Examination of Experimental Designs for In vitro Studies Using ELF Magnetic Fields.
Final rept.
M. Frazier, J. Morris, and M. Misakian. 1990, 6p
Prepared in cooperation with Battelle Pacific Northwest Labs., Richland, WA.
Pub. in Proceedings of Conference BPNL/NIST Workshop on Exposure Parameters In vitro Studies with ELF Magnetic and Electric Fields, San Antonio, TX., June 10, 1990, 6p.

Keywords: *Magnetic fields, *Electromagnetic fields, *Frequencies, *Biology, In vitro analysis, Exposure, Dosimetry. Reprints.

The exposure parameters for several experimental configurations that can be used for conducting in vitro studies with ELF magnetic fields are examined. Many of the biological parameters and constraints that must be considered with the different experimental arrangements are also discussed.

Toxicology

201,131
PB92-144120 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Chemical Kinetics and Thermodynamics Div.
Mutation of Potassium Permanganate- and Hydrogen Peroxide-Treated Plasmid pZ189 Replicating in CV-1 Monkey Kidney Cells.
Final rept.
S. A. Akman, G. P. Forrest, J. H. Doroshow, and M. Dizdaroglu. 1991, 8p
See also PB91-187070. Sponsored by National Cancer Inst., Bethesda, MD., and Department of Energy, Washington, DC.
Pub. in Mutation Research 261, p123-130 1991.

Keywords: *Plasmids, *DNA replication, *Mutations, *Potassium permanganate, *Hydrogen peroxide, Monkeys, Cells(Biology), Transfection, Mass fragmentography, Cell nucleus, Nucleic acids, Reprints.

A study examined the effect of the oxidation of plasmid pZ189 by KMnO4, which does not produce free radicals, and H2O2/Fe(sup 2+)-diethylenetriaminepentaacetic acid (DTPA), which does, on the mutation frequency of pZ189 transfected into monkey kidney CV-1 cells. Treatment with 1.5 mM KMnO4 increased the content of certain modified bases, principally Thy and Cyt modified at C-5 and C-6, by up to 300-fold, as measured by GC/MS; however, the mutation frequency increased only 5-fold above background. 1.0 mM H2O2/0.1 mM Fe(sup 2+)-DTPA treatment, which increased the mutation frequency 10-fold above background, increased the content of certain modified bases by up to 4-fold. Sequence analysis revealed both deletions and point mutations, with a predominance of C-G substitutions, among H2O2/Fe(sup 2+)-DTPA-associated mutations. These data suggest that KMnO4-modified DNA is only weakly mutagenic in DNA replicating in mammalian nuclei, despite substantial production of Thy glycol and other base modifications, whereas H2O2/Fe(sup 2+)-DTPA-modified DNA is more mutagenic. H2O2/Fe(sup 2+)-DTPA generated mutations occur predominantly at C-G base pairs.

201,132
PB92-144963 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Biotechnology Div.
Nickel(II)- and Cobalt(II)-Dependent Damage by Hydrogen Peroxide to the DNA Bases in Isolated Human Chromatin.
Final rept.
Z. Nackerdien, K. S. Kasprzak, G. Rao, B. Halliwel, and M. Dizdaroglu. 1991, 6p
See also PB91-187526.
Pub. in Cancer Research 51, p5837-5842, 1 Nov 91.

Keywords: *Toxicity, *Nickel, *Cobalt, *Hydrogen peroxide, *DNA damage, *Chromatin, Humans, Free radicals, Glutathione, Superoxide dismutase, Mass fragmentography, Mutagens, Carcinogens, Reprints.

Nickel compounds are known to be carcinogenic to humans and animals. Cobalt compounds produce tumors in animals and are probably carcinogenic to humans. The mechanisms of the carcinogenicity of these metal compounds, however, have remained elusive. In the present work, the authors have investigated the ability of Ni(II) and Co(II) ions in the presence of H2O2 to cause chemical changes in DNA bases in chromatin extracted from cultured cells of human origin. DNA damage in chromatin caused by Ni(II) and Co(II) ions in the presence of H2O2 may contribute to the established genotoxicity and carcinogenicity of these metal ions.

201,133
PB92-144971 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD.
Chemical Nature of DNA-Protein Cross-Links Produced in Mammalian Chromatin by Hydrogen Peroxide in the Presence of Iron or Copper Ions.
Final rept.
Z. Nackerdien, G. Rao, M. A. Cacciuttolo, E. Gajewski, and M. Dizdaroglu. 1991, 7p
See also PB91-187484.
Pub. in Biochemistry 30, n20 p4873-4879 1991.

Keywords: *DNA-binding proteins, *Crosslinking, *Chromatin, *Hydrogen peroxide, *Iron, *Copper, *Toxicity, Mass fragmentography, Mammals, Hydrolysis, Superoxide dismutase, Reprints.

A study reports on the elucidation of DNA-protein cross-links formed in isolated mammalian chromatin upon treatment with H2O2 in the presence of iron or copper ions. Analysis of chromatin samples by gas chromatography/mass spectrometry after hydrolysis and derivatization showed the presence of 3-((1,3-dihydro-2,4-dioxopyrimidin-5-yl)methyl)-L-tyrosine (thymine-tyrosine cross-link) on the basis of the gas chromatographic and mass spectrometric characteristics of the trimethylsilylated authentic compound. Other DNA-protein cross-links involving thymine and the aliphatic amino acids and cytosine and tyrosine, which were known to occur in nucleohistone gamma-irradiated under anoxic conditions, were not observed. This was due to inhibition by oxygen as clearly shown by experiments that were carried out using ionizing radiation under both oxic and anoxic conditions instead of using H2O2 and metal ions. However, oxygen did not inhibit formation of the thymine-tyrosine cross-link in gamma-irradiated chromatin or in chromatin treated with H2O2 and metal ions. The yield of the thymine-tyrosine cross-link was higher upon treatment with H2O2/chelated Fe(sup 3+) ions than with H2O2/unchelated Fe(sup 3+) ions. By contrast, H2O2/unchelated Cu(sup 2+) ions produced a higher yield than H2O2/chelated Cu(sup 2+) ions. Almost complete inhibition of cross-link formation was provided by the hydroxyl radical scavengers mannitol and dimethyl sulfoxide when H2O2/chelated metal ions were used.

201,134
PB92-192087
(Order as PB92-192079, PC **A05**)
National Inst. of Standards and Technology, Gaithersburg, MD.
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.
B. C. Levin, Y. Alarie, M. F. Stock, and S. B. Schiller. 1992, 8p
Prepared in cooperation with University of Pittsburgh, PA.
Included in Jnl. of Research of the National Institute of Standards and Technology, v97 n2 p245-252 Mar/Apr 92.

Keywords: *Combustion products, *Smoke, *Toxicity, *Standards, Building materials, Respiration, Calibration, *Standard reference materials, Nylon 6/6, University of Pittsburgh, Building fires.

A standard reference material (SRM 1049) has been developed for the University of Pittsburgh smoke toxicity method. SRM 1049 is a nylon 6/6 and has the molecular structure of (-NH(CH2)6NHCO(CH2)4CO-)n. The SRM is for calibrating the apparatus and providing confidence that the method is being conducted in a correct manner and that the equipment is functioning properly. The certified figure of merit is a LC(50) value plus its 95% prediction interval which were calculated and found to be 4.4+3.4 g. The 95% prediction interval indicates the range in which the next determined LC(50) value would be expected to fall. Thus, if an investigator were to test the SRM under their laboratory conditions according to the specifications of the University of Pittsburgh test procedure and found the LC(50) value fell within the certified 95% prediction interval, the probability is good that the test is being conducted correctly.

Zoology

201,135
PB92-144179 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Organic Analytical Research Div.
Alaskan Marine Mammal Tissue Archival Project.
Final rept.
P. R. Becker, B. J. Koster, S. A. Wise, and R. Zeisler. 1990, 6p
See also PB88-199732.
Pub. in Biological Trace Element Research 26-27, p329-334 Jul 90.

Keywords: *Mammals, *Aquatic animals, *Tissues(Biology), Alaska, Liver, Kidney, Muscles, Adipose 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 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 summarized. Instrumental neutron activation analysis has been used for an initial evaluation of trace element content in samples of northern fur seal (Callorhinus ursinus) from the Pribilov Islands. The findings agree with previously observed trace element levels. The banked samples can be used in future studies when comparison to the present levels of pollutants is needed.

MILITARY SCIENCES

Logistics, Military Facilities, & Supplies

201,136
PB92-181122 PC **A03**/MF **A01**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
Overview of the Document Style Semantics and Specification Language and the MIL-M-28001A Output Specification.
R. B. Wilson. Mar 92, 17p NISTIR-4800

Keywords: Comparison, Standards, Documents, Specifications, Semantics, Data processing, Input output processing, Format, Translators, *CALS, *DSSSL(Document Style Semantics and Specification Language), *OS(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 each standard's capabilities 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 PC **A07**/MF **A02**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Information Systems Engineering Div.
Procedures Manual for Testing CGM Generator Products That Claim Conformance to FIPS 128 and MIL-D-28003.
Rept. for Jan 90-Dec 92.
D. R. Benigni. Mar 92, 137p NISTIR-4806
See also PB90-228016. 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, Logistics 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 suite that tests both the CGM standard (FIPS 128) and the CGM Application Profile for the Computer-aided Acquisition and Logistics Support (CALS) (MIL-D-28003) must test three things: metafiles, generators, and interpreters. The National Institute of Standards and Technology (NIST) has developed a test tool for testing metafiles, and 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 PC **A03**/MF **A01**
National Inst. of Standards and Technology (NCTL), Gaithersburg, MD. Office Systems Engineering Group.
Next Generation Documents.
R. B. Wilson, and R. F. Sies. Apr 92, 20p NISTIR-4830
See also PB91-187773.

Keywords: *Documentation, *Standards, Computer program portability, Applications programs(Computers), Computer systems programs, Interfaces, Data management, Man computer interface, Requirements, Procurement, *CALS, *NGD(Next Generation Documents), OSE(Open Systems Environment), POSIX(Portable Operating System Interface for Computer Environments), GOSIP(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.

201,139
PB92-191238 PC **A03**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
Development Plan: STEP Conformance Testing Service. National PDES Testbed Report Series.
S. J. Kemmerer. Aug 91, 43p NISTIR-4641
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 Acquisition and Logistic Support (CALS) Program. A major goal of the National PDES Testbed is to provide technical leadership in a national effort to implement a complete and useful standard for the exchange of product data. This standard must be designed to meet the needs of American industry and the CALS Program.

201,140
PB92-196070 PC **A04**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
Raster Graphics Validation.
F. E. Spielman. May 92, 65p NISTIR-4848
Sponsored by Assistant Secretary of Defense (Production and Logistics), Washington, DC. Computer-aided Acquisition and Logistic Support Program.

Keywords: *Tests, *Standards, Federal information processing standards, Computer graphics, Requirements, Specifications, Policies, Computer systems programs, Computer software, Forms(Paper), Instructions, *CALS, *Roster graphics, National Institute of Standards and Technology, Department of Defense, Conformance testing.

The publication describes the guidelines for establishing and managing raster graphics validations which include both conformance testing and the issuing of a certificate of validation. Raster graphics validation supports the National Institute of Standards and Technology (NIST) initiative to validate products professing to support Federal Information Processing Standard (FIPS) Publication 150, Planned FIPS (ODA Raster DAP), Department of Defense (DoD) Military Standard MIL-STD-1840, and DoD Specification 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 testing system software and procedure 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.

201,141
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. Q. Sherrick. Jul 92, 25p NISTIR-4876
See also PB90-154774.

Keywords: *Computer graphics, *Man computer interface, Specifications, Interactive graphics, Applications programs(Computers), Computer program portability, Standards, Recommendations, *CALS, *CITIS(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 GUI be used within the Contractor 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 Program, Application User Interface, or Application Programmer's Interface (API). One of the major problems with GUIs is the potential lack of portability of an application developed to run using 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.

201,142
PB92-213503 PC **A04**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
Requirements and Recommendations for STEP Conformance Testing. National PDES Testbed Report Series (Revised).
S. J. Kemmerer. Jun 92, 59p NISTIR-4743-REV
See also PB91-107177, PB92-158294 and PB92-191238. Sponsored by CALS Evaluation and Integration Office, Washington, DC.

Keywords: *Product inspection, Computer aided design, Computer aided manufacturing, Standards, Tests, Evaluation, Technology transfer, Recommendations, *CALS, *STEP(Standard for the Exchange of Product Model Data), *Conformance testing, ITI(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 presented draws from the Industrial Technology Institute's (ITI's) past conformance testing experience in order 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 major 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 AV **E99**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
CALS: A Strategy for Change (English Version, 1/2 inch, VHS Format) (Video).
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 VHS format (German language), and PB92-780980, 1/2 inch PAL format (German language). See also PB92-780923.

Keywords: *Weapon systems, *Computer aided design, *Computer aided manufacturing, Product development, Maintenance, Digital data, Data bases, Standards, Data processing, Video tapes, *Audio visual, *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 by means of 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.

201,144
PB92-780949 AV **E99**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
CALS: A Strategy for Change (English Version, 3/4 inch, PAL Format) (Video).
Audio-Visual.
Dec 89, 1 VHS video
Also available as PB92-780931, 1/2 inch VHS 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 VHS format (German lnaguage); and PB92-780980, 1/2 inch PAL format (German language). See also PB92-780923.

Keywords: *Weapon systems, *Computer aided design, *Computer aided manufacturing, Product development, Maintenance, Digital data, Data bases, Standards, Data processing, Video tapes, *Audio visual, *CALS, National Institute of Standards and Technology.

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201,145
PB92-780956 AV **E99**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
CALS: A Strategy for Change (French 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); PB92-780964, 3/4 inch PAL format (French language); PB92-780972, 1/2 inch VHS format (German language); and PB92-780980, 1/2 inch PAL format (German language). See also PB92-780923.

Keywords: *Weapon 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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201,146
PB92-780964 AV **E99**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
CALS: A Strategy for Change (French Version, 3/4 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); PB92-780972, 1/2 inch VHS format (German language); and PB92-780980, 1/2 inch PAL format (German language). See also PB92-780923.

Keywords: *Weapon 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 by means of 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 3/4 inch videotape is in PAL format.

201,147
PB92-780972 AV **E99**
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); PB92-780964, 3/4 inch PAL format (French language); and PB92-780980, 1/2 inch PAL format (German language). See also PB92-780923.

Keywords: *Weapon 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 by means of 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 VHS format.

201,148
PB92-780980 AV **E99**
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 VHS format (German language). See also PB92-780923.

Keywords: *Weapon 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 by means of 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.

201,149
PB93-113603 PC **A04**/MF **A01**
National Inst. of Standards and Technology (MEL), Gaithersburg, MD.
Status Report for Second Quarter FY92 (January 1 through March 31, 1992). National PDES Testbed Report Series.
Status rept.
H. M. Bloom. 9 Oct 92, 68p NISTIR-4914
See also PB92-172758. Sponsored by CALS Evaluation and Integration Office, Washington, DC.

Keywords: *Tests, Configuration management, Protocol, Technology transfer, Computer aided design, Computer aided manufacturing, *CALS, *PDES(Product Data Exchange using STEP), STEP(STandard for the Exchange of Product Model Data).

An emerging information standard will make products more affordable to develop, manufacture, and maintain. The standard is STEP (STandard for the Exchange of Product Model Data). U.S. development efforts are collectively called PDES (Product Data Exchange using STEP). Much of STEP is being tested at the National Institute of Standards and Technology (NIST), in the National PDES Testbed. The status report-the second in a series-summarizes the activities of the Testbed during the second quarter of the U.S. Government's 1992 fiscal year (2O92). The quarter ran from 01 January through 31 March 1992. The purpose of the report is to inform the Computer-aided Acquisition and Logistic Support (CALS). Evaluation and Integration Office (CEIO), of the Testbed's 2Q92 accomplishments. For convenience, the technical status sections (2.0 through 5.0) correspond with the Testbed's FY92 Statement of Work. While technology transfer is addressed throughout these sections, Section 6.0 describes how Testbed personnel have conveyed the importance of product data standards to Governmental and industrial decisionmakers.

201,150
PB93-113637 PC **A04**/MF **A01**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Information Systems Engineering Div.
Database Language SQL: Integrator of CALS Data Repositories.
L. Gallagher, and J. Sullivan. Sep 92, 64p NISTIR-4902
Sponsored by Office of the Deputy Assistant Secretary of Defense for Total Quality Management, Washington, DC.

Keywords: *Data management, Object-oriented programming, Data bases, Federal information processing standards, Tests, *CALS, *SOL database language, RDA(Remote Database Access), ANSI(American National Standards Institute), GOSIP(Government Open Systems Interconnection Profile), ISO(International Organization for Standardization).

The Computer-aided Acquisition and Logistic Support (CALS) program of the U.S. Department of Defense requires a logically integrated database of diverse data. Previous reports to CALS have identified the importance of Database Language SOL and its distributed processing counterpart, Remote Database Access (RDA), for their ability to address a significant portion of CALS data management requirements. The report presents the new 'Object SOL' facilities proposed for inclusion in SOL3, introduces SQL abstract data types (ADTs), discusses the benefits of 'generic ADT packages' for management of application specific objects, and proposes a new external repository interface (ERI) that would allow integration of heterogenous, non-SOL data repositories. The appendices give the current status and applicability of national, international, and Federal standards for SQL and RDA, discuss the availability of conforming implementations, and present the status of the National Institute of Standards and Technology (NIST) SOL and RDA validation testing.

201,151
PB93-120764 PC **A03**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
Transformr: A Prototype STEP Exchange File Migration Tool.
S. N. Clark. Oct 92, 16p NISTIR-4944
Sponsored by Assistant Secretary of Defense (Production and Logistics), Washington, DC. Computer-aided Acquisition and Logistic Support Program.

Keywords: *File maintenance, *Software tools, Prototypes, Data processing, File structures, *CALS, *STEP(Standard for the Exchange of Product Model Data), *PDES(Product Data Exchange using STEP), EXPRESS formal language, TCSL(Transformr Correspondence Specification Language), Computer-aided Acquisition and Logistics Support.

The paper is a User's Guide to the Transformr Standard for the Exchange of Product Model Data (STEP) exchange file translation tool. Transformr transforms STEP exchange files between successive versions of their underlying EXPRESS information models. The Transformr Correspondence Specification Language (TCSL), which is used to establish the mapping between these schema versions, is described. The usage of Transformr is also described.

201,152
PB93-120772 PC **A04**/MF **A01**
National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Office of Applied Economics.
Present Worth Factors for Life-Cycle Cost Studies in the Department of Defense (1993).
Final rept.
S. R. Petersen. Oct 92, 61p NISTIR-4942
Sponsored by Assistant Secretary of Defense (Production and Logistics), Washington, DC.

Keywords: *Life-cycle cost, *Military facilities, *Present worth, *Energy supplies, Tables(Data), Benefit cost analysis, Economic analysis, Return on investment, Cost engineering, Fuels, Energy conservation, *Military construction.

The document provides 45 tables of present worth factors to be used in computing the present worth of future costs (or cost reductions) in economic analyses of design decisions for projects in the DoD Military Construction Program. These factors are especially useful for the life-cycle cost analysis of investments in buildings or building systems which are intended to reduce future operating, maintenance, repair, replacement, and energy costs over the life of the facility. The tables include present worth factors for both one-time costs and annually recurring costs, based on the FEMP discount rate of 4.0% (FY 1993) for energy-related studies and on the OMB discount rate of 10.0% for non-energy studies. Forecasts of future energy prices used in the calculation of present worth factors for energy costs were provided by the Energy Information Administration.

201,153
PB93-125029 PC **A06**/MF **A02**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
Computer-Aided Acquisition and Logistic Support (CALS) Testing: Programs, Status, and Strategy.
S. J. Kemmerer. Oct 92, 110p NISTIR-4940

Keywords: *Tests, *Standards, Specifications, Standardization, Federal information processing standards, *CALS(Computer-aided Acquisition and Logistics Support), National Institute of Standards and Technology, Concurrent engineering, PDES(Product Data Exchange Using STEP), STEP(Standard for the Exchange of Product Model Data).

The report contains both tutorial information and issues associated with the various types of testing activities under the purview of the Computer-aided Acquisition and Support (CALS) initiative. It additionally provides general tutorial information about the various types of testing activities and associated terminology, and summarizes conformance testing activities for several national and international standards. The four primary testing activities discussed in the report are: standards testing, component testing, conformance testing, and acceptance testing. Because terminology is important for communicating in the testing community, an extensive glossary of terms has been added as an appendix.

NATURAL RESOURCES & EARTH SCIENCES

Cartography

201,154
PB92-158278 PC **A07**/MF **A02**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
Technology Integration Workshop: Selected Papers.
H. Tom. Oct 91, 150p NISTIR-4703

Keywords: *Geographic information systems, *Expert systems, *Meetings, Object-oriented programming, Data management, Artificial intelligence, Automatic mapping, Computer aided mapping.

The report contains selected summaries of technical presentations and demonstrations given at the National Institute of Standards and Technology (NIST) Geographic Information Systems (GIS) Standards Laboratory's Technology Integration Workshop held at NIST, Gaithersburg, Maryland on August 23-24, 1990. The Technology Integration Working Group was formed within the GIS Lab as a cooperative technology transfer vehicle to share advances being made in applying expert systems, object-oriented database technologies, and GIS to practical problems in spatial data management and cartographic portrayal. The Workshop focused upon demonstrations of work-in-progress prototypes 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
PB92-145259 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Inorganic Analytical Research Div.
Re-Os Isotope Systematics of Ni-Cu Sulfide Ores, Sudbury Igneous Complex, Ontario: Evidence for a Major Crustal Component.
Final rept.
R. J. Walker, J. W. Morgan, A. J. Naldrett, C. Li, and J. D. Fassett. 1991, 13p
Pub. in Earth and Planetary Science Letters 105, p416-428 1991.

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 Levack West, 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 give isochron ages of 1840 + or - 60 Ma, 1770 + or - 60 Ma and 1780 + or - 110 Ma, suggesting that the Re-Os system became closed at the time of, or soon after the 1850 + or - 1 Ma crystallization age of the complex. Heterogeneities require that 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
PB92-237528 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Use of Resonance Ionization Mass Spectrometry for Measuring the Isotopic Compositions of Rhenium and Osmium Extracted from Silicate Rocks.
Final rept.
R. J. Walker, J. D. Fassett, and J. C. Travis. 1988, 6p
Pub. in Proceedings of International Symposium (4th) on Resonance Ionization Spectroscopy and Its Applications, Gaithersburg, MD., April 10-15, 1988, p337-342 1989.

Keywords: *Silicate minerals, *Rhenium, *Osmium, *Mass spectroscopy, Isotope ratio, Sensitivity, Precision, Reprints, Geological samples, Resonance ionization mass spectroscopy.

Current resonance ionization mass spectrometry techniques used in the isotopic measurement 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.

Mineral Industries

201,157
PB92-144641 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Building Materials Div.

Mineral Industries

Temperature and Radiation of Diffusion Flames with Suppression.
Final rept.
J. P. Gore, D. D. Evans, and B. J. McCaffrey. 1991, 14p
Pub. in Combustion Science and Technology 77, p189-202 1991.

Keywords: *Diffusion flames, *Water injection, *Blowouts, *Fires, Combustible flow, Methane, Laminar flow, Gas wells, Fire fighting, Temperature measurement, Radiation, Reprints.

Temperature and radiation properties of 1-8 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 applicability of the analyses to the present flame scales. The results for flames with water addition indicate that finite rates of evaporation and separated flow effects need to be considered for accurate predictions at high water loading.

Natural Resource Management

201,158
PB93-113660 PC **A14**/MF **A03**
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Process Measurements Div.
Proceedings: Workshop on Federal Programs Involving Supercritical Water Oxidation. Held in Gaithersburg, Maryland on July 6-7, 1992.
G. J. Rosasco. Sep 92, 308p NISTIR-4920

Keywords: *Oxidation, *Chemical reactions, *Water supply, *Meetings, Nitrogen, 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
PB92-205400 PC **A03**/MF **A01**
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Gradiometer Antennas for Tunnel Detection.
D. A. Hill. Jun 92, 38p NISTIR-3990
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 empty tunnels is analyzed. For reception in vertical boreholes, the gradiometer consists of two vertical electric or magnetic dipoles with a vertical separation. Both 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.

NUCLEAR SCIENCE & TECHNOLOGY

Nuclear Instrumentation

201,160
AD-A250 776/2 PC **A10**/MF **A03**
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.
Methodology Investigation Nuclear Radiation Metrology Methods. Phase 1.
Final rept. Oct 88-Sep 89.
H. Heaton, K. G. Inn, W. L. McLaughlin, and B. M. Coursey. May 92, 215p

Keywords: *Metrology, *Radiation measuring instruments, Calibration, Control, Facilities, Instrumentation, Libraries, Nuclear radiation, Operation, Quality assurance, Quality control, Resources, Standards, Test and evaluation, Training, Methodology investigation, Nuclear radiation metrology, RADIAC, Quality assurance, Training, Calibration, Library Resources.

The objective of this investigation was to assess the ability of USAEPG to perform required RADIAC testing using currently recognized standards of performance and quality assurance, and to recommend actions which will lead to improved methodology, i.e., capabilities, test procedures, and quality assurance. To this end, the authors of this Phase I report have reviewed USAEPG RADIAC facilities, procedures, personnel training, staffing, library resources, and other resources. They present their findings, which include recommendations for improved procedures, quality control, documentation, professional contacts, library and other resources, training, peer review, and instrumentation. They found locally available library resources to be wholly inadequate to support current and future missions, and comment also on the professional isolation of the RADIAC staff. Appendices include: (1) an extensive list of books, reports, and periodicals deemed necessary to support USAEPG RADIAC missions; (2) 'Criteria for operation of Federally-owned Calibration Laboratories (Ionizing Radiation)'; and (3) an extensive presentation on RADIAC calibration technology.

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.
K. G. W. Inn, B. M. Coursey, E. H. Eisenhower, M. D. Walker, H. T. Heaton, and K. C. Duvall. 1992, 10p
Pub. in Jnl. of Radioanalytical and Nuclear Chemistry 156, n2 p313-322 1992.

Keywords: *Ionizing radiation, Quality assurance, Radiation protection, Personnel dosimetry, 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 testing to support and affirm the caliber 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.
E. H. Eisenhower. 1989, 3p
Pub. in Health Physics Society's Newsletter XVII, n6 p1 and 3-4, Jun 89.

Keywords: *Radiation protection, Health physics, Radiation doses, 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 (NCRPM) to double the present value of neutron quality factor. Reasons why the recommendations have not been adopted are examined, principally the failure by the ICRP and NCRP to adhere to earlier definitions of standard radiation. The undesirable impact of that lack of adherence on the present system of radiation protection is identified. That impact can be avoided if experimental data are properly normalized. The adjustments required for adoption of a new standard radiation 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**/MF **A02**
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Evaluation and Compilation of DOE Waste Package Test Data. Biannual Report: February 1989-July 1989.
Technical rept.
C. G. Interrante, A. C. Fraker, and E. Escalante. Dec 91, 130p NUREG-CR-4735-V7
Grant NRC-FIN-A4171
Also available from Supt. of Docs. See also NUREG/CR-4735-V6. Sponsored by Nuclear Regulatory Commission, Washington, DC. Office of Nuclear Material Safety and Safeguards.

Keywords: *Radioactive waste disposal, *High-level radioactive wastes, *Packaging, Radioactive waste storage, Borosilicate glass, Waste forms, Vitrification, Leaching, Test methods, Corrosion, Crack propagation, Environmental transport, Austenitic stainless steel, Spent fuel, Cladding, Yucca Mountain project, Nevada disposal sites.

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. Outlines for planned interpretative reports on the topics of aqueous corrosion of copper, mechanisms of stress corrosion cracking and internal failure modes of Zircaloy cladding are included. For the publications reviewed during this reporting period, short 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. Metallurgy Div.

Review Process and a Database for Waste-Package Documents.
Final rept.
C. Interrante, C. Messina, and A. Fraker. 1991, 6p
Contract NRC-A4171-0
Sponsored by Nuclear Regulatory Commission, Washington, DC.
Pub. in Materials Research Society Symposium Proceedings, v212 p917-922 1991.

Keywords: *High-level radioactive wastes, *Radioactive waste storage, *Information systems, Data base management, Reviews, US NRC, Long term effects, Radioisotopes, Containment systems, Reprints.

The work reported here is part of a program conducted by the Nuclear Regulatory Commission on the efficacy 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 evaluation of available literature on components of a waste package. A review process and a database have been developed and tailored to provide information 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 containment. Additions to the database are made as information becomes available, and this source is as current 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.
Reactor Radiation. Technical Activities, 1991. NAS-NRC Assessment Panel, February 13-14, 1992.
H. J. Prask. Nov 91, 65p NISTIR-4698
See also PB88-141379.

Keywords: *NBSR reactor, *Research reactors, *Research projects, *Nondestructive tests, *Neutron activation analysis, Cold neutrons, Standards, Irradiation, Characterization, Radioisotopes, Trace amounts, Neutron radiography, Neutron diffraction, Crystal structure, Neutron fluence, Measurement, Calibrating, Residual stress, Texture, US NBS, Microanalysis, US NIST, Molecular dynamics.

The responsibilities of the Reactor Radiation Division are threefold: to operate the research reactor (NBSR) 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 instrumentation to ensure the best utilization of the NBSR neutron scattering facilities; and to develop and operate the Cold Neutron Research Facility (CNRF) as a National center, providing unique measurement capabilities to U.S. researchers. The techniques include nuclear methods for chemical analysis, neutron diffraction and scattering for the characterization of microstructure and dynamics of materials (e.g., hydrogen in metals, polymers, layered materials, surfaces and interfaces, ceramics, alloys, amorphous materials, micelles, microporous materials, and buckminsterfullerene) neturon diffraction metods for determination of residual stress and texture, neutron radiography for the non-destructive examination of large components, neturon autorafiography 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 echnical activities of the Reactor Radiation Division from October 1,1990 through September 30, 1991. A detailed report on work performed at the NIST reactor is available in a NIST Technical Note entitled 'NIST Reactor: Summary of Activities July 1990 through June 1991'.

201,166
PB92-187053 PC **A04**/MF **A01**
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Use of Time-Domain Dielectric Spectroscopy to Evaluate the Lifetime of Nuclear Power Station Cables.
Final rept. 1989-91.
F. I. Mopsik. Apr 92, 52p NISTIR-4486
See also NUREG/CR-4091 and PB84-220946. Sponsored by Nuclear Regulatory Commission, Washington, 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 lifetime of electrical insulation in a nuclear power plant is assessed. The factors governing dielectric constant and loss over an extended frequency range are summarized. The Time-Domain Spectrometer is shown to be suitable for the task, given the changes expected in an insulator upon exposure to radiation 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 results are reported. It is shown that for the hydrocarbon based insulation studied, with the aging conditions used, a characteristic loss region centered near 10 Hz at 50C is radiation induced and follows dose. The loss seems to be a good marker for radiation exposure and history, 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 lifetime assessment with further research. Comparison is made with some mechanical measurements that illustrate the enhanced sensitivity of dielectric measurements.

201,167
PB92-222744 PC **A07**/MF **A02**
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
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 Brunt. Jul 92, 145p NISTIR-4487
Contract NRC-RES-91-001
Sponsored by Nuclear Regulatory Commission, Washington, DC.

Keywords: *Signal analysis, *Nuclear power plants, *Electric wire, Safety engineering, Defects, Mechanical properties, Mathematical models, Electrical insulation, Electric discharges, Detection, Electrical measurement, Cables, Aging, *Partial discharge signal analysis.

As one of the objectives of a program aimed at assessing test methods for in-situ detection of incipient defects in cables due to aging, a laboratory test system was implemented to demonstrate that the partial discharge analysis method can be successfully applied to low-voltage cables. Previous investigations generally involved cables rated 5 kV or higher, while the objective of the program focused on the lower voltages associated with the safety systems of nuclear power plants. The defect detection system implemented for the project was based on commercially available signal analysis hardware and software packages, customized for the specific purposes of the project. The test specimens included several cables of the type found in nuclear power plants, including artificial defects introduced at various points of the cable. The results indicate that indeed, partial discharge analysis is capable of detecting incipient defects in low-voltage cables. There are, however, some limitations of technical and non-technical nature that need further exploration before this method can be accepted in the industry.

201,168
PB93-113694 PC **A04**/MF **A01**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD.
Software Quality Assurance: Documentation and Reviews.
D. R. Wallace, W. W. Peng, and L. M. Ippolito. Sep 92, 61p NISTIR-4909

Keywords: *Nuclear power plants, *Computer applications, *Computer program verification, Computer software, Quality assurance, Safety engineering, Configuration management, Software engineering, Requirements, Project management.

The study examines the contents of a software quality assurance standard for nuclear applications. The study includes recommendations for the documentation of software systems. Background information on the standard, documentation, and the review process is provided. The report includes an analysis of the applicability, content, and omissions of the standard and 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 evaluation 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 (CSL), Gaithersburg, MD.
High Integrity Software Standards and Guidelines.
Special pub. (Final).
D. R. Wallace, L. M. Ippolito, and D. R. Kuhn. Sep 92, 107p NIST/SP-500/204, NUREG/CR-5930
Contract NRC-RES-91-003
Also available from Supt. of Docs. as SN003-003-03171-2. Sponsored by Nuclear Regulatory Commission, Washington, DC.

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 hereafter be referred to as documents) that provide requirements for the assurance of software in safety systems in nuclear power plants. The study focused on identifying the attributes necessary in a standard for providing reasonable assurance for software in nuclear systems. The study addressed some issues involved in demonstrating conformance to a standard. The documents vary widely in their requirements and the precision with which the requirements are expressed. Recommendations are provided for guidance for the assurance of high integrity software. It is recommended that a nuclear industry standard be developed based on the documents reviewed in this study with additional attention to the concerns identified in this report.

201,170
PB93-116382 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Practical Applications of Nuclear Research Reactors.
Special pub. (Final).
B. Hammouda. Sep 92, 49p NIST-SP-844
Also available from Supt. of Docs as SN003-003-03178-0.

Keywords: *Research reactors, Neutron activation analysis, Neutron scattering, Neutron radiography, Neutron capture therapy, Neutron irradiation, Radiation effects, Radioisotopes, 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 introductory nuclear physics notions only (elementary particles, elements of the periodic table, etc.). The intent, here, is to introduce the reader to the various practical uses of nuclear reactors with no attempt for thoroughness. Section headings are as follows: Neutron Activation Analysis, Radioisotopes Applications; Co-60 Applications; Neutron Interrogation; Neutron Processing/Radiation Effects; Neutron Scattering.

Reactor Physics

201,171
PB92-145077 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Status of Research Reactor Instrumentation in the USA.
Final rept.
J. M. Rowe, and H. J. Prask. 1991, 9p
Pub. in Physica B 174, p421-429 1991.

Keywords: *Research reactors, *Reactor instrumentation, MURR reactor, HFBR reactor, HFIR reactor, NBSR 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 NBSR 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
PB92-159920 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Existing Cold Sources at U.S. Reactors.
Final rept.
J. M. Rowe, and D. C. Rorer. 1991, 10p
Sponsored by Brookhaven National Lab., Upton, NY.
Pub. in Proceedings of International Workshop on Cold Neutron Sources, Los Alamos, NM., March 5-8, 1990, p121-130 1991.

Keywords: *NBSR 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 Brookhaven National Laboratory (BNL) and the Neutron Beam Split-core Reactor (NBSR) at the National Institute of Standards and Technology (NIST). These two sources are of different design than those installed in European reactors, reflecting design constraints imposed both by the regulatory environment and by the sealed vessel design of the reactors themselves.

OCEAN TECHNOLOGY & ENGINEERING

Marine Engineering

201,173
PB92-213354 PC **A03**/MF **A01**
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Unmanned Systems Group.
Submarine Simulator Driven by a Hierarchical Real-Time Control System Architecture.
Rept. for Nov 90-Mar 92.
H. M. Huang, R. Hira, and P. Feldman. Jul 92, 16p
NISTIR-4875
Contract ARPA-7829
Prepared in cooperation with Advanced Technology and Research, Inc., Laurel, MD. Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.

Keywords: *Submarines, *Automation, *Computerized simulation, Real time systems, Control systems design, Hierarchies, Robotics, Neural nets, Computer animation, Feedback control, Computer software.

The Robot Systems Division (RSD) at the National Institute of Standards and Technology (NIST) has been developing a generic reference model architecture for intelligent control, known as the Real-time Control System (RCS), for the last two decades. Much of the previous work has been in the area of industrial robots and autonomous vehicles, which led to the understanding that simulation and animation are an integral part of control system design. The paper illustrates the use of simulation and animation in an RCS design for submarine automation. The automation of submarine operations involves complex system functionalities and requires an enormous amount of intelligence to be built into the software to enable a submarine to operate in an unstructured and often hostile environment semi-autonomously. Visualization provides the designer immediate feedback of his or her design. The paper describes an example of fusing simulation and animation with RCS.

General

201,174
PB92-171677 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Office of Standard Reference Data.
Computerized Materials Property Data Systems.
Final rept.
J. Rumble, and D. B. Anderson. 1989, 4p
See also PB89-187512.
Pub. in Sea Technology 30, n6 p42-45 1989.

Keywords: *Marine engineering, *Materials specifications, *Information systems, Sea water corrosion, Corrosion fatigue, Mechanical properties, Failure, Databases, Standards, Computer networks, Reprints.

The harsh marine environment has always demanded care in the selection of materials for structures and other purposes. The choice of materials is complicated by the enhancement of mechanical failures by corrosion. Not only are data such as corrosion fatigue scarce, locating the available data can be very difficult. The computer offers an opportunity to allow easy and efficient access to technical data. The article describes many activities to take advantage of these opportunities.

201,175
PB92-183748 • PC **A11**/MF **A03**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Reliability of Offshore Operations: Proceedings of an International Workshop. Held in Gaithersburg, Maryland on March 20-22, 1991.
Special pub. (Final).
E. Simiu. Apr 92, 241p NIST/SP-833
Also available from Supt. of Docs. as SN003-003-03148-8. Sponsored by Minerals Management Service, Herndon, VA., Canada Oil and Gas Lands Administration, Vanier (Ontario), Health and Safety Executive, London (England), and American Society of Civil Engineers, New York.

Keywords: *Meetings, *Offshore drilling, *Risk assessment, *Gas production, *Oil recovery, Occupational safety and health, Oil pollution, Case studies, Data bases, Energy source development, Pipelines, Resource conservation, Offshore platforms, Marine surveys, United States, Safety, Environmental protection, Water pollution control, Regulations, Foreign technology.

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 papers on current practice 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 Practices; (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.

201,176
PB93-129278 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Structures Div.
Reliability of Complaint Drilling and Production Platforms.
Final rept.
E. Simiu. 1986, 7p
Sponsored by Minerals Management Service, Reston, VA.
Pub. in Technology Assessment and Research Program for Offshore Minerals Operations, 1986 Report, OCS Study MMS 86-0083, p9-15.

Keywords: *Offshore structures, *Reliability, *Risk assessment, *Structural analysis, Ocean waves, Wind pressure, Loads(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 Compliant 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 nonprofessionals. Also described in the article are investigations currently underway at NBS.

ORDNANCE

Ammunition, Explosives, & Pyrotechnics

201,177
PB93-125938 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Organic Analytical Research Div.
Microanalysis of Explosives and Propellants by On-Line Supercritical Fluid Extraction/Chromatography with Triple Detection.
Final rept.
A. Munder, R. G. Christensen, and S. A. Wise. 1991, 14p
Pub. in J. Microcolumn Separations 3, n2 p127-140 1991.

Keywords: *Propellants, *Explosives, *Liquid chromatography, *Microanalysis, Chemical analysis, Detectors, Sampling, Colorimetry, Spectroscopic analysis, Chemical tests, Reprints.

A compact analytical instrument is described which allows microsamples to be extracted 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 and sensitivity for selected species, three different detectors (UV absorption, flame ionization and electron capture) were all connected on-line. This analytical fluid chromatograph 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 firearm propellants were characterized through their extractable organic constituents, and the usefulness of such characterization in forensic investigations is discussed.

Combat Vehicles

201,178
PB92-172808 PC **A03**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Preliminary Report on Proposed Baffled Noise Abatement Structure.
F. Y. Yokel, and L. Knab. Feb 92, 33p NISTIR-4479
Sponsored by Construction Engineering Research Lab. (Army), Champaign, IL.

Keywords: *Noise reduction, *Tanks(Vehicles), *Military facilities, Acoustic measurement, Mufflers, Acoustic absorption, Military vehicles, Test facilities, Mathematical models, Attenuation, Sound transmission, Artillery, Baffles.

A preliminary concept for an artillery noise abatement structure is presented. The structure is a sand-covered oval corrugated steel arch structure with transverse baffles and is designed to act like a reactive muffler. The structure can accommodate a battle tank and provides clearance for target practice. The results of an acoustical 1/200 scale model test by the Georgia Institute of Technology are presented and assessed, together with available full scale test data from other types of artillery mufflers. It is concluded that the data from the model test and other available information are encouraging enough to justify the continuation of the study of a baffled tunnel structure.

PHOTOGRAPHY & RECORDING DEVICES

Photographic Techniques & Equipment

201,179
PB92-171487 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Precision Engineering Div.
Computer-Generated Holography Using a Personal Computer.
Final rept.
O. A. Manuar, A. B. Kiely, and T. R. Lettieri. 1988, 4p
Pub. in Proceedings of SPSE Annual Conference (41st), Arlington, VA., May 22-26, 1988, 4p.

Keywords: *Holography, *Computer applications, Personal computers, Photography, Lasers, Fourier transformation, Diffraction, Reprints.

The presentation concerns the application of a personal computer (PC) to the calculation of Fourier transform holograms. To calculate a hologram, an object was first modeled by line segments positioned at various locations in the object plane and oriented at discrete angles. The far-field diffraction pattern of such an object is then simply a summation of sinc functions. Next, using a high-level language program, a discrete transform of each segment was calculated. By exploiting certain symmetries and limiting the choice of angles, each segment could be processed in less than eight sec. The complete hologram, a summation of the individual transforms, consisted of 76X76 cells, each corresponding to a sampled point in the Fourier transform plane. Amplitude and phase information at these points was represented using the binary detour phase technique (Lohmann's method) via a laser printer. In the final step, the printed output was photographically reduced by about 10:1 onto high contrast 35 mm slide film. Optically reconstructed real images from these PC-generated holograms exhibited several diffraction orders due to the modest oversampling of the Fourier transforms.

201,180
PB93-125615 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Precision Engineering Div.
Efficient Algorithm for 3-D Computer Holography.
Final rept.
O. A. Manuar, A. B. Kiely, and T. R. Lettieri. 1989, 4p
Pub. in Proceedings of SPSE's Annual Conference (42nd), Boston, MA., May 14-19, 1989, p40-43.

Keywords: *Holography, *Computer applications, *Algorithms, Holograms, Three dimensional models, Fourier transformation, Images, Photography, Reprints.

The paper describes an algorithm which efficiently calculates computer-generated holograms (CGHs) of 3-D objects composed of planar (2-D) objects spaced along the optical axis. The planar objects themselves are composed of line segments. To calculate a CGH, the Fourier transform of each line segment in the object is calculated independently; the final hologram is a summation of these individual transforms. The transforms for each plane in the 3-D object includes its own radially varying quadratic phase factor in order to account for the position of the plane along the optical axis. Throughout the algorithm, several mathematical simplifications are used to reduce the number of computations so that the program will run more efficiently. After encoding the amplitude and phase information using a modification of the binary detour phase technique, the CGH is laser printed and then photographed onto 35-mm slide film. To reconstruct the 3-D holographic images, a weakly focused laser beam is transmitted through the CGH, and 2-D real images form at different places along the optical axis.

PHYSICS

Acoustics

201,181
PB92-175975 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Spherical-Wave Expansions of Piston-Radiator Fields.
Final rept.
R. C. Wittmann, and A. D. Yaghjian. 1991, 9p
Pub. in Jnl. of the Acoustical Society of America 90, n3 p1647-1655 Sep 91.

Keywords: *Acoustic fields, Spherical waves, Near field, Half spaces, Computation, Reprints, Piston radiators.

Simple spherical-wave expansions of the continuous-wave fields of a circular piston radiator in a rigid baffle are derived. These expansions are valid throughout the illuminated half-space and are useful for efficient numerical computation in the near-field region. Multipole coefficients 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.
NIST Measurement Services: NIST Leak Calibration Service.
Special pub. (Final).
C. D. Ehrlich, and S. A. Tison. Jan 92, 92p NIST/SP-250/38
Also available from Supt. of Docs. as SN003-003-03130-5. See also PB89-193841, PB88-152418 and PB91-147272.

Keywords: *Leakage, *Calibration, Primary standards, Temperature dependence, High vacuum, Gas flow, Flowmeters, Helium, Leak calibration service, Leak standards program, US NIST.

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 Comparator System are discussed in detail. Important properties of helium permeation leaks, especially the temperature 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 Installation Effects with Emphasis on the Research Period February-December 1990: TEE, Used as an Elbow Configuration.
G. E. Mattingly, and T. T. Yeh. Jan 92, 61p NISTIR-4753
See also PB90-221847 and PB92-149855.

Keywords: *Flowmeters, *Pipe flow, Flow measurement, Turbulence, Pipelines, Research programs, Orifice meters, Velocity distribution, Mathematical models, Orifices, Pipes(Tubes).

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 that meets twice yearly to review and discuss 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 quantify the salient features of non-ideal pipe flows from such pipeline elements as elbows, reducers, valves, flow conditioners, etc. or combinations of these, (2) correlate meter-factor shifts for 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.

201,184
PB92-149855 PC **A03**/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 Installation Effects with Emphasis on the Research Period May 1989-February 1990: Tube Bundle Effects.
G. E. Mattingly, and T. T. Yeh. Dec 91, 48p NISTIR-4751
See also PB92-149848.

Keywords: *Flow meters, *Pipe flow, Turbulence, Flow measurement, Pipelines, Research programs, Orifice meters, Mathematical models, Velocity distribution, Orifices, Pipes(Tubes).

The report presents results produced in a consortium-sponsored research program on flowmeter installation effects. The project is a collaborative one that has been underway for four years; it is supported by an industry-government consortium that meets twice yearly to review and discuss results and to plan subsequent phases of the work. The report contains the results and conclusions of the recent meeting of this consortium at NIST-Gaithersburg, MD in February 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 a strategy to (1) measure, understand, and quantify the salient features of non-ideal pipe flows from such pipeline elements as elbows, reducers, valves, flow conditioners, etc. or combinations of theses, (2) correlate meter-factor shifts for selected types of flowmeters, relative to the features of these non-ideal pipe flows 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.

201,185
PB92-175785 Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.
Orifice Meter Performance Downstream from Elbows or a Tee.
Final rept.
C. Sindt, M. Lewis, and J. Brennan. 1990, 10p
Pub. in Proceedings of International Symposium on Fluid Flow Measurement (2nd), Calgary, Alberta, Canada, June 6-8, 1990, p18-27.

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 flowmeters. The effectiveness of a tube bundle 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 discussed. Recommendations for future research needs and for improving the installation specifications for flow measurement standards are suggested.

201,186
PB92-189521 PC **A05**/MF **A01**

PHYSICS

Fluid Mechanics

National Inst. of Standards and Technology (NML), Boulder, CO. Chemical Engineering Science Div.
Orifice Meter Performance Downstream of a Tube Bundle Flow Conditioner, Elbows, and a Tee.
Technical note.
C. F. Sindt, M. A. Lewis, and J. A. Brennan. 1989, 76p NIST/TN-1344
Contract GRI-5088-271-1680
Also available from Supt. of Docs. as SN003-003-03160-7. 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, Piping systems, Rod bundles, Flow distortion.

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 conditioner can also influence measurement accuracy if improperly located relative to the orifice plate in the orifice meter. Tests were conducted in a 3.8 mu m (150 mu in) Ra surface finish pipe with a tube bundle flow conditioner located at four different positions upstream of an orifice plate. The resulting orifice discharge coefficients are shown for the tube bundle flow conditioner at each of the locations. Changes in the orifice discharge coefficient for orifice plates downstream of three flow disturbances consisting of elbows or a tee were measured. For most of the configurations tested, installing a tube bundle flow conditioner immediately downstream of the disturbances reduced these changes in the discharge coefficient from as much as 2 percent to less than 0.2 percent. Recommendations for future research needs are suggested.

201,187
PB93-135465 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.
C. Presser, A. K. Gupta, R. A. Dobbins, and H. G. Semerjian. 1990, 18p
Pub. in ASTM STP 1083, p93-111 1990.

Keywords: *Drop size, *Distribution functions, *Particle size distribution, Probability distribution functions, Light scattering, Interferometry, Polarization, Reprints, Lognormal distribution functions.

Measurements with single particle counting devices, i.e., phase/Doppler interferometry (PDI) and light intensity deconvolution (LID), and the ensemble light scattering/polarization ratio (ESPR) technique have been carried out in a kerosene spray, introduced vertically upwards into coflowing nonswirling and swirling 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 functions on the droplet size measurements, several different monomodal distribution functions with varying degrees of skewness and a bimodal distribution function were examined. Calculations for the ESPR technique using a log-normal distribution function are 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.

201,188
PB93-135531 Not available NTIS
National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Applied and Computational Mathematics Div.
Effect of Gravity Modulation on Thermosolutal Convection in an Infinite Layer of Fluid.
Final rept.
B. V. Saunders, B. T. Murray, G. B. McFadden, S. R. Coriell, and A. A. Wheeler. 1992, 14p
See also PB92-112291.
Pub. in Phys. Fluids A 4 n6 p1176-1189 Jun 92.

Keywords: *Convection, *Hydrodynamics, *Gravity, *Thermal boundary layer, Fluid flow, Diffusion, Solidification, Stability analysis, Frequencies, Reprints, Floquet theory, Thermosolutal convection.

The effect of time-periodic vertical gravity modulation on the onset of thermosolutal 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 destablize 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, regions 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; in the double-diffusive system this mode persists under subcritical conditions as a high-frequency lobe.

Optics & Lasers

201,189
AD-A247 628/1 PC **A03**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
Diamond as an Optical Material.
Interim rept.
A. Feldman, L. H. Robins, E. N. Farabaugh, and D. Shechtman. 20 Feb 92, 26p TR-12
Contract N00014-90-F-0011

Keywords: *Diamonds, Absorption, Carbon, Cathodoluminescence, Distribution, Electron microscopy, High resolution, Impurities, Polishing, Polycrystalline, Raman spectroscopy, Resolution, Scattering, Surface roughness, Optical materials, Defects(Materials), Thin films, Chemical vapor deposition, Progress report.

CVD diamond, which is mainly polycrystalline, exhibits several materials problems that limit its optical transmission, such as scattering due to large surface roughness and absorption due to defects, nondiamond carbon phases, and impurities. Optical spectroscopy, Raman spectroscopy, cathodoluminescence imaging and spectroscopy, and high resolution electron microscopy are used to examine the defects in the material; however, a relationship between observed defects and optical absorption is not always evident. New polishing methods are promising an ability to produce smooth surfaces in reasonable polishing times.

201,190
PB92-144609 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Optical Waveguide Modes: An Approximate Solution Using Galerkin's Method with Hermite-Gauss Basis Functions.
Final rept.
R. L. Gallawa, I. C. Goyal, Y. Tu, and A. K. Ghatak. 1991, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Jnl. of Quantum Electronics 27, n3 p518-522 Mar 91.

Keywords: *Optical waveguides, *Optical fibers, Galerkin method, Orthogonal functions, Modal response, Approximation, Eigenvalues, Scalers, Reprints.

In Galerkin's method, an orthogonal set of functions is used to convert a differential equation into a set of simultaneous linear equations. The authors choose the Hermite-Gauss functions as the set of orthogonal basis functions to solve the eigenvalue problem based on the two-dimensional scalar-wave equation subject to the radiation boundary conditions at infinity. The method gives an accurate prediction of modal propagation constant and of the field distribution. The method is tested by using the step-index optical fiber, which has a known exact solution, and the truncated parabolic profile fiber, for which trends are well known. The authors also test the method using square and eliptic core fibers. The method is found to agree with known results.

201,191
PB92-144658 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Approximate Solution to the Wave Equation - Revisited.
Final rept.
I. C. Goyal, R. L. Gallawa, and A. K. Ghatak. 1991, 14p
Pub. in Jnl. of Electromagnetic Waves and Applications 5, n6 p623-636 1991.

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 methodology but the solution, although approximate, is much more accurate than the traditional WKB solution and can be used with almost as much ease. The method is extremely powerful but, to their knowledge, has never been used by the optics community, where its use in analyzing optical fibers and integrated optical waveguides would be beneficial.

201,192
PB92-149897
(Order as PB92-149889, PC **A08**)
National Inst. of Standards and Technology, Gaithersburg, MD.
Results of a CCPR Intercomparison of Spectral Irradiance Measurements by National Laboratories.
J. H. Walker, R. D. Saunders, J. K. Jackson, and K. D. Mielenz. 1991, 22p
Included in Jnl. of Research of the National Institute of Standards and Technology, v96 n6 p647-668 Nov/Dec 91.

Keywords: *Radiometry, *Irradiance, Near infrared radiation, Near ultraviolet radiation, Visible radiation, Interlaboratory comparisons, Spectral response, Intercomparison.

An intercomparison of spectral irradiance measurements by 12 national laboratories has been carried out between 1987 and 1990. The intercomparison 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 transfer 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 visible spectral region and 2 to 4% in the ultraviolet and infrared portions of the spectrum. The intercomparison revealed no statistically significant differences between spectral-irradiance scales based on blackbody physics and absolute detector radiometry.

201,193
PB92-159508 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Laser-Induced Optical Emissions of CVD Diamond Studied in the Raman Microprobe.
Final rept.
E. S. Etz, T. D. Schroeder, E. N. Farabaugh, L. H. Robins, and A. Feldman. 1989, 15p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Diamond Optics II, San Diego, CA., August 7-8, 1989, v1146 p104-118.

Keywords: *Diamonds, *Vapor deposition, *Thin films, *Synthetic materials, Photoluminescence, Raman spectra, Raman spectroscopy, Crystal structure, Mullite, Silicon, Spectrum analysis, Reprints.

A multichannel-detection Raman microprobe, with laser-excitation at 514.5 nm, is employed in the rapid characterization of the microstructural and compositional perfection of diamond deposits prepared by the hot-filament chemical vapor deposition (CVD) method. Examined are single microcrystals of CVD diamond and polycrystalline thin diamond films deposited on silicon ((111) Si) and polycrystalline mullite (3Al2O3(dot)2SiO2) substrates. Reported are the results from a series of films grown under constant deposition conditions of substrate temperature (750 C), gas pressure (40 torr), and gas flow rate (52 sccm), 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 per cm 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 per cm (Raman shift) is examined to monitor the presence of a photoluminescence (PL) band centered at 738 nm (1.68 eV) attributed to a lattice vacancy in diamond.

201,194
PB92-159573 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.
Diamond Optics.
Final rept.
A. Feldman, and S. Holly. 1989, 2p
See also AD-A243 097.
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Diamond Optics, San Diego, CA., August 16-17, 1988, v969 pvi-vii 1989.

Keywords: Crystal growth, Thermal conductivity, Transparence, 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.

201,195
PB92-159581 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.
Optical Properties of Mixed Yttria-Silica Films.
Final rept.
A. Feldman, X. T. Ying, and E. N. Farabaugh. 1989, 4p
Pub. in Applied Optics 28, n24 p5229-5232 1989.

Keywords: *Silicon dioxide, *Yttrium oxides, Absorption coefficients, Refractive 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 evaporation can be reduced by admixture with silica; 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.

201,196
PB92-165299 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Precise Length Measurements in Multimode Optical Fibers.
Final rept.
B. L. Danielson. 1991, 6p
Sponsored by Department of the Air Force, Washington, DC.
Pub. in Applied Optics 30, n27 p3867-3872, 20 Sep 91.

Keywords: *Optical fibers, *Dimensional measurement, Near infrared radiation, Michelson interferometers, Fiber optics, Time domain, Multimode, Precision, Reflectometers, Reprints, *Length measurement.

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 tabulated. Group delays were 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.

201,197
PB92-165307 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Absolute Optical Ranging Using Low Coherence Interferometry.
Final rept.
B. L. Danielson, and C. Y. Boisrobert. 1991, 5p
Pub. in Applied Optics 30, n21 p2975-2979, 20 Jul 91.

Keywords: *Dimensional measurement, *Optical measurement, Michelson interferometers, Light emitting diodes, Fourier analysis, Frequency domain, High resolution, Reflectivity, Accuracy, Reprints, *Nanometer measurement.

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 efficiency in data acquisition and processing.

201,198
PB92-165430 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Determination of Kerr Cell Parameters with Comparative Digitized Measurements.
Final rept.
G. J. FitzPatrick, and J. E. Lagnese. 1991, 5p
Pub. in Proceedings of International Symposium on Digital Techniques in High-Voltage Measurements, Toronto, Ontario, Canada, October 28-30, 1991, p5-29-5-33.

Keywords: *Kerr cells, Curve fitting, High voltage, Signal processing, Measurement, Waveforms, Reprints.

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 range from 10kV-300kV. Cell constants for the same cell geometry but with different Kerr liquids are also reported. The uncertainties of the evaluated Kerr cell parameters and their dependence on fringe number are discussed. The effects on the evaluated cell constants produced by segmenting the digitized Kerr waveforms are also examined.

201,199
PB92-165869 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Quantum Physics Div.
Optical Heterodyne Spectroscopy Enhanced by an External Optical Cavity: Toward Improved Working Standards.
Final rept.
M. Long-Sheng, and J. L. Hall. 1990, 7p
Contract N00014-85-0816
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Jnl. of Quantum Electronics 26, n11 p2006-2012 Nov 90.

Keywords: *Laser radiation, *Frequency stability, Frequency standards, Optimal control, Iodine 127, Helium neon lasers, Accuracy, Reprints, Optical heterodyne spectroscopy, Modulation transfer spectroscopy.

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)I2 resonance at 612 nm with a low-power He-Ne laser, the authors observed a S/N of 250:1 in a 10 kHz bandwidth. Used in an optimal control loop, this performance would provide a laser stability of 10 Hz at 1 s. Such a > hundredfold improvement in stability should lead to interesting increases in accuracy as well.

201,200
PB92-165943 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Scanning Confocal Microscope for Precise Measurement of Optical Fiber Diameter.
Final rept.
S. Mechels, and M. Young. 1992, 7p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Scanning Microscopy Instrumentation, San Diego, CA., July 22-23, 1991, v1556 p164-170 1992.

Keywords: *Optical fibers, *Dimensional measurement, *Line width, Optical measurement, Fiber optics, Diameters, Precision, Reprints, Scanning conformal 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 systematic error due to partial coherence. The results obtained with the scanning confocal microscope are checked by comparison with those obtained from a contact micrometer and by measuring a chrome-on-glass Standard Reference Material provided by NIST, Gaithersburg. Fiber diameters can be measured with a random uncertainty of 40 nm and a systematic error estimated to be 40 nm.

201,201
PB92-166073 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Dual Wavelength Pulse Generation Using a Mode-Locked Erbium-Doped Fiber Ring Laser.
Final rept.
J. B. Schlager, S. Kawanishi, and M. Saruwatari. 1991, 2p
Pub. in Electronics Letters 27, n22 p2072-2073, 24 Oct 91.

Keywords: *Two-wavelength lasers, Mode locked lasers, Ring lasers, Doped materials, Picosecond pulses, Light pulses, Birefringence, 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.

201,202
PB92-166289 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Temperature Dependence of the Verdet Constant in Several Diamagnetic Glasses.
Final rept.
P. A. Williams, A. H. Rose, G. W. Day, T. E. Milner, and M. N. Deeter. 1991, 3p
Pub. in Applied Optics 30, n10 p1176-1178, 1 Apr 91.

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 of SiO2, SF-57, and BK-7 glasses. In each case the Verdet constant increases with temperature by the order of 1 part in 10,000/K over the range from room temperature to 150 C. The results for each glass are within 3 to 20% of estimates obtained using the Becquerel formula with published dispersion and dn/dT data on the glasses.

201,203
PB92-171248 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Atomic Physics Div.
Absolute Wavelength Determinations in Molecular Tellurium: New Reference Lines for Precision Laser Spectroscopy.
Final rept.
J. D. Gillaspy, and C. J. Sansonetti. 1991, 6p
Pub. in Jnl. of the Optical Society of America B 8, n12 p2414-2419 Dec 91.

Keywords: *Laser spectroscopy, *Tellurium 130, Visible spectra, Line spectra, Interferometry, Wavelengths, Precision, Reprints, Transfer standards.

We have observed the spectrum of (130)Te2 in the range 4712-5020 A by using Doppler-free frequency-modulation spectroscopy. The wave numbers of 32 selected lines have been measured interferometrically with an accuracy of 2.2 parts in 10 billion. These measurements provide a 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 use as transfer standards in the spectroscopy of hydrogen, deuterium, positronium, and muonium.

201,204
PB92-171610 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Fields Div.
Simple Noise Calibration Radiometer.
Final rept.
S. Perera. 1990, 2p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Ottawa, Canada, June 11-14, 1990, p32-33.

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, was designed at NIST. It 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 (EEEL), Boulder, CO. Electromagnetic Technology Div.
Megawatt Laser Calorimeter Design.
Final rept.
T. R. Scott. 1991, 5p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Instrumentation and Measurement Technology Conference Enhancing Productivity with Instrumentation and Measurement Technologies, Atlanta, GA., May 14-16, 1991, p227-231.

Keywords: *High power lasers, *Laser radiation, *Power measurement, *Calorimeters, Continuous wave lasers, Megawatt power range, Near infrared radiation, Infrared lasers, Intensity, Design, Reprints.

The accurate determination of laser energy becomes extremely difficult when seeking to measure the output of laser sources having average powers in the megawatt range. The paper describes the conceptual design of a calorimeter which could safely capture the output of continuous-wave (cw), megawatt lasers operating in the near infrared wavelength region. A primary consideration in the design was the possibility that at some point in the future it would have to be scaled to even larger dimensions. Accordingly, the design uses standard optical techniques and a simple geometry to handle the high irradiance expected from the laser sources. An array of curved, reflective rods is used to spread the laser radiation before it is absorbed by a black-walled cavity. The calorimeter is designed to capture the entire laser beam with subsequent conversion of the electromagnetic energy to thermal energy. The temperature of the calorimeter is monitored and used to determine the energy of the incident laser radiation.

201,206
PB92-171776 Not available NTIS
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Precision Engineering Div.
Methods for Characterizing Surface Topography.
Final rept.
T. V. Vorburger. 1992, 15p
Pub. in Tutorials in Optics, Chapter 8, p137-151 1992.

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 described. Next, stylus profiling techniques, in particular some of the parameters and statistics that may be calculated from measurements using these techniques, are described. Following that 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 integrated 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 rept.
T. V. Vorburger, L. X. Cao, C. H. W. Giauque, J. Raja, and D. E. Gilsinn. 1988, 9p
Pub. in Proceedings of International Colloquium on Surfaces (7th), Karl-Marx-Stadt, February 8-10, 1988, p308-316.

Keywords: *Light scattering, *Surface roughness, Helium 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 hand-lapped stainless steel specimens and compared the results for angular scattering with theoretical predictions. The computed scattering distributions are calculated from an optical phase integral that contains in its integrand the surface profile as measured by a stylus instrument. Ten profiles were measured for 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 rept.
D. J. Wineland, J. Dalibard, and C. Cohen-Tannoudji. 1992, 11p
Pub. in Jnl. of the Optical Society of America B 9, n1 p32-42 Jan 92.

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 dipole 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 basic aspects of 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 zero-point energy 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 (EEEL), Boulder, CO. Electromagnetic Technology Div.
Fiber Cladding Diameter by Contact Micrometry.
Final rept.
M. Young. 1991, 4p
Pub. in Proceedings of Optical Fibre Measurement Conference, York, United Kingdom, September 17-18, 1991, p123-126.

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 other than an optical fiber because the measured result is a function of illumination and because reflection from a metal film displays phase shifts that are not present in reflection from a glass edge (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 micrometer with polarization (Mechels and Young, 1991b). At any rate, even if a chrome-on-glass standard is finally 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 rept.
D. L. Franzen. 1991, 2p
Pub. in Optics and Photonics, p30-31 May 91.

Keywords: *Optical fibers, *Optical measurement, Attenuation, Geometry, Reprints, Single mode fibers, 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 rept.
M. G. Raizen, and B. Rosenstein. 1990, 1p
Pub. in Physical Review Letters 65, n21 p2744, 19 Nov 90.

Keywords: *Magnetooptics, Quantum electrodynamics, 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 existing technology, it is now feasible to observe the effect experimentally. In this comment the authors show that their calculation is not correct and find 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 (EEEL), Boulder, CO. Electromagnetic Technology Div.
Extended-Cavity Operation of Rare-Earth-Doped Glass Wavelength Lasers.
Final rept.
N. A. Sanford, K. J. Malone, and D. R. Larson. 1991, 3p
Pub. in Optics Letters 16, n14 p1095-1097, 15 Jul 91.

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. Endfire pumping was performed with a Ti:sapphire laser operating at 807 nm. The 4-nm FWHM output spectrum was centered near 1057 nm. Slope efficiencies were typically 4-11%, with thresholds near 20 mW. Active mode locking and Q switching were separately performed; mode-locked pulse widths were roughly 80 ps FWHM. Q-switched peak power was 1.2 W. The cw output narrowed to 7 GHz and tuned over a range of 24 nm when a grating provided feedback; single-frequency operation resulted when a high-reflectivity etalon was added.

201,213
PB92-175843 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Dispersion-Shifted Dual-Shape Core Fibers: Optimization Based on Spot Size Definitions.
Final rept.
R. Tewari, B. P. Pal, and U. K. Das. 1992, 5p
Pub. in Jnl. of Lightwave Technology 10, n1 p1-5 Jan 92.

Keywords: *Optical fibers, Fiber optics, Optimization, Dispersion, Splices, Reprints, Single mode fibers, Bending losses, Spot size.

Design features for very low bend and splice losses in dispersion-shifted dual-shape core (DSC) single-mode fibers are obtained in terms of characteristic mode spot sizes W(bar) responsible for splice loss, and W(sub infinity) responsible for bend loss. Dual-shape core fiber designs are given with W(sub infinity)/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(up arrow)m at the operating wavelength of 1550 nm. With this design goal 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
Pub. in Nuclear Instruments and Methods in Physics Research A296, p647-653 1990.

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 Submicrometer Resolution.
Final rept.
S. Mechels, and M. Young. 1991, 10p
Pub. in Applied Optics 30, n16 p2202-2211, 1 Jun 91.

Keywords: *Optical fibers, *Dimensional measurement, *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 geometry. 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 40 nm across the full field of view, but width 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 (NML), 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
Pub. in AIP Conference Proceedings Adv. Laser Sci.-4, v191 p503-508 1989.

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(exclamation point) for high n. This may be related to the nonmonotonic behavior of high harmonic generation observed in recent experiments.

201,217
PB92-236850 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Radiometric Physics Div.
Photodetector Spectral Response Based on 100% Quantum Efficient Detectors.
Final rept.
J. M. Houston, and E. F. Zalewski. 1989, 10p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Opt. Radiat. Meas. 2, v1109 p268-277 1989.

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 reverse bias response properties. The 100% quantum efficient detector was compared with the NIST absolute detector response scale using a monochromator-based detector spectral comparator. This was a demonstration of the feasibility of using a 100% quantum efficient detector as an absolute standard with conventional detector comparator instrumentation.

201,218
PB92-236868 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Radiometric Physics Div.
Comparison between a Side-Viewing Cryogenic Radiometer and Self-Calibrated Silicon Photodiodes.
Final rept.
C. C. Hoyt, P. J. Miller, P. V. Foukal, and E. F. Zalewski. 1989, 10p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Opt. Radiat. Meas. 2, v1109 p236-245 1989.

Keywords: *Photodiodes, *Radiometers, Laser radiation, Optical measurement, Power measurement, Cryogenic equipment, Silicon diodes, Quantum efficiency, Comparison, Reprints, Self calibration, Intercomparison.

A convenient cryogenic electrical substitution radiometer has been developed for laser radiometry. The radiometer system consists of a side-viewing active cavity receiver of 10 second time constant, a table-top liquid helium cryostat with a Brewster-angle window port, and two digital temperature controllers interfaced with an AT-class microcomputer. Radiometer measurements of an intensity-stabilized laser beam have been compared to measurements taken with silicon photodiodes self-calibrated using a new, non-destructive technique. Agreement between these two techniques of light measurement is obtained at the 0.05% level. The disagreement at the 0.05% level may be significant, and we put forward several possible explanations for future investigation.

201,219
PB92-236975 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Wavelengths of the O VI 2s (2)S - 2p (2)P deg Resonance-Doublet Lines.
Final rept.
V. Kaufman, and W. C. Martin. 1989, 2p
Pub. in Jnl. of the Optical Society of America B 6, n10 p1769-1770 1989.

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 spectrograms obtained with a 10.7-m normal-incidence vacuum spectrograph. The values are 1031.926(5) and 1037.620(5) A for the doublet S(1/2) - doublet P(deg)(3/2) and doublet S(1/2) - doublet P(deg)(1/2) lines, respectively. Combining these values with values of comparable accuracy obtained in three other laboratories, we suggest use of the averages 1031.9261(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 Argon Miniarc Irradiance Standards at 214 nm.
Final rept.
J. L. Lean, H. J. Kostkowski, R. D. Saunders, and L. M. Hughey. 1989, 8p
Pub. in Appl. Opt. 28, n15 p3246-3253 1989.

Keywords: *SURF II storage ring, *Argon plasma, *Arc discharges, *Standards, Near ultraviolet radiation, Solar ultraviolet radiation, Primary standards, Spectroradiometers, Comparison, 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
PB92-237197 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Atomic, Molecular and Optical Physics.
Optical Molasses.
Final rept.
P. D. Lett, R. N. Watts, C. E. Tanner, S. L. Rolston, W. D. Phillips, and C. I. Westbrook. 1989, 24p
Pub. in Jnl. of the Optical Society of America B 6, n11 p2084-2107 1989.

Keywords: Temperature dependence, Temperature measurement, Laser spectroscopy, Reprints, *Laser cooling, Ultracold atoms, Sodium atoms, Polarization gradient cooling.

A review of the two-level theory of Doppler cooling in optical molasses is presented, as is a qualitative overview of polarization gradient cooling. Experiments are described in which the temperature of sodium atoms released from optical molasses is measured and found to be well below the Doppler-cooling limit. Measurements of the temperature dependence on many experimental parameters are found to be in good qualitative agreement with the new theories of polarization gradient cooling.

201,222
PB92-237544 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Doppler Broadening of Raman Lines.
Final rept.
A. Weber. 1988, 2p
Pub. in Proceedings of International Conference on Raman Spectroscopy (11th), London, England, September 5-9, 1988, p79-80.

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.

201,223
PB93-102259 PC **A11**/MF **A03**
National Inst. of Standards and Technology, Boulder, CO.
Technical Digest-Symposium on Optical Fiber Measurements, 1992. Held in Boulder, Colorado on September 15-17, 1992.
Special pub. (Final).
G. W. Day, and D. L. Franzen. Sep 92, 249p NIST/SP-839
Also available from Supt. of Docs. as SN003-003-03177-1. See also PB91-132308. Prepared in cooperation with Lasers and Electro-Optics Society (IEEE), Piscataway, NJ. and Optical Society of America, Washington, DC.

Keywords: *Fiber optics, *Optical fibers, *Optical measurement, *Meetings, Optical communication, 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
PB93-125722 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Precision Engineering Div.
Light Scattered by Random Rough Surfaces and Roughness Determination.
Final rept.
E. Marx, and T. Vorburger. 1989, 15p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers)-Scatter from Optical Components, San Diego, CA., August 8-10, 1989, v1165 p72-86.

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 a stylus instrument and angular distributions of 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 function, as well as the roughness of rougher surfaces that produce no specular beam, can in principle be determined by fitting the distribution computed from a model of a random rough 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 profiles using a simplified model of the electromagnetic scattering.

201,225
PB93-125953 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Lambdameter for Accurate Stability Measurements of Optical Transmitters.
Final rept.
G. E. Obarski. 1991, 8p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Laser Testing and Reliability, San Jose, CA., November 7, 1991, v1620 p41-48.

Keywords: Near infrared radiation, Distributed feedback lasers, Helium neon lasers, Optical communication, Optical fibers, Frequency stability, Red(Color), Wavelengths, Transmitters, Reprints, *Lambdameters.

To accurately measure wavelength of 1.3 and 1.5 micrometer single-mode sources, we developed a lambdameter that can be used in the near IR and the red regions of the spectrum. Wavelength accuracy and resolution are about 0.1 ppm (parts per million) at 0.633 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 from 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 within 0.2 ppm. We describe our lambdameter 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
PB93-126043 Not available NTIS
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Precision Engineering Div.
Research on Laser Length Standards in the Precision Engineering Division, NIST.
Final rept.
J. Stone, S. Zushan, and A. Stejskal. 1992, 4p
See also NBS-TN-449.
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 control systems, 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 as practical length standards. This paper will report on one project nearing completion - development of a new design for an iodine-stabilized 633nm He-Ne laser - and 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 simplicity of operation. 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(oo) modes, using the beat frequencies between adjacent modes as an indication of position on the gain curve. Preliminary results indicate that the method shows promise as an alternative to standard schemes for stabilization of the vacuum wavelength.

201,227
PB93-129369 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Simple, Low-Contrast Thermal Resolution Test Target.
Final rept.
J. Geist, J. E. Luther, D. B. Novotny, and J. Vahakangas. 1992, 3p
Pub. in Applied Optics 31, n16 p2978-2980 Jun 92.

Keywords: Infrared radiation, Radiometry, Silica, Reprints, *Thermal resolution, Test targets.

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
PB93-129385 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Atomic Physics Div.
Stray-Light Suppression with High-Collection Efficiency in Laser Light-Scattering Experiments.
Final rept.
K. Deilamian, J. D. Gillaspy, and D. E. Kelleher. 1992, 5p
Pub. in Appl. Opt., v31 p2820-2824 1992.

Keywords: *Light scattering, Laser induced fluorescence, Laser spectroscopy, Laser radiation, Cylindrical configuration, Reprints, Photon burst spectroscopy, Stray light.

We describe an optical system that we constructed to collect a large fraction of fluorescent light emitted isotropically from a cylindrical interaction region. While maintaining an overall detection efficiency of 9%, the system rejects, by more than 12 orders of magnitude, incident laser light along a single axis that intersects the interaction region. Such a system is useful for a wide variety of light-scattering experiments in which high-collection efficiency is desirable, but in which light from an incident laser beam must be rejected without resorting to spectral filters.

201,229
PB93-129435 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Effects of the Structure and Composition of Lead Glasses on the Thermal Lensing of Pulsed Laser Radiation.
Final rept.
B. Taheri, A. Munoz, W. D. St. John, J. P. Wicksted, R. C. Powell, D. H. Blackburn, and D. C. Cranmer. 1992, 8p
Pub. in Jnl. of Applied Physics 71, n8 p3693-3700, 15 Apr 92.

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 tight 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 fluence transmission experiments. The influence of material properties such as different types of network former and modifier ions on the nonlinear optical properties of these materials werer also studied. It was found that: (i) the greatest influence of the network modifier ions was due to their effect on the absorption coefficient of the glasses; (ii) in lead 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 power (charge to radius-squared ratio) of the network former ions.

201,230
PB93-135168 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Electron and Optical Physics Div.
Perturbation-Theory Study of High-Harmonic Generation.
Final rept.
L. Pan, K. T. Taylor, and C. W. Clark. 1990, 8p
Pub. in Jnl. of the Optical Society of America B, v7 n4 p509-516 1990.

Keywords: *Harmonic generation, Perturbation theory, Nonlinear optics, Nonlinearity, 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 invalid in the range of intensities used in current experiments.

201,231
PB93-135176 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Electron and Optical Physics Div.
Volkov-Like Coulomb Continuum.
Final rept.
L. Pan. 1989, 3p
Pub. in Jnl. of Modern Optics 36, n7 p877-889 1989.

Keywords: *Multi-photon processes, Laser target interactions, Perturbation theory, Reprints, *Multiphoton ionization, Volkov state.

A field-dressed Coulomb continuum state is derived, and its application in the calculation of intense field multiphoton ionizations is discussed.

201,232
PB93-135358 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Time Dependent Thermal Lensing in Lead Oxide-Modified Silicate Glass.
Final rept.
W. D. St. John, B. Taheri, J. P. Wicksted, R. C. Powell, D. Blackburn, and D. Cranmer. 1992, 7p
Pub. in Jnl. of the Optical Society of America B, v9 n4 p610-616 1992.

Keywords: *Lead glass, *Thermal lens effect, Time dependence, Laser radiation, Lead oxides, Radiation effects, Silicates, Reprints.

The detection and characterization of the thermal lensing effect has been measured for a lead oxide modified silicate glass materials. The self-modulation of the exciting beam is measured with a simple experimental setup on both a millisecond and nanosecond time scale. The results of our analysis indicate that to first order the operative mechanism of self-focusing is the same on both time scales, namely the time-dependent 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 these undulations 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 Z-scans and transmittance vs. power profiles. This is indicative of a strong thermooptic effect and a consequence of Maxwell's equations. From our model, a dn/dT value of 1 X 10(sup -5)/deg K has been extracted.

Plasma Physics

201,233
PB92-166008 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Mass Spectrometric and Optical Emission Diagnostics for rf Plasma Reactors.
Final rept.
J. K. Olthoff, J. R. Roberts, R. J. Van Brunt, J. R. Whetstone, M. Sobolewski, and S. Djurovic. 1992, 11p
Pub. in SPIE (Society of Photo-Optical Instrumentation Engineers) - Process Module Metrology, Control, and Clustering, San Jose, CA., September 11-13, 1991, v1594 p168-178 1992.

Keywords: *Gas discharges, *Plasma diagnostics, Radio frequency discharge, Mass spectroscopy, Light emission, Argon plasma, Kinetic energy, Oxygen, Reprints.

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 O2 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 PC **A03**/MF **A01**
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Growth Defects in Diamond Films.
Technical rept.
D. Shechtman, J. L. Hutchison, L. H. Robins, E. N. Farabaugh, and A. Feldman. 9 Jul 92, 27p
Contract N00014-90-F-0011
Supported in part by the Office of Naval Research, Arlington, VA.

Keywords: *Crystal growth, *Crystal defects, Diamonds, 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 growth of the diamond film was evaluated. The observations included various twin boundaries of the type Sigma=3 as well as Sigma=9, Sigma=27 and Sigma=81, which form by an interaction of lower order twins. These higher order boundaries are loci of intersection points of growing planes on two adjacent twins and can serve as an indicator for the local crystal growth direction. The central nucleation site for the growing planes in many cases can be traced back to a quintuplet twin point. A twin quintuplet 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 PC **A03**/MF **A01**
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.
Twin Quintuplets in CVD Diamond.
Interim rept.
D. Shechtman, A. Feldman, and J. L. Hutchison. 26 Aug 92, 12p
Contract N00014-90-F-0011
Supported in part by the Office of Naval Research, Arlington, VA.

Keywords: Angles, Atomic structure, Diamonds, Dislocations, Electron microscopy, Grain boundaries, High resolution, Microscopy, Tilt, Vapor 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 boundaries and the conventional diamond lattice twin boundaries are the only types of boundaries that we have observed in CVD diamond.

201,236
N92-21622/5
(Order as N92-21605/0, PC **A21**/MF **A04**)
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Processing Bi-Pb-Sr-Ca-Cu-O Superconductors from Amorphous State.
C. K. Chiang, W. Wong-Ng, L. P. Cook, S. W. Freiman, N. M. Hwang, M. Vaudin, and M. D. Hill. Jan 91, 10p
In NASA. Goddard Space Flight Center, Amsahts 1990: Advances in Materials Science and Applications of High Temperature Superconductors p 127-136.

Keywords: *High temperature superconductors, Aluminum oxides, Amorphous materials, Bismuth compounds, Ceramics, Crystallization, Glass, Heat treatment, Alternating current, Crystallinity, Diffraction patterns, Electrical resistivity, Magnetic 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 powders in an alumina 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 Bi2Sr2Ca2Cu3Ox phase (T(sub c)= 110 K). The processing method, crystallization, and results of dc electrical resistivity and ac magnetic susceptibility measurements are discussed.

201,237
N92-21630/8
(Order as N92-21605/0, PC **A21**/MF **A04**)
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD.
Levitation of Superconducting Composites.
C. K. Chiang, M. Turchinskaya, L. J. Swartzendruber, R. D. Shull, and L. H. Bennett. Jan 91, 5p
In NASA. Goddard Space Flight Center, Amsahts 1990: Advances in Materials Science and Applications of High Temperature Superconductors p 181-185.

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 pining capability between the two material forms are small but significant.

201,238
N92-21634/0
(Order as N92-21605/0, PC **A21**/MF **A04**)
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD.
Flux Flow and Flux Dynamics in High-Tc Superconductors.
L. H. Bennett, M. Turchinskaya, L. J. Swartzendruber, A. Roitburd, D. Lundy, J. Ritter, and D.. L. Kaiser. Jan 91, 17p
In NASA. Goddard Space Flight Center, Amsahts 1990: Advances in Materials Science and Applications of High Temperature Superconductors p 213-229.

Keywords: *High temperature superconductors, Hysteresis, Magnetization, Defects, Electric current, Impurities, Magnetic flux, Time dependence, Cuprates.

Because high temperature superconductors, including YBCO and BSCCO, 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, with the applied field between H(sub c1) and H(sub c2), flux lines have penetrated the material and can form a flux lattice and can be pinned 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 depinning, H(sub cp) as that field at which the hysteresis loop changes from irreversible to reversible. As a function of temperature, it is found that H(sub cp) is well described by a power law with an exponent of 1.5. The behavior of H(sub cp) for various materials and its relationship to flux flow and flux dynamics are discussed.

201,239
N92-21637/3
(Order as N92-21605/0, PC **A21**/MF **A04**)
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD.
Lower Critical Field Measurements in YBa2Cu3O6+x Single Crystals.
D. L. Kaiser, L. J. Swartzendruber, F. W. Gayle, and L. H. Bennett. Jan 91, 7p
In NASA. Goddard Space Flight Center, Amsahts 1990: Advances in Materials Science and Applications of High Temperature Superconductors p 249-255.

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 YBa2Cu3O6+x single crystals 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 kOe was estimated for the thermodynamic critical field at T = O by comparison of calculated Hc2 values with experimental data from the literature.

201,240
PB92-144211 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Complex Dynamics in Domain Wall Motion.
Final rept.
L. H. Bennett, L. J. Swartzendruber, I. Aviram, and I. I. Satija. 1990, 2p
Pub. in Jnl. of Applied Physics 67, n9 p5350-5351 1990.

Keywords: *Domain walls, Mathematical models, Barkhausen effect, Magnetic domains, Ferromagnetic materials, Numerical solution, Flux pinning, Impurities, Simulation, Dynamics, Motion, Reprints.

A simple, almost exactly solvable, model which simulates the dynamics of a single magnetic domain wall crossing a single impurity site in a ferromagnetic material, is solved numerically for some ranges of parameters. The dynamics is complex and very sensitively dependent on the physical parameters: the frequency and strength of the applied field, the strength of the pinning, the reversible permeability, the effective mass of the domain wall, the wall viscosity, and the amount of energy retained by the wall when it breaks free of the pinning site. A frequency quintupling is displayed. Phase space portraits, return maps and total energy spectra are used to display the results.

201,241
PB92-144229 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Magnetic Viscosity in Ni/Cu Compositionally-Modulated Alloys.
Final rept.
L. H. Bennett, L. J. Swartzendruber, H. Ettedgui, U. Atzmony, D. S. Lashmore, and R. E. Watson. 1990, 3p
See also DE90002303.
Pub. in Jnl. of Applied Physics 67, n9 p4904-4906 1990.

Keywords: Nickel alloys, Copper alloys, Relaxation, Cryogenics, Reprints, *Magnetic aftereffect, Magnetic viscosity, Multilayers.

The existence of a magnetic aftereffect ('magnetic viscosity') in Ni/Cu multilayered alloys was established using a vibrating sample magnetometer at room temperature and at 86 K. It was shown that the effect is strongly dependent on the step field, H2 (i.e., the value the field is reduced to after the magnetic moment has been aligned in high field) and exhibits a maximum relaxation rate for values of H2 around the reverse coercive field, -H(c). Aftereffect behavior of this type has been observed in other materials, though most often for systems composed of superparamagnetic particles, where the relaxation freezes out at low temperatures. In contrast, the relaxation in the CMA was shown to be enhanced at 86 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 does freeze out. The temperature of maximum enhancement varies from sample to sample.

201,242
PB92-144237 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
SQUID and MAMMA Observations of the Superconducting Transition in Single Crystals of YBa2Cu3O7-x.
Final rept.
L. H. Bennett, L. J. Swartzendruber, D. Kaiser, J. Bohandy, B. F. Kim, F. J. Adrian, and K. Moorjani. 1990, 3p
Pub. in Jnl. of Applied Physics 67, n9 p5044-5046 1990.

Keywords: *High temperature superconductors, Transition temperature, Single crystals, SQUID devices, Superconductivity, Reprints, *Yttrium barium cuprates, Microwave absorption.

Two melt-grown single crystals of YBa2Cu3O(7-x), one (crystal A) in the shape of a nearly perfect parallelepiped of dimensions 200x200x70 micrometers and with x approx = 0, the other (crystal B) with somewhat less oxygen content and of less geometric perfection, with dimensions approx = 750x900x10 micrometers, were measured by both SQUID magnetometry 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 90K. For crystal B, the SQUID measurements show a broad transition near 80 K, implying a material with a range of oxygen concentrations, while the MAMMA reveals considerable structure, with details of this structure depending on the direction in which the magnetic fields are applied.

201,243
PB92-144567 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
High-Transport Current Density Up to 30 T in Bulk YBa2Cu3O7 and the Critical Angle Effect.
Final rept.
J. W. Ekin, K. Salama, and V. Selvamanickam. 1991, 3p
Sponsored by Office of Naval Research, Arlington, VA., and Department of Energy, Washington, DC.
Pub. in Applied Physics Letters 59, n3 p360-362, 15 Jul 91.

Keywords: *Critical current, *Superconductors, High temperature superconductors, Current density, Magnetic fields, Reprints, *Yttrium barium cuprates.

Measurements of the dc transport critical current of oriented-grained YBa2Cu3O7 have been made using high quality Ag contacts and a high-current sample mount. The critical-current density J(sub c) at 77 K for mutually perpendicular current and magnetic field B in the a,b plane is 8 kA/sq cm at 8 T, decreasing gradually to 3.7 kA/sq cm at 20 T, and remaining over 1 kA/sq cm out to 30 T. High magnetic field measurements of J(sub c) as a function of the angle theta of B with respect to the c axis are also reported. In contrast to earlier results at lower fields (= or < 3 T) the measurements reported here in high fields reveal a J(sub c) vs theta curve with a head-and-shoulders shape, consisting of a sharp peak ('head') < 5 degrees wide for B parallel to the CuO2 planes, and a wide (30 degrees at 9 T, for example) shoulder region on either side of B perpendicular to c axis, where the transport J(sub c) remains high and constant. Beyond the shoulder region, however, the transport J(sub c) decreases sharply, giving rise to the concept of a critical field angle for application design, defined by the minima in the second derivative of J(sub c) with respect to theta at the edge of the shoulders.

201,244
PB92-144617 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Magnetic Correlations and Energy Gap in Superconducting YBa2Cu3O6.6 with Tc=53 K.
Final rept.
P. M. Gehring, J. M. Tranquada, G. Shirane, J. R. D. Copley, R. W. Erwin, M. Sato, and S. Shamoto. 1991, 4p
Pub. in Physical Review B 44, n6 p2811-2814, 1 Aug 91.

Keywords: *High temperature superconductors, *Superconductors, Orthorhombic lattices, Single crystals, Neutron scattering, Inelastic scattering, Energy gap, Reprints, *Yttrium barium cuprates.

The dynamic magnetic correlations have been characterized in a large, orthorhombic single crystal of YBa2Cu3O(6+x) with x=0.6, having a T(c) of 53 K. Inelastic-neutron-scattering measurements reveal a gap (zero magnetic cross section) of 5 meV in the spin-excitation spectrum at 10 K. The size of the gap fits well between those reported by Rossat-Mignod et al. for x=0.51 and 0.69. However, the rapid change in the gap size with a relatively small change in T(c) is not understood.

201,245
PB92-144757 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Annealing Behavior of Sputter Deposited Al-Mn and Al-Mn-Si Films.
Final rept.
M. J. Kaufman, K. G. Kreider, and F. S. Biancaniello. 1988, 7p
Pub. in Jnl. of Materials Research 3, n6 p1342-1348 1988.

Keywords: *Aluminum manganese alloys, Amorphous materials, Silicon alloys, Metal films, Thin films, Intermetallics, Annealing, Reprints, *Quasicrystal, Sputtered films, Icosahedral phase.

The annealing behavior of amorphous and icosahedral Al-17Mn and Al-20Mn 4Si films, prepared by sputter deposition have been studied. Both hot stage transmission electron microscopy of thin (20-200nm) films and furnace annealing plug x-ray diffraction of thicker (1-10 micrometer) films were used to study the various transformation sequences resulting from elevated temperature exposures. The results are presented and discussed with reference to the reactions anticipated from the phase diagrams and to the results reported in previous studies.

201,246
PB92-144930 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Novel Procedure for Mapping the Jc-Hc2-Tc Surface and Its Application to High Temperature Superconductors.
Final rept.
J. Moreland, Y. K. Li, L. F. Goodrich, A. Roshko, and R. H. Ono. 1990, 10p
Pub. in Science and Technology of Thin Film Superconductors 2, p429-438 1990.

Keywords: *High temperature superconductors, *Superconducting films, Critical current, Thin films, Cryostats, Reprints, Yttrium barium cuprates.

The authors have used an ac lock-in method for measuring the dynamic resistance versus current (dV/dI-I) curves to determine J(sub c)(T,H). The sample current consisted of a small constant oscillating current added to a variable dc current. The dc current was either slowly ramped for dV/dI-I measurements or controlled keeping the dV/dI level constant while ramping temperature or field. In this way, it was possible to measure J(sub c)(T) at constant H. The temperature was controlled between 4 and 300 K using a bathysphere cryostat. The bathysphere cryostat was inserted into a high field magnet for measurements at fields up to 7 T. The authors have measured several high temperature superconductors including YBa2Cu3O(7-delta) thin films. In addition, the authors have measured the dV/dI-I curve of a simulator. Upon numerical integration, the data for the simulator are consistent with those obtained by a dc method using an analog dc nanovoltmeter to measure the V-I curves directly.

201,247
PB92-145093 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Photoexcited Hot Electron Relaxation Processes in n-HgCdTe Through Impact Ionization into Traps.
Final rept.
D. G. Seiler, J. R. Lowney, C. L. Littler, I. T. Yoon, and M. R. Loloee. 1991, 5p
Pub. in Jnl. of Vacuum Science and Technology B 9, n3 p1847-1851 May/Jun 91.

Keywords: *Mercury cadmium tellurides, *Band theory, Narrow gap semiconductors, Carbon dioxide lasers, Excited states, Energy gap, Hot electrons, Photoconductivity Spectroscopy, Reprints, Magnetoabsorption.

In the article the authors report on a new type of spectroscopy for impurity and/or defect levels in the energy gap of narrow-gap semiconductors using the near-band-gap photon energies from a laser. The spectroscopy is done under the conditions of intense laser photoexcitation and is associated with the Auger relaxation processes of hot electrons involving impact ionization of valence electrons into impurity or defect levels. Wavelength-independent structure in the photoconductive response versus magnetic field is observed at high intensities in samples of Hg(1-x)Cd(x)Te with x approximately = 0.22 and 0.24. The structure arises from hot electrons photoexcited high into the conduction band by sequential absorption of CO2 laser radiation. The hot electrons lose their energy by impact ionizing valence electrons into impurity/defect levels in the gap. For the sample with x approximately = 0.22 and an energy gap of 95 meV, three levels are found at 15, 45, and 59 meV above the valence band. A level at 61 meV is found for the sample with x approximately = 0.24 and a gap of 122 meV.

201,248
PB92-145101 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Process Measurements Div.
Effects of Oxidation and Air Exposure on RbxBal-xBiO3 Superconducting Thin Films.
Final rept.
M. A. Sobolewski, S. Semancik, E. S. Hellman, and E. H. Hartford. 1991, 5p
Pub. in Jnl. of Vacuum Science and Technology A 9, n5 p2716-2720 Sep/Oct 91.

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(x)Ba(1-x)BiO3, the degradation of its surface on exposure to air, and the feasibility of cleaning techniques to reverse this degradation. The sample was a superconducting thin film grown on MgO by molecular-beam epitaxy. It was found that sputter/oxidation treatments may prove useful in restoring the surfaces of films exposed to air (during patterning, for example), prior to overlayer 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 Pr2Fe17N2.8.
Final rept.
J. K. Stalick, J. A. Gotaas, S. F. Cheng, J. Cullen, and A. E. Clark. 1991, 4p
Pub. in Materials Letters 12, p93-96 1991.

Keywords: *Magnetic materials, Praseodymium compounds, Iron compounds, Nitrides, Trigonal lattices, Crystal structure, Cryogenic temperature, Neutron diffraction, Magnetic anisotropy, Reprints, Rietveld method.

A neutron Rietveld refinement study of nitrided Pr2Fe17 at room temperature and at 4K shows that the basic Th2Zn17 structure is maintained, with the N atoms occupying the interstitial 9e sites. Pr2Fe17N(2.8) is rhombohedral, space group R3m, with a=8,776(1)A, c=12.649(2)A at 4K, and a=8.794(1)A, c=12.668(2)A at 295K. At both temperatures, the easy magnetization direction is perpendicular to the c axis.

201,250
PB92-145168 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Origin of Grain Boundary Weak Links in BaPb1-xBixO3 Superconductor.
Final rept.
T. Takagi, Y. M. Chiang, and A. Roshko. 1990, 9p
Sponsored by National Science Foundation, Washington, DC. Materials Research Labs.
Pub. in Jnl. of Applied Physics 68, n11 p5750-5758, 1 Dec 90.

Keywords: *Superconductors, High temperature superconductors, Grain boundaries, Electron microscopy, Reprints, *Barium lead bismuth oxides, Weak links, SIS(Superconductors).

Although BaPb(0.75)Bi(0.25)O3(BPB) has a comparatively large superconducting coherence length of about 7 nm and no reported anisotropy in its superconducting parameters, polycrystalline BPB exhibits the same rapid decrease in transport critical current density (Jct) with low applied field (< about 50 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 on the composition of BPB boundaries with and without second phase, in order to understand the origin of these weak links. It is found that the grain boundaries remain Bi- and Pb-rich even after the retraction of secondary phases; samples that never exceed the melting temperature of the secondary phase show absence of segregation at some but not all grain boundaries. The composition of the grain boundaries as well as (Jct) vs temperature measurements indicate that the boundaries act as SIS tunnel junctions.

201,251
PB92-145275 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Electron and Optical Physics Div.
Insulating Cs Overlayer on InSb(110).
Final rept.
L. J. Whitman, J. A. Stroscio, R. A. Dragoset, and R. J. Celotta. 1991, 4p
See also PB91-195750. Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Physical Review B 44, n11 p5951-5954, 15 Sep 91.

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) overlayer is observed, consisting of four-atom, Cs(110)-like planar clusters arranged in a c(2x6) superlattice. Interestingly, current-versus-voltage (I-V) spectra exhibit a band gap of approx. 0.6 eV, larger than the substrate band gap of approx. 0.15 eV. The I-V spectra are very similar to those observed on the similar 2D overlayer 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. Semiconductor Electronics Div.
High Excited States of Magnetodonors in InSb: An Experimental and Theoretical Study.
Final rept.
W. Zawadzki, X. N. Song, C. L. Littler, and D. G. Seiler. 1990, 10p
Grant NSF-DMR86-17823
See also PB91-147603. Sponsored by National Science Foundation, Washington, DC.
Pub. in Physical Review B 42, n8 p5260-5269, 15 Sep 90.

Keywords: *Indium antimonides, *Magnetooptics, Optical transition, Excited states, Impurities, Phonons, Reprints, High magnetic fields.

New optical transitions between magnetodonor states in InSb assisted by optic-phonon emission have been observed and described theoretically. Photoconductive detection and magnetic-field modulation were 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 gigantic magnetic fields. The magnetodonor states have been described variationally, taking into account the narrow energy gap and the spin-orbit interaction of the band structure of InSb. It has been shown how the phonon emission breaks the selection rules for the magneto-optical 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
PB92-149731 PC **A11**/MF **A03**
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
NIST Reactor: Summary of Activities July 1990 through June 1991.
Technical note.
C. O'Connor. Jan 92, 234p NIST/TN-1292
Also available from Supt. of Docs. as SN003-003-03133-0. See also PB91-159772.

Keywords: *NBSR reactor, Research reactors, Activation analysis, Cold neutrons, Crystal structure, Neutron diffraction, Neutron radiography, Nondestructive tests, 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 standards to sample irradiations for activation analysis, isotope production, neutron radiography, and nondestructive evaluation.

201,254
PB92-154004 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.
Phase Composition and Superconducting Properties of the High Tc Ceramic Materials, Ba2-zR1+zCu3O6+x.
Final rept.
J. E. Blendell, W. Wong-Ng, C. K. Chiang, R. D. Shull, and E. R. Fuller. 1989, 10p
Pub. in High Temperature Superconducting Compounds: Processing and Related Properties, p193-202 1989.

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 Ba(2-z) R(1+z) Cu3O(6+x), where x approx = 0.9, have been prepared to study trends of solid solution formation with the ionic size 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 lanthanide ions, R(3+), with a larger ionic size, i.e., those with an ionic radius greater than or equal to that of Gd(3+). Phase transformation between the orthorhombic and tetragonal structures 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, T(c), and superconducting fraction, as determined by ac magnetic susceptibility, were measured as a function of z. For the Gd and Y series, was characterized for small deviations about the z=O composition, Ba2RCu3O(6+x).

201,255
PB92-154244 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Metal/Semiconductor Interfaces on SnO2(110).
Final rept.
J. W. Erickson, T. B. Fryberger, and S. Semancik. 1988, 6p
Pub. in Jnl. of Vacuum Science and Technology A 6, n3 p1593-1598 May/Jun 88.

Keywords: *Tin oxides, *Palladium, *Tin, *Interfaces, X-ray photoelectron spectroscopy, Ultraviolet spectroscopy, Metal films, Photoemission, Semiconductors, Metallizing, Substrates, Reprints, Low energy electron diffraction.

Interfaces formed by tin and palladium deposition on the (110) face of tin dioxide, SnO2 (a semiconductor due to native defects), have been studied from coverages of 0.05 monolayer (ML) to over 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 interface abruptness and the metallization due to Sn and Pd.

201,256
PB92-154376 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Orbital and Spin Anisotropy of Conduction Electrons in InSb.
Final rept.
C. L. Littler, I. T. Yoon, X. N. Song, W. Zawadzki, P. Pfeffer, and D. G. Seiler. 1990, 4p
Grant NSF-DMR86-17823
Sponsored by National Science Foundation, Washington, DC.
Pub. in Proceedings of International Conference on the Physics of Semiconductors (20th), Thessaloniki, Greece, August 6-10, 1990, v3 p1763-1766.

Keywords: *Indium antimonides, *Conduction electrons, Energy bands, Conduction bands, Cyclotron resonance, Effective mass, Anisotropy, Reprints.

The anisotropy of the orbital and spin properties of conduction electrons in InSb has been measured simultaneously for the first time using a cyclotron-resonance-type experiment. A novel approach was used to measure precisely small shifts of the resonant field positions with respect to the crystal axes--the cyclotron resonance signals were detected at the same time from two differently oriented samples. The data have been described using a five-level k (dot) p energy band model, which accounts for both the nonparabolicity and anisotropy of the conduction band in III-V compounds in the presence of a magnetic field.

201,257
PB92-154400 Not available NTIS

National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Intrinsic Carrier Concentration of Narrow-Gap Mercury Cadmium Telluride Based on the Nonlinear Temperature Dependence of the Band Gap.
Final rept.
J. R. Lowney, D. G. Seiler, C. L. Littler, and I. T. Yoon. 1992, 6p
Pub. in Jnl. of Applied Physics 71, n3 p1253-1258, 1 Feb 92.

Keywords: *Mercury cadmium tellurides, *Carrier density, Conduction bands, Energy gap, Temperature dependence, Nonlinear analysis, Reprints, Density of states, Magnetoabsorption.

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 magnetoabsorption data, is used. The relation is further supported here by additional one-photon magnetoabsorption 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. Kane's k (dot) p theory is used to account for the conduction-band nonparabolicity. Large percentage differences occur between the new calculations and previously calculated values for n sub i at low temperatures. A nonlinear least-squares fit was made to the results of the calculations for ease of use. The implications of the results for Hg(1-x)Cd(x)Te materials characterization and device operations are discussed.

201,258
PB92-154418 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Polarized Neutron Reflectometry.
Final rept.
C. F. Majkrzak. 1991, 14p
Pub. in Physica B 173, p75-88 1991.

Keywords: Magnetic properties, Thin films, Superlattices, Reflectivity, Reprints, *Polarized neutron reflectometry, *Neutron reflectometry, Multilayers.

Polarized neutron reflectometry is a powerful technique for studying the microscopic magnetic structures in thin films and multilayers. The corresponding analysis of spin-dependent reflectivity data is discussed and illustrated with a number of specific examples. The measurement of the precession of the neutron moment within a nonmagnetic medium, but in the presence of an applied field, as a means of determining the nuclear density profile is also considered.

201,259
PB92-154491 Not available NTIS
National Inst. of Standards and Technology (CAML), Gaithersburg, MD.
Self-Avoiding Random Surfaces: Monte Carlo Study Using Oct-tree Data-Structure.
Final rept.
J. O'Connell, F. Sullivan, D. Libes, E. Orlandini, M. Tesi, A. Stella, and T. Einstein. 1991, 17p
Pub. in Jnl. of Physics A: Mathematical and General 24, n19 p4619-4635, 7 Oct 91.

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 surfaces have empty boundary and the topology of a 2-sphere. An oct-tree data-structure allows good statistics to be obtained for surfaces whose plaquette 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 plaquette fugacity, 1/mu, and the entropic exponent, theta, are determined by maximum likelihood methods and by logarithmic plots of the average surface area versus fugacity. The latter approach, which produces results having much better convergence by taking advantage of the scaling properties of several runs at various fugacities, leads to the estimates mu = 1.729 + or - 0.036 and theta = 1.500 + or - 0.026. Linear regression estimates for the radius of gyration exponent give nu = 0.509 + or - 0.004, while the asymptotic ratio of surface area over average volume enclosed approaches a finite value 3.18 + or - 0.03. The authors results give strong corroborating evidence that this long-controversial problem belongs to the universality class of branched polymers.

201,260
PB92-154558 Not available NTIS
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Precision Engineering Div.
Cryopump Vibration Isolation System for an SEM.
Final rept.
M. T. Postek, and W. J. Keery. 1991, 6p
Pub. in Scanning 13, p404-409 1991.

Keywords: *Scanning electron microscopy, *Electron microscopes, *Vibration isolators, *Cryopumps, Vacuum systems, Contamination, Reprints.

A standard commercially available cryopump system has been installed on a scanning electron microscope (SEM) using specially optimized vacuum vibration isolation bellows. The installation was successful in reducing the cryopump-induced vibration to a level that did not degrade the standard performance or resolution of the SEM in the pump-on mode and, in the pump-off (or coasting) mode, eliminated all measurable instrument-induced vibration (i.e., from the vacuum system). The article outlines the manner in which this performance has been accomplished and presents the results of an experiment demonstrating the reduction of specimen contamination provided by this type of vacuum system.

201,261
PB92-154616 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Surface Extended X-ray Adsorption Fine Structure Studies of the Si(001) 2X1-Sb Interface.
Final rept.
M. Richter, J. C. Woicik, P. Pianetta, K. E. Miyano, T. Kendelewicz, C. W. Bouldin, W. E. Spicer, and I. Lindau. 1991, 5p
See also PB91-237263.
Pub. in Jnl. of Vacuum Science and Technology A 9, n3 p1951-1955 May/Jun 91.

Keywords: *Silicon, *Antimony, *Interfaces, Scanning tunneling microscopy, Auger electron spectroscopy, Chemical bonds, Surfaces, Dimers, Metallizing, Semiconductors, Reprints, Extended x-ray absorption fine structure.

Surface extended x-ray absorption fine structure (SEXAFS) has been used to investigate the structure of Sb on the Si(001) 2x1 surface. The coverage of Sb which remains after annealing thick layers at 375 C, previously reported to be one monolayer (ML), is found in the work to form a disordered overlayer with three dimensional Sb clusters. The finding is concluded from the Sb L3 absorption spectra which are similar for this coverage to that of bulk Sb. After a 550 C anneal, Auger electron spectroscopy, and scanning tunneling microscopy (STM) show that about 1 ML of Sb remains. Phase and amplitude analysis of the Sb L3 edge SEXAFS shows that the remaining Sb atoms occupy a modified bridge site with a Si-Sb bond length of 2.63 + or - 0.04 A. The Sb atoms form dimers with a Sb-Sb bond length of 2.91 + or - 0.04 A, which is almost identical to the bulk Sb-Sb bond length of 2.90 A. The Sb atoms lie 1.74 + or - 0.06 A above the Si(001) surface. STM confirms the dimer structure of the Sb overlayer.

201,262
PB92-154681 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.
Insight into the Genesis of Irregularity during Crystal Growth Achieved Through High Sensitivity Monochromatic Synchrotron X-radiation Diffraction Imaging (Topography).
Final rept.
B. Steiner, M. Kuriyama, and R. C. Dobbyn. 1990, 28p
Pub. in Prog. Crystal Growth and Charact. 20, p189-216 1990.

Keywords: *Crystal growth, *Crystal defects, Synchrotron radiation, Monochromatic radiation, X-ray diffraction, Resolution, Sensitivity, Reprints, X-ray tomography.

Lattice irregularities observed in monochromatic synchrotron x-radiation diffraction imaging (topography) are summarized. Important recent advances in sensitivity and resolution are described. The resulting insight into the genesis of variation in high quality crystals is reviewed. Finally, areas in which additional progress can be anticipated in light of these advances are indicated.

201,263
PB92-154707 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Phonon Density of States in Pr2-xCexCuO4 and Pr2CuO4.
Final rept.
I. W. Sumarlin, J. W. Lynn, D. A. Neumann, J. J. Rush, J. L. Peng, Z. Y. Li, and S. J. Hagen. 1991, 2p
Pub. in Physica C 185-189, p2571-2572 1991.

Keywords: *Superconductors, Neutron scattering, Inelastic scattering, Phonons, Reprints, *Praseodymium cerium cuprates, *Praseodymium cuprates, Density of states.

The authors report inelastic neutron scattering measurements of the generalized phonon density of states in superconducting Pr(2-x)Ce(x)CuO4 and insulating Pr2CuO4. Substantial decreases in the peak intensities of some of the phonon features, and an increase in the intensity of one of the peaks, were observed as 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
PB92-154764 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Conservation of Bond Lengths in Strained Ge-Si Layers.
Final rept.
J. C. Woicik, C. E. Bouldin, M. I. Bell, J. O. Cross, D. J. Tweet, B. D. Swanson, T. M. Zhang, L. B. Sorensen, C. A. King, J. L. Hoyt, P. Pianetta, and J. F. Gibbons. 1991, 4p
Pub. in Physical Review B 43, n3 p2419-2422, 15 Jan 91.

Keywords: *Germanium, *Silicon, *Chemical bonds, X-ray diffraction, Semiconducting 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 strain and bond distortions in epitaxial Ge-Si on Si(001). In a 31% Ge, 340-A pseudomorphic Ge-Si film, the Ge-Ge and Ge-Si first-neighbor bond lengths have been found to be 2.44 + or - 0.02 and 2.38 + or - 0.02 A, respectively. The lattice parameter perpendicular to the Ge-Si/Si(001) interface has been found to be a(perpendicular) = 5.552 + or - 0.002 A, in agreement with the predictions of macroscopic elastic theory. The results show that the bond-length strain in the epitaxial layer appears in the second and higher coordination shells, rather than in the nearest-neighbor bond lengths, which remain the same as in unstrained Ge-Si. A microscopic model is presented that accounts for the findings.

201,265
PB92-154772 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Local Bonding Structure of Sb on Si(111) by Surface Extended X-ray-Absorption Fine Structure and Photoemission.
Final rept.
J. C. Woicik, T. Kendelewicz, K. E. Miyano, C. E. Bouldin, P. L. Meissner, P. Pianetta, and W. E. Spicer. 1991, 9p
Contract N00014-89-J-1083
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Physical Review B 43, n5 p4331-4339, 15 Feb 91.

Keywords: *Silicon, *Antimony, *Interface, *Chemical bonds, Photoelectron spectroscopy, Photoemission, Metallizing, Surfaces, Trimers, 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(111) interface. From photoemission, the authors find that the Sb atoms adsorb in a unique environment that completely saturates the dangling bonds of the Si(111) surface and that completely eliminates the surface components of the Si 2p core-level spectrum. The Sb-induced Si 2p interfacial core level is found to be shifted 0.20 + or - 0.02 eV towards higher binding energy with an intensity that corresponds to the top monolayer of surface atoms. The SEXAFS determination of the absolute surface coordination numbers and bond lengths within the first Sb shell is 2.1 + or - 0.3 Sb atoms at 2.86 + or - 0.02 A and 2.0 + or - 0.4 Si atoms at 2.66 + or - 0.03 A. Combined, the results indicate that Sb trimers occupy the threefold atop sites of the Si(111) surface, where each Sb atom is bonded to two Si atoms in a modified bridge configuration.

201,266
PB92-159045 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.
Magnetic Aftereffect in Compositionally-Modulated Ni/Cu Multilayers Prepared by Electrodeposition and By Sputtering.
Final rept.
L. H. Bennett, L. J. Swartzendruber, U. Atzmony, D. S. Lashmore, and W. Abdul-Razzaq. 1990, 4p
Pub. in Materials Research Society Symposium Proceedings, v160 p595-598 1990.

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 a compositionally-modulated Ni/Cu multilayer produced by sputtering. This finding demonstrates that the relaxation previously found in compositionally-modulated alloys produced by electrodeposition is a property of the material and not an artifact of the electrodeposition process.

201,267
PB92-159102 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.
APFIM Analysis of Composite Magnetic Thin Films.
Final rept.
P. P. Camus, R. D. Shull, and A. J. Melmed. 1989, 6p
Pub. in Colloque de Physique C-8, p343-348 Nov 89.

Keywords: *Magnetic films, Field ion microscopy, Iron oxides, Silver, Thin films, Microstructure, Sputtering, Reprints, Atom probes.

Composite thin films prepared by sputter codeposition of Fe3O4 with small additions of Ag were investigated in this initial feasibility study. These nanocomposites possess unique magnetic properties which may be controlled by compositional variations. Atom probe field-ion microscopy was used to investigate the microstructure and microchemistry of the material. Field-ion microscopy in hydrogen was found to be the most suitable to provide microstructural contrast, and atom probe analysis using electrical pulses at various temperatures proved to be feasible and indicated that the Ag is not homogeneously distributed.

201,268
PB92-159151 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Neutron Powder Diffraction Study of Pb2Sr2YCu3O8, the Prototype of a New Family of Superconductors.
Final rept.
R. J. Cava, F. Beech, A. Santoro, W. F. Peck, M. Marezio, and J. J. Krajewski. 1989, 7p
Pub. in Physica C 157, n2 p272-278 1989.

Keywords: *Superconductors, Orthorhombic lattices, Neutron diffraction, Prototypes, Reprints, *Lead strontium yttrium cuprates, Rietveld method.

The structure of Pb2Sr2YCu3O8 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 material has pseudo tetragonal symmetry, but is orthorhombic, space group Cmmm with lattice parameters a = 5.3933(2), b = 5.4311(2), and c = 15.7334(6). The orthorhombic distortion is caused by the disordering in the ab plane of the oxygen atoms of the PbO layers over the general position of the space group, with x = 0.275(5) and y = 0.402(5). The structure of this compound can be derived from that of YBa2Cu3O6 by substituting the Cu layers with blocks of ...PbO.CuPbO.... Of the two Cu atoms in the asymmetric unit, one has two fold coordingation while the other has five fold pyramidal coordingation with the apex elongated along the c-axis.

201,269
PB92-159425 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.
Reflection High-Energy Electron Diffraction (RHEED) Oscillations at 77 K.
Final rept.
W. F. Egelhoff, and I. Jacob. 1989, 4p
Pub. in Physical Review Letters 62, n8 p921-924, 20 Feb 89.

Keywords: *Epitaxial growth, Cryogenic temperature, Oscillations, Surfaces, Copper, Iron, Silver, Reprints, Reflection high energy electron diffraction.

Strong intensity oscillations have been found in RHEED during epitaxial growth at 77 K. The temperature is too low for thermally activated diffusion and establishes that the deposited atom uses its latent heat of condensation to skip across the surface, preferentially coming to rest at growing island edges, to achieve quasi-layer-by-layer growth. The growth mechanism implies that RHEED oscillations should be observable at 0 K. The data also provide insight into the basic principles governing RHEED oscillations.

201,270
PB92-159441 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Domain Size and Spin Waves in a Reentrant Spin Glass.
Final rept.
R. W. Erwin. 1990, 3p
Pub. in Jnl. of Applied Optics 67, n9 p5229-5231 1990.

Keywords: *Magnetic domains, *Spin waves, Spin glass state, Small angle scattering, Neutron scattering, Size determination, Magnons, Reprints, Iron nickel phosphide boride alumindes, Depolarization.

(Fe(x)Ni(1-x)(75)P(16)B6Al3, above the multicritical concentration x > 0.15, indicate that domain sizes are in the range of 2 to 4 micrometers. This is approximately two orders of magnitude larger than the length scales observed with magnetic small-angle-neutron-scattering techniques. The depolarization shows evidence of domain size changes and/or canting as the reentrant-spin-glass state is entered, in agreement with the small-angle-scattering results. Sufficiently near to the multicritical concentration, the results can not be interpreted solely in terms of a canting transition, because the change in depolarization is too great. In the samples where anomalous low temperature spin waves have been observed, the depolarization behaves as in a conventional ferromagnet, indicating that the reentrant-spin-glass spin-wave behavior is related to a canting transition. The spin-wave spectrum calculated for a model canting system reasonably explains the observed spin-wave measurements.

201,271
PB92-159458 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Structure of Er-Y Superlattices.
Final rept.
R. W. Erwin, C. P. Flyn, R. Du, M. B. Salamon, J. J. Rhyne, and J. Borchers. 1988, 2p
See also PB90-149444.
Pub. in Jnl. of Physique 49, nNC-8 p1631-1632 1988.

Keywords: *Erbium, *Yttrium, *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 SQUID magnetometry on single crystal samples grown on sapphire substrates by molecular-beam-epitaxy techniques. The turn angle in the Er layers is magnetoelastically 'clamped', and in fact locks-in to the commensurate state omega = 2pi/7 below about 35 K. For the (Er(13)/Y(26)) superlattice the low temperature state is not 2pi/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
PB92-159466 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Magnetoelasticity in Rare-Earth Superlattices and Films.
Final rept.
R. Erwin, J. Rhyne, J. Borchers, R. Du, M. Salamon, and C. P. Flynn. 1989, 9p
Pub. in Physica B 161, n1-3 p260-268 Oct 89.

Keywords: *Magnetostriction, *Superlattices, *Yttrium, *Dysprosium, *Erbium, Thin films, Elasticity, Molecular beam epitaxy, Neutron scattering, Reprints, Exchange interactions.

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/Y) and (Er/Y) superlattices and Dy and Er thin films by neutron scattering and SQUID magnetometry have provided new insight into the interplay of magnetoelastic and exchange interactions in rare earths.

201,273
PB92-159565 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.
A. Feldman, H. P. R. Frederikse, and X. T. Ying. 1990, 7p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Diamond Optics II, San Diego, CA., August 7-8, 1989, v1146 p78-84 1990.

Keywords: *Thermal conductivity, *Thermal diffusivity, Chemical vapor deposition, Radiometry, Reprints, *Diamond films.

The superior thermal conductivity of single crystal diamond (20 W/cm/K at room temperature for type IIa diamond) makes diamond desirable for many applications requiring the dissipation of heat. Several experimental methods have been used to determine whether chemical vapor deposited (CVD) diamond has a comparable thermal conductivity. Values as high as 10 W/cm/K have been measured. In the paper, the authors discuss the use of photothermal radiometry to measure the thermal diffusivity and conductivity of CVD diamond.

201,274
PB92-159672 Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Estimated dTc/dP and dTc/dsigmaij for the Y1Ba2Cu3O7 Superconductor.
Final rept.
H. Ledbetter, and M. Lei. 1990, 3p
Pub. in Physica C 177, p86-88 1991.

Keywords: *High temperature superconductors, *Superconductors, Elastic properties, Transition temperature, Reprints, *Yttrium barium cuprates, Madelung energy, Ohta model.

For Y1Ba2Cu3O7 the authors estimated the critical-temperature pressure derivative dT(sub c)/dP and the three principal uniaxial compressive-stress derivatives dT(sub c)/d sigma(sub a), dT(sub c)/d sigma(sub b), dT(sub c)/d sigma(sub c).

201,275
PB92-159680 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Bound Hole Excitations in p-Hg0.76Cd0.24Te.
Final rept.
C. L. Littler, M. R. Loloee, W. Zawadzki, and D. G. Seiler. 1990, 4p
Pub. in Proceedings of International Conference on the Physics of Semiconductors (20th), Thessaloniki, Greece, August 6-10, 1990, v3 p2263-2266.

Keywords: *Mercury cadmium tellurides, Holes(Electron deficiencies), Photovoltaic effect, Laser radiation, Energy bands, Excitation, Reprints, Landau levels.

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 photovoltaic response of a p-type Hg(0.76)Cd(0.24) Te sample subjected to CO2 laser radiation. The transitions are well described by the Pidgeon-Brown energy band model, yielding an activation energy of 32 + or - 2 meV above the valence band edge for the deep level.

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 rept.
J. Pellegrino, J. Griffin, L. Myers, and M. Spencer. 1990, 6p
See also PB92-154525 Sponsored by National Science Foundation, Washington, DC.
Pub. in Materials Research Society Symposium Proceedings, v163 p881-886 1990.

Keywords: *Aluminum gallium arsenides, *Gallium arsenides, *Beryllium, Doped crystals, Molecular beam epitaxy, Bipolar transistors, Carrier mobility, Interstitials, Reprints.

Beryllium is an effective p-dopant in GaAs and AlGaAs and plays an important role in device characterizations of hetero bipolar transistors. The work addresses the doping and mobility properties for two series of beryllium-doped samples: GaAs and AlGaAs. Within each series the doping ranged between 3 x 10 to the 15th power/cc to levels of 5 x 10 to the 19th power/cc. Mobility and carrier concentrations were obtained through Hall and Polaron measurements. The doping concentration results suggest the onset of carrier compensation at higher doping levels. One possible explanation is that for high doping levels, Be is incorporated as interstitial donors. A thermodynamic model is used to explain the observations.

201,277
PB92-165034 Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Stacking Faults and Microstrain in La1.85M0.15CuO4 (M = Ca, Ba, Sr) by Analyzing X-ray Diffraction Line Broadening.
Final rept.
D. Balzar, H. Ledbetter, and A. Roshko. 1991, 2p
Pub. in Physica C 185-189, p871-872 1991.

Keywords: *Superconductors, *Stacking faults, X ray diffraction, High temperature superconductors, Strains, Reprints, *Lanthanum calcium cuprates, *Lanthanum barium cuprates, *Lanthanum strontium cuprates.

The authors obtained x-ray diffraction patterns for three oxides: La(1.85)M(0.15)CuO4 (M = Ca, Ba, Sr). The superconductors show zero-resistance T(c) values of 19, 28, and 36 K, respectively. Diffraction-line profiles were fit with a convolution of specimen and instrumental functions. The specimen line-broadening angular dependence was analyzed by the Warren-Averbach method of real Fourier coefficients. Stacking-fault probability increases with increasing T(c); microstrain decreases.

201,278
PB92-165323 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Sensitivity Limits to Ferrimagnetic Faraday Effect Magnetic Field Sensors.
Final rept.
M. N. Deeter, A. H. Rose, G. W. Day, and S. Samuelson. 1991, 3p
See also PB92-144518.
Pub. in Jnl. of Applied Physics 70, n10 p6407-6409, 15 Nov 91.

Keywords: *Faraday effect, Yttrium ion garnets, Gallium additions, Magnetic measurement, Ferrimagnetic materials, Cylindrical configuration, Demagnetization, Magnetooptics, Sensitivity, Reprints, Magnetic field sensors.

In general, the sensitivity of ferrimagnetic Faraday effect magnetic field sensors is a function of both the crystal geometry and composition. The geometrical dependence of the sensitivity in nonellipsoidal crystals, such as cylinders, is complicated by their spatially nonuniform demagnetizing factors. We compare sensitivity data obtained from a variety of cylindrical ion garnet samples with models which predict the effective demagnetizing factor N(eff) as a function of the length-to-diameter ratio. With respect to composition, we present experimental results of sensitivity vs diamagnetic substitution (x) in the iron garnet series Y3Fe(5-x)Ga(x)O12. As expected, the sensitivity rises sharply as x approaches the compositional compensation point.

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.
Final rept.
E. N. Farabaugh, A. Feldman, L. H. Robins, and E. S. Etz. 1989, 8p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Diamond Optics, v969 p24-31 1989.

Keywords: Chemical vapor deposition, Auger electron spectroscopy, Scanning electron microscopy, Raman spectroscopy, Thin films, Silicon carbides, Silica, Silicon, Substrates, Reprints, *Diamond films, Electron energy loss spectroscopy.

Results of research on diamond films grown by the hot filament chemical vapor deposition process are discussed. The parameters for film deposition have been surveyed and the conditions for routine and reproducible film formation established for the authors deposition system. These were: 800 C substrate temperature, 52-78 sccm flow rate, 5,000 Pa deposition pressure and 99.5% H2, 0.5% CH4 gas composition. Characterization of the deposited films has been accomplished with scanning electron microscopy (SEM), X-ray diffraction (XRD), Auger electron spectroscopy (AES), electron energy loss spectroscopy (EELS) and Raman spectroscopy; and the presence of the diamond phase was verified. Initial depositions on Si and Al2O3 substrates resulted in individual diamond particles showing the distinct diamond morphology. Deposition rates were of the order of 0.1 micrometer/hr, with the fastest apparent growth occurring on pretreated polycrystalline SiC substrates.

201,280
PB92-165448 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Materials Reliability Div.
Magnetic Studies of Pr2-xCexCuO4-delta.
Final rept.
M. Foldeaki, H. Ledbetter, and Y. Hidaka. 1991, 2p
Pub. in Physica C 185-189, p1127-1128 1991.

Keywords: *Superconductors, Magnetic susceptibility, Magnetic hysteresis, Meissner effect, Flux pinning, Spin glass, Reprints, *Praseodymium cerium cuprates.

In Pr2-xCexCuO4-delta compounds with x = 0.15, 0.18, the authors observed superconductivity below about 20 K. The authors measured magnetic hysteresis at 5 K in fields of 0.01-1.1 T. Above 0.5 T, the single-ion paramagnetism of Pr(3+) overwhelms the superconductivity. After correction, the superconductive M-H hysteresis loop shows a pinched-neck shape, resembling that found in Bi-Pb-Sb-Ca-Sr-Cu-O. The shape is attributed to dynamic flux-depinning effects. Time dependence of both the Meissner effect after zero-field cooling and the remanence after field cooling was studied in a 0.01-T field. It can be described best by an empirical relationship M(t) = M(o)t(sup -alpha) proving the failure of a simple thermally activated flux-creep model. One can interpret the behavior by using a spin glass model in the framework of hierarchically constrained dynamics.

201,281
PB92-165588 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Comment on 'Aluminum Cladding of High Tc Superconductor by Thermocompression Bonding'.
Final rept.
G. G. Harman. 1989, 1p
Pub. in Applied Physics Letters 55, n3 p321, 17 Jul 89.

Keywords: *High temperature superconductors, *Electric contacts, *Aluminum, Reliability(Electronics), Failure(Electronics), Reprints, *Yttrium barium cuprates, *Claddings, Thermocompression bonding.

This is a response to an earlier paper on aluminum cladding of silver-contacted YBaCuO superconductor ceramics. The authors envisioned using their method for production when such superconductors become practical. The response points out, with 8 references, the long history of reliability problems with the Ag-Al metallurgical couple, indicating that the proposed system cannot be improved without basic metallurgical changes.

201,282
PB92-165695 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Static and Nonlinear Complex Susceptibility of YBa2Cu3O7.
Final rept.
T. Ishida, R. B. Goldfarb, S. Okayasu, and Y. Kazumata. 1991, 2p
See also PB91-134148.
Pub. in Physica C 185-189, p2515-2516 1991.

Keywords: *High temperature superconductors, *Magnetic susceptibility, Temperature dependence, Meissner effect, Complex variables, Reprints, *Yttrium barium cuprates.

The authors have investigated the harmonic susceptibility chi(sub n) of sintered YBa2Cu3O7 in the field of H(dc) + H(ac)sin omega(t). Both even and odd chi(sub n)'s were detected for nonzero H(dc), but only odd harmonics were observed for zero H(dc). At constant temperature, chi(sub n) is an even function of H(dc) when n is odd while chi(sub n) is an odd function of H(dc) when n is even. The authors compared experimental features with the prediction of the critical state model. For comparison, the static susceptibility chi(dc) of YBa2Cu3O7 was examined as a function of temperature.

201,283
PB92-165836 Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Atomic Frequency and Elastic Constants.
Final rept.
H. Ledbetter. 1991, 3p
Pub. in Zeitschrift fur Metallkunde 82, n11 p820-822 1991.

Keywords: *Elastic properties, Vibrational spectra, Shear modulus, Bulk modulus, Debye temperature, Cubic lattices, Frequency, Reprints.

Since 1910, teachers and researchers have invoked the Einstein-Madelung-Sutherland relationship to relate solid-state atomic-vibration frequencies to other basic solid-state properties: M = atomic mass, V(a) = atomic volume, and B = Bulk modulus. The usual relationship for the frequency is nu = K(V(a)(sup 1/6) M(sup -1/2) B(sup 1/2), where K denotes a material-independent numerical constant. For 24 elements crystallized in a cubic lattice, the authors show that substituting the shear modulus for the bulk modulus improves the E-M-S relationship from an average 24-percent discrepancy to an average 2-percent discrepancy.

201,284
PB92-165893 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
In-situ Surface Roughness Measurement during Sputter-Depth Profiling.
Final rept.
D. Marton, and J. Fine. 1988, 4p
See also PB88-147236.
Pub. in Physics of Ionized Gases, p228-231 1988.

Keywords: *Surface roughness, Ion bombardment, Auger effect, Interfaces, Chromium, Nickel, Silver, Reprints, Total integrated scattering, Multilayers.

Measurements of surface roughness obtained while Auger sputter-depth profiling thin metallic multilayered systems were correlated with that of the observed Auger interface width. The surface roughness increases with the sputtered depth and the energy of the bombarding ions, and constitutes an important contribution to the interface width.

201,285
PB92-165927 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.

X-ray-Absorption Near-Edge Structure of Transition-Metal Zinc-Blende Semiconductors: Calculation versus Experimental Data and the Pre-Edge Feature.
Final rept.
D. A. McKeown. 1992, 6p
See also PB92-117092.
Pub. in Physical Review B 45, n6 p2648-2653, 1 Feb 92.

Keywords: *X ray absorption, *Chalcopyrite, *Sphalerite, Zinc sulfides, Semiconductors, Reprints.

X-ray-absorption near-edge structure (XANES) data were collected for Zn in 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 was 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 multiple- and single-scattering contributions to the calculated edge spectra were scaled down to better fit the experimental data. The conclusions from the calculations indicate that the pre-edge feature in the experimental Cu- and Fe-edge data for chalcopyrite can 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 bound-state transitions of the absorber.

201,286
PB92-170646 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Grazing-Angle Neutron Diffraction.
Final rept.
J. F. Ankner, H. Zabel, D. A. Neumann, C. F. Majkrzak, J. A. Dura, and C. P. Flynn. 1989, 7p
Contract DE-AC02-76-ER01198
Sponsored by Department of Energy, Washington, DC.
Pub. in Colloque de Physique C7, p189-195 Oct 89.

Keywords: *Neutron diffraction, Molecular beam epitaxy, Grazing incidence, Metal films, Thin films, Chromium, Reprints, Neutron reflectometry.

We describe the principles of grazing-angle neutron diffraction and our implementation of it. By relaxing nonessential collimations, we can maximize the limited intensity available from conventional neutron sources, yet still preserve the depth-sensitivity of the grazing-angle method. We have studied a 3200A Cr film, grown by molecular beam epitaxy, and discuss the results of this measurement in the context of current experimental conditions and future improvements.

201,287
PB92-170869 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Ultrasonic Sensor for Process Modeling and Process Control of Ceramic Superconductors.
Final rept.
E. Drescher-Krasicka. 1990, 6p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v9A-9B p2079-2084 1990.

Keywords: *High temperature superconductors, *Process control, Crystal-phase transformations, Temperature dependence, Elastic properties, Nondestructive analysis, Acoustic velocity, Ultrasonic radiation, Sensors, Reprints, Yttrium barium cuprates.

An ultrasonic sensing technique was developed to continuously monitor elastic and anelastic properties of YBaCuO superconductors during the processing over a wide temperature range. Ultrasonic velocity changes, as a function of processing time and temperature, indicate the transformation of the tetragonal phase to orthorhombic phase (at elevated temperatures) in these ceramics. The reversibility of the transition in YBaCuO provides a good model system for studying the effect of phase changes on ultrasonic velocity. The feasibility of using a nondestructive ultrasonic sensor for monitoring the effects of processing time and temperature on the resultant mechanical and structural properties of 123 ceramic superconductors has been demonstrated.

201,288
PB92-170968 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Structure of Er(Vertical Bar)Y Superlattices.
Final rept.
R. W. Erwin, J. J. Rhyne, J. Borchers, M. B. Salamon, R. Du, and C. P. Flynn. 1988, 2p
Grant NSF-DMR85-21616
See also PB90-149444. Sponsored by National Science Foundation, Washington, DC.
Pub. in Journal de Physique C8, p1631-1632 Dec 88.

Keywords: *Superlattices, *Erbium, *Yttrium, Molecular beam epitaxy, Neutron diffraction, Single crystals, Magnetostriction, Substrates, Sapphire, Reprints.

The magnetic structure of Er (vertical bar) Y superlattices has been determined by neutron diffraction and squid magnetometry on single crystal samples grown on sapphire substrates by molecular-beam-epitaxy techniques. The turn angle in the Er layers is magnetoelastically 'clamped', and in fact locks-in to the commensurate state omega = 2pi/7 below about 35 K. For the (Er13 (vertical bar) Y26) 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.

201,289
PB92-171032 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Anisotropic Magnetic Response of Rare Earths in Superlattices.
Final rept.
C. P. Flynn, F. Tsui, M. B. Salamon, R. W. Erwin, and J. J. Rhyne. 1990, 11p
Pub. in Magnetic Properties of Low-Dimensional Systems II: New Developments, p128-138 1990.

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 through Y space layers over 120 A thick. In superlattices grown along the b axis, however, no 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.

201,290
PB92-171057 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Thermal Diffusivity of CVD Diamond Films Using Thermal Wave Techniques.
Final rept.
H. P. R. Frederikse, A. Feldman, and X. T. Ying. 1990, 3p
Pub. in Photoacoustic and Photothermal Phenomena II, p130-132 1990.

Keywords: *Thermal diffusivity, Chemical vapor deposition, Thermal conductivity, Thin films, Radiometry, Reprints, *Diamond films.

The thermal diffusivities of CVD diamond films have been measured by means of photothermal radiometry.

201,291
PB92-171255 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Secondary Ion Yield Matrix Effects in SIMS Depth Profiles of Si/Ge Multilayers.
Final rept.
G. Gillen, J. M. Phelps, P. Williams, R. W. Nelson, and S. M. Hues. 1989, 10p
Pub. in Surface and Interface Analysis 14, n11 p771-780 1989.

Keywords: *Germanium, *Silicon, Auger electron spectroscopy, Thin films, Reprints, Secondary ion mass spectroscopy, Depth profiles, Multilayers.

Thin multilayer samples of Si/Ge, with individual layer thicknesses of 4-33 nm, have been analyzed by secondary ion mass spectrometry (SIMS) using Ar(1+), O2(1+), and Cs(1+) primary ion beams. Bombardment with both Ar(1+) and O2(1+) produced positive secondary ion depth profiles in which pronounced distortions were observed. Similar effects were found in negative secondary ion depth profiles with Cs(1+) bombardment. 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 periodicity indicating that the layers were superposed, a condition which was not consistent with sample preparation, as verified by Auger electron spectroscopy (AES). AES depth profiling was also used to quantitate the level of oxygen in the films. From the data it was concluded that the distortions in the positive secondary ion depth profiles under Ar(1+) bombardment were the result of secondary ion yield variations induced by enhanced incorporation of ambient oxygen, during sample preparation, into the stronger oxide-forming silicon layers. Under O2(1+) and Cs(1+) bombardment, the profile distortions were introduced by differential incorporation of the implanted primary species into the lower-sputter-yield silicon layers.

201,292
PB92-171578 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Surface Analysis of Interfacial Properties for Thin Film and Bulk YBa2Cu3O7.
Final rept.
A. J. Nelson, L. L. Kazmerski, A. R. Mason, A. B. Swartzlander, R. D. McConnell, R. Ono, J. Beall, and J. W. Ekin. 1988, 7p
Pub. in Proceedings of Annual Conference on Superconductivity and Applications (2nd), Buffalo, NY., April 18-20, 1988, p161-167.

Keywords: *High temperature superconductors, *Superconducting films, Auger electron spectroscopy, Grain boundaries, Electrical resistance, Surface chemistry, Electric contacts, Thin films, Interfaces, Indium, Silver, Reprints, *Yttrium barium cuprates.

Auger electron spectroscopy (AES) has been used to characterize the surface and grain boundary chemistry of thin film YBa2Cu3O7 and the interface chemistry between In and Ag contacts to bulk YBa2Cu3O7 before and after the standard post-deposition annealing. Compositional variations at grain boundaries as well as substrate effects have been related to the observed nonlinear tailing in the resistivity vs temperature curves. In addition, AES analysis of the contact/YBa2Cu3O7 interfacial chemistry is used to explain the large variations in contact resistances observed for these technologically important materials.

201,293
PB92-171644 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Temperature Dependence of Magnetic Order in UPdSn.
Final rept.
R. A. Robinson, A. C. Lawson, J. W. Lynn, and K. H. J. Buschow. 1992, 6p
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review B 45, n6 p2939-2944, 1 Feb 92.

Keywords: *Palladium intermetallics, *Tin intermetallics, Time-of-flight method, Antiferromagnetic materials, Temperature dependence, Cryogenic temperature, 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, it is a noncollinear antiferromagnet with magnetic space group P(sub c)2(sub 1), and a uranium magnetic moment of (2.05 + or - 0.04) mu(sub B), in agreement with previous work. The structure can be described in terms of the magnitude of the uranium magnetic moment mu and two independent canting angles 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 the magnetic order. All three model parameters (mu, theta, and phi) vary continuously with temperature, and there is no evidence from the authors' data of any sharp transitions below the Neel point of 43 + or - 2 K. The angle phi is almost constant over the whole temperature range, while the magnetic moment decreases continuously until it disappears just above 40 K. The angle theta decreases continuously up to a temperature 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.

PHYSICS

Solid State Physics

201,294
PB92-175041 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Electron and Optical Physics Div.
Limitations on a Combined Phonon: Non-Phonon Mechanism for Superconductivity in Bi2Sr2Ca1Cu2Ox.
Final rept.
T. W. Barbee, M. L. Cohen, and D. R. Penn. 1991, 4p
Sponsored by National Science Foundation, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Physics Letters A 161, p85-88 1991.

Keywords: *High temperature superconductors, Isotope effects, Phonons, Limitations, Reprints, *Bismuth strontium calcium cuprates.

Despite the large number of theories proposed to explain high-temperature superconductivity, no clear explanation of its origin exists. Experimental data such as the isotope effect alpha and the gap ratio 2 Delta/k(B)T(c) can be used to constrain possible models for high-temperature superconductivity. The authors consider a class of models which contain contributions to pairing from phonons and also from another unspecified boson, and place limitations on such models in light of these experimental data and recent results derived from photoemission data for Bi2Sr2Ca1Cu2Ox.

201,295
PB92-175058 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Calculated Majority- and Minority-Carrier Mobilities in Heavily Doped Silicon and Comparisons with Experiment.
Final rept.
H. S. Bennett, and J. R. Lowney. 1992, 12p
Pub. in Jnl. of Applied Physics 71, n5 p2285-2296, 1 Mar 92.

Keywords: *Carrier mobility, *Silicon, Born approximation, Quantum mechanics, Phase shift, Scattering, Reprints.

As silicon devices approach 0.1 micrometer in size, it will be essential to have accurate values of the majority and minority mobilities of electrons and holes. These mobilities have been calculated in silicon for donor and acceptor densities between 10(sup 17) and 10(sup 20)/cc. All the important scattering mechanisms have been included. The ionized impurity scattering has been treated with a quantum-mechanical phase-shift analysis. The results are in good agreement with experiment, but predict that the change of minority electron mobility with increasing dopant density should decrease slightly at high dopant densities for a small range of densities. The effect occurs mainly because of the reduction of plasmon scattering. Some recent experiments support these findings. In addition, the ionized impurity scattering rates calculated from the quantum-mechanical phase shifts and those rates calculated from the Born approximation are shown to differ by more than factors of 3. The Born approximation is not valid for low-energy carriers near band extrema.

201,296
PB92-175108 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Electron and Optical Physics Div.
Magnetic Imaging via Scanning Electron Microscopy with Polarization Analysis.
Final rept.
R. J. Celotta, M. Scheinfein, J. Unguris, and D. T. Pierce. 1991, 4p
Pub. in Science and Technology of Nanostructured Magnetic Materials, p335-338 1991.

Keywords: *Magnetic domains, Scanning electron microscopy, Imaging techniques, Magnetism, Polarization, Reviews, Reprints.

A brief review is provided of the technique of scanning electron microscopy with polarization analysis (SEMPA) with examples of magnetic domain observation.

201,297
PB92-175264 Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Magnetic Susceptibility of Pr2CuO4 Monocrystals and Polycrystals.
Final rept.
M. Foldeaki, H. Ledbetter, and Y. Hidaka. 1991, 3p
Pub. in Jnl. of Applied Physics 70, n10 p5736-5738, 15 Nov 91.

Keywords: *Magnetic susceptibility, *Superconductors, Single crystals, Polycrystalline, Temperature dependence, Magnetic fields, Crystal field, Reprints, *Praesodymium cuprates.

The authors measured the field dependence and temperature dependence of Pr2CuO4 monocrystals and polycrystals and found indications of field-dependent Cu(+2)-Pr(+3) interactions. One can interpret the non-Curie-Weiss behavior by considering crystal-field effects.

201,298
PB92-175314 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Critical Current Measurement of High Tc Superconductors.
Final rept.
L. F. Goodrich. 1990, 5p
Pub. in Proceedings of Annual U.S.-Japan Workshop on Superconductors (3rd), Buffalo, NY., September 20-21, 1990, p64-68.

Keywords: *High temperature superconductors, *Critical current, Superconducting films, Electrical measurement, Direct current, Simulators, Reprints, Yttrium barium cuprates.

A passive voltage-current (V-I) simulator has been developed and tested using conventional direct current (dc), lock-in amplifier and pulse current methods. The simulator was designed to generate the extremely nonlinear V-I characteristic of a superconductor. It is intended to be used to test various components of the measurement system, such as instrumentation, measurement method and data analysis software, to determine the transport critical current (Ic) or critical current density (Jc) of a superconductor. Comparison of the pulse current and the lock-in amplifier methods with the conventional direct current method on the passive simulator are presented. Also, preliminary comparisons of dc and pulse methods using a thin film YBCO sample are given.

201,299
PB92-175322 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
High-Tc Superconductor Voltage-Current Simulator and the Pulse Method of Measuring Critical Current.
Final rept.
L. F. Goodrich. 1991, 8p
Pub. in Cryogenics 31, p720-727 Aug 91.

Keywords: *High temperature superconductors, *Critical current, Superconducting films, Electrical measurement, Direct current, Simulators, Reprints, Yttrium barium cuprates.

A passive voltage-current (V-I) simulator has been developed and tested using conventional direct current (d.c.) and pulse current methods. The simulator was designed to generate the extremely non-linear V-I characteristic of a superconductor and has a similar power-law behavior. It is intended to be used to test various components of the measurement system such as instrumentation, measurement method and data analysis software, to determine the transport critical current, Ic or critical current density, Jc, of a superconductor. This simulator does not emulate all the subtle effects of flux flow in a superconductor. However, it approximates a superconductor's major static and dynamic electrical characteristics. The simulator is therefore a necessary but incomplete test of a measurement system. Critical currents obtained on the simulator using the pulse and d.c. methods are compared and show close agreement. Also, preliminary comparisons of methods using bulk and thin film YBCO samples are given.

201,300
PB92-175348 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Critical-Current Simulation and Data Acquisition.
Final rept.
L. F. Goodrich, and A. N. Srivastava. 1992, 9p
Pub. in Superconductor Industry, p28-36 1992.

Keywords: *Superconductors, *Critical current, Electrical measurement, Data acquisition, Simulators, Circuits, Reprints.

The superconductor simulator is an electronic circuit that emulates the extremely nonlinear voltage-current characteristic (the basis of a critical-current measurement) of a superconductor along with its other major electrical properties. The authors designed three different types of simulators: the passive, temperature controlled passive (TCP), and active simulators. These simulators are high precision instruments, and are thus useful for establishing the integrity of part of a superconductor measurement system. They could significantly benefit superconductor measurement applications that require high-precision quality assurance. The authors have also designed software to control their computer-driven data acquisition and analysis system. It uses various algorithms to efficiently characterize the conductor's electrical properties, and generates summaries of the acquisition and analysis phase of the measurement along with plots of relevant data. The software and the superconductor simulator serve as diagnostic tools for determining sources of systematic and random errors in the authors' measurement system.

201,301
PB92-175462 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Magnetic Properties of NiMnSb Films.
Final rept.
R. Kabani, M. Terada, A. Roshko, and J. S. Moodera. 1990, 3p
Grant NSF-DMR86-19087
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Applied Physics 67, n9 p4898-4900, 1 May 90.

Keywords: Ferromagnetic materials, Magnetic properties, Thin films, Auger effect, Kerr effect, Magnetization, Polycrystalline, Reprints, *Nickel manganese antimonides.

Thin polycrystalline films of half-metallic ferromagnetic NiMnSb compound have been successfully prepared by simultaneous evaporation of Ni, Mn, and Sb elements onto heated glass and sapphire substrates. X-ray diffraction, Rutherford backscattering spectroscopy, energy-dispersive X-ray spectroscopy, and Auger studies confirmed the quality of the films and surface composition. Magnetization and Kerr rotation obtained for these films agree well with those made on a single crystal of NiMnSb. Using electron tunneling techniques, attempts have been made to measure the conduction electron spin polarization, which is theoretically predicted to be large.

201,302
PB92-175488 Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Elastic Properties of Bi2Sr2Ca1Cu2O8 and Bi2Sr1.5Ca1.5Cu2O8.
Final rept.
H. Ledbetter, S. Kim, and K. Togano. 1991, 2p
Pub. in Physica C 185-189, p935-936 1991.

Keywords: *High temperature superconductors, Elastic properties, Poisson ratio, Shear modulus, Young modulus, Polycrystalline, Reprints, *Bismuth strontium calcium cuprates.

For polycrystalline Bi-Sr-Ca-Cu-O (2212 and 2, 1.5, 1.5, 2), the authors report the 5-295-K elastic constants: shear modulus, Young modulus, bulk modulus, Poisson ratio. The two materials behave differently. The 2212 behaves nearly regularly: for example the bulk modulus increases smoothly and monotonically about 3% between 295 and 5 K, showing little thermal hysteresis. However, during cooling, the higher-calcium material shows a strong elastic softening below 200 K, and also a large thermal hysteresis. The strong mode softening in the higher-calcium material differs from that found in (La-Sr)2CuO4. The extrapolated 0-K elastic constants lead to Debye temperatures of 284 and 269 K.

201,303
PB92-175496 Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.

Monocrystal Elastic Constants of Orthotropic Y1Ba2Cu3O7: An Estimate.
Final rept.
H. Ledbetter, and M. Lei. 1991, 3p
Pub. in Jnl. of Materials Research 6, n11 p2253-2255 Nov 91.

Keywords: *High temperature superconductors, Single crystals, Debye temperature, Bulk modulus, Elastic properties, Reprints, *Yttrium barium cuprates.

For Y1Ba2Cu3O7, using only reported monocrystal measurements and some analysis-theory, the authors estimated the complete nine-component orthotropic-symmetry elastic-stiffness matrix, the Voigt C(ij) matrix. Comparison with very-high-frequency tetragonal-symmetry phonon-dispersion results shows good agreement (9% on average), except for C(12).

201,304
PB92-175512 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Anisotropic Weak-Link Properties and Intergranular Lower Critical Field of Grain-Aligned YBa2Cu3Ox.
Final rept.
R. J. Loughran, and R. B. Goldfarb. 1991, 5p
Pub. in Physica C 181, p138-142 1991.

Keywords: *High temperature superconductors, *Critical field, Magnetic susceptibility, Magnetization, Anisotropy, Reprints, *Yttrium barium cuprates, 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 a,b planes. 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 0.15 kA/m (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 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Scanning Tunneling Microscopy of the Surface Morphology of YBa2Cu3Ox Thin Films between 300 and 76 K.
Final rept.
J. Moreland, P. Rice, S. E. Russek, B. Jeanneret, A. Roshko, R. H. Ono, and D. A. Rudman. 1991, 3p
Contract DE-AI05-90ER14044
Sponsored by Department of Energy, Washington, DC.
Pub. in Applied Physics 59, n23 p3039-3041, 2 Dec 91.

Keywords: *Superconducting films, Scanning tunneling microscopy, High temperature superconductors, Strontium titanates, Magnesium oxides, Temperature dependence, Substrates, Thin films, Reprints, *Yttrium barium cuprates, Lanthanum aluminates, Laser ablation.

Scanning tunneling microscopy (STM) images of YBa2Cu3Ox (YBCO) thin films show different growth mechanisms depending on the deposition method and substrate material. The authors present images of YBCO films sputter deposited onto MgO and SrTiO3, and laser ablated onto LaAlO3 showing screw dislocation and ledge 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 of 1.2nm at 76 K. The phenomenon reflects changes in either the surface tunneling barrier or tunneling density of states upon cooling.

201,306
PB92-175777 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Crystallography.
Final rept.
A. Santoro. 1990, 38p
Pub. in High Temperature Superconductivity, Chapter 4, p84-121 1990.

Keywords: *High temperature superconductors, *Crystal structure, X-ray diffraction, Neutron diffraction, Crystal chemistry, Reviews, Reprints, Lanthanum strontium cuprates, Yttrium barium cuprates, Bismuth strontium calcium cuprates.

The high temperature superconductors discovered so far belong to five chemical systems having the following general formulas: (1) BaPb1-xBixO3, (2) La2-xMxCuO4-y (M = Ba, Sr), (3) Ba2MCu3Odelta (M = Y, Gd, Eu, etc.), (4) Ba2-xLa1+xCu3Odelta, and (5) Bi2CaSr2Cu2Odelta. 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 will review the atomic arrangement and the crystal chemistry of the most important materials analyzed up to the present time.

201,307
PB92-192103
(Order as PB92-192079, PC **A05**)
National Inst. of Standards and Technology, Gaithersburg, MD.
Optical Calibration of a Submicrometer Magnification Standard.
J. Geist, B. Belzer, M. L. Miller, and P. Roitman. 1992, 6p
Included in Jnl. of Research of the National Institute of Standards and Technology, v97 n2 p267-272 Mar/Apr 92.

Keywords: *Electron microscopes, *Standards, *Calibration, Transmission electron microscopy, Scanning electron microscopy, Film thickness, Ellipsometry, Polysilicons, 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-oxide 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 thickness for the layer from the ellipsometric parameters is also derived.

201,308
PB92-196088 PC **A06**/MF **A02**
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Ferroelectric Thin Films Prepared by Pulse Laser Deposition Processing and Characterization.
L. P. Cook, C. K. Chiang, and P. K. Schenck. May 92, 124p NISTIR-4844

Keywords: *Ferroelectric crystals, *Barium titanates, *PZT, Nonvolatile memories, Laser ablation, Crystal structure, Thin films, Pulsed laser deposition.

The report describes the development of piezoelectric lead zirconate-titanate (PZT) and barium titanate (BT) thin films for application to non-volatile memories 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 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Electron and Optical Physics Div.
Photoinduced Resonant Tunneling Treated by an Extended Transfer Hamiltonian Method.
Final rept.
S. P. Apell, and D. R. Penn. 1992, 12p
Pub. in Physical Review B 45, n12 p6757-6768, 15 Mar 92.

Keywords: *Resonant tunneling, Hamiltonian functions, Scanning tunneling microscopy, Transition probabilities, Frequency response, Reprints, Quantum wells.

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 barrier and an irradiated quantum 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 cutoff in the frequency response for high frequencies is limited by the optical properties of the outer electrodes of the double barrier.

201,310
PB92-197532 Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Magnetic-Susceptibility-Temperature Peaks in Fe-Cr-Ni Alloys.
Final rept.
M. Foldeaki, and H. Ledbetter. 1992, 8p
Pub. in Physica Status Solidi (a) 129, p255-262 1992.

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
PB92-197557 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Surface and Microanalysis Science Div.
Inelastic Resonance Scattering, Tunneling, and Desorption.
Final rept.
J. W. Gadzuk. 1991, 12p
Pub. in Physical Review B 44, n24 p13 466-13 477, 15 Dec 91.

Keywords: *Resonance scattering, *Resonant tunneling, Inelastic scattering, Electron scattering, Electron tunneling, Nitrogen oxide(NO), Platinum, Phonons, Reprints, Laser induced desorption, Quantum wells, Heterostructures.

Excitation of a localized oscillator or phonon due to transient 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 probabilities and translational energy distribution--are obtained. These results and insights are considered in the light of a semiclassical wave-packet-dynamics model, which previously had been developed to account for observed nonthermal, laser-induced desorption in the system NO/Pt(111).

201,312
PB92-197581 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Trends in Superconductor Critical-Current Measurement Technology in the USA.
Final rept.
L. F. Goodrich, and A. N. Srivastava. 1991, 4p
Pub. in Proceedings of International Symposium on Pre-Standards Research for Advanced Materials, Tokyo, Japan, December 16-18, 1991, p297-300.

Keywords: *Superconductors, *Critical current, *Electrical measurement, High temperature superconductors, Interlaboratory comparisons, Uncertainty, Precision, Standards, Trends, USA, Reprints.

The paper indicates trends in superconductor measurement technology in the USA, and discusses available methods to reduce measurement uncertainty and imprecision. The results of interlaboratory comparisons of critical-current measurements have indicated that a detailed sample test procedure is essential to reduce interlaboratory measurement variation. High temperature superconductors are particularly susceptible to degradation with time, mounting, and use. These factors contribute to the overall uncertainty in the measurement, and play a similar role in the measurement uncertainty as do random processes. A standard reference material such as SRM-1457 or a superconductor simulator can greatly aid in identifying sources of measurement variation. Although HTS and LTS technologies are in different states 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 (MSEL), Gaithersburg, MD. Metallurgy Div.
Eddy Current Sensing of Oxygen Content in High-T(c) Superconductors.
Final rept.
W. Johnson, A. H. Kahn, C. K. Chiang, and H. N. G. Wadley. 1990, 6p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v9B p2085-2090 1990.

Keywords: *High temperature superconductors, Eddy current tests, Process control, Electrical resistivity, Monitoring, Sensors, Reprints, *Yttrium barium cuprates, *Oxygen content, Nondestructive evaluation.

The superconducting properties of high-T(c) ceramics depends critically on the oxygen content which is, in turn, determined by the details of powder processing and sintering. A noncontact eddy current technique has been devised for monitoring the oxygen in these materials during high-temperature processing, taking advantage of the fact that the resistivity at elevated temperatures is dominated by carriers contributed by oxygen. The sensor employs a resonant circuit, with a coil surrounding the sample and with a capacitor connected in parallel, chosen such that resonance occurs near one megahertz. This configuration is suitable for studying small pill-shaped samples which are now commonly used in research on high-T(c) ceramics.

201,314
PB92-197912 Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Critical-Temperature/Debye-Temperature Correlation in (La-M)2CuO4 Superconductors.
Final rept.
H. Ledbetter, S. Kim, and A. Roshko. 1991, 2p
Pub. in Physica C 190, p129-130 1991.

Keywords: *Superconductors, Elastic properties, High temperature superconductors, Calcium oxides, Barium oxides, Electron phonon interactions, Debye temperature, Critical temperature, Ultrasonic radiation, Acoustic velocity, Reprints, *Lanthanum strontium cuprates.

The authors consider three La(1.85)M(0.15)CuO4 compounds with M=Ca, Ba, Sr. By measuring ultrasonic sound velocities, they determined the acoustic Debye temperature Theta(D) which at T=0 K equals the specific-heat Debye temperature. Like conventional BCS materials, T(c) depends regularly on Theta(D). Unlike BCS materials where T(c) decreases with increasing Theta(D) (lattice softening increases T(c)), T(c) increases with increasing Theta(D). This difference reflects in how the electron-phonon parameter lambda depends on Theta(D). In McMillan's analysis, lambda approx = Theta(D)(sup -2). Thus, for conventional materials, the T(c)-Theta(D) curve increases, passes through a maximum at lambda=2, and then decreases. Keeping the usual T(c)(Theta(D),lambda) models requires us to abandon the lambda approx = Theta(D)(sup -2) relationship and adopt lambda approx = Theta(D)(sup n), where n > -lambda.

201,315
PB92-198027 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Periodicities in the X-Ray Diffraction of Low Order AlAs/GaAs Superlattices.
Final rept.
J. G. Pellegrino, S. Qadri, W. F. Tseng, W. R. Miller, and J. Comas. 1992, 6p
Pub. in Materials Research Society Symposia Proceedings, v230 p219-224 1992.

Keywords: *Superlattices, Aluminum arsenides, Gallium arsenides, Molecular beam epitaxy, X-ray diffraction, Interfaces, Layers, Reprints.

In the work the authors examine the physical properties for the superlattice system (GaAs)n1 (AlAs)n2/GaAs(100) for low values of n1 and n2, i.e., n1 = n2 = 3, 6, 12. Normal, interrupted growth, and migration enhanced epitaxy (MEE) growth techniques were used to grow the superlattice structures in a molecular beam epitaxy system. X-ray, diffraction spectra were obtained, and the major and satellite peak positions were analyzed to obtain the superlattice periodicity. An analysis of the major diffraction peaks and their associated satellites produced superlattice periodicity in good agreement with theory. Diffraction peaks were also observed in regions adjacent to the primary diffraction peaks which did not occur in the expected satellite positions. An analysis of these peaks relative to the primary peak indicate periodicities corresponding to layer thickness greater than the intended period. One possible cause for these periodicities is growth conditions that exist during the growth of the superlattice which result in the deposition of fractional monolayers. In the study the authors present results which suggest that an arsenic-deficient growth condition may be a contributing factor in the deposition of fractional monolayers.

201,316
PB92-198050 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Critical Currents in Silver-Sheathed (Bi,Pb)2Sr2Ca2Cu3O10-y Superconducting Tapes.
Final rept.
D. Shi, S. Salem-Sugui, Z. Wang, L. F. Goodrich, S. X. Dou, H. K. Liu, Y. C. Guo, and C. C. Sorrell. 1991, 3p
Sponsored by Department of Energy, Washington, DC.
Pub. in Applied Physics Letters 59, n24 p3171-3173, 9 Dec 91.

Keywords: *High temperature superconductors, *Critical current, Doped materials, Lead additions, Microstructure, Powder(Particles), Transport properties, Sintering, Tapes, Reprints, *Bismuth strontium calcium cuprates.

Nearly 95 vol % of the 110 K superconducting phase was formed by lead doping in a Bi-Sr-Ca-Cu-O system. The processed 110 K superconducting powders were used to produce long silver-sheathed tapes with a highly textured microstructure by rolling and prolonged sintering. The transport critical current density was measured at 4.0 K to be 70,000 A/sq cm (the corresponding critical current is 74 A) at zero field and 16,000 A/sq cm at 12 T for H parallel ab. At 76 K, the critical current density reached a value of approx 10,000 A/sq cm at zero field for H parallel ab and gradually decreased to 419 A/sq cm at 1 T. Excellent grain alignment in the a-b plane led to greatly improved critical current densities under a magnetic field. The relationship between the transport properties and the microstructure of the tapes is discussed.

201,317
PB92-205426 PC **A05**/MF **A01**
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Workshop on Characterizing Diamond Films. Held in Gaithersburg, MD. on February 27-28, 1992.
A. Feldman, C. P. Beetz, M. Drory, and S. Holly. May 92, 96p NISTIR-4849
Prepared in cooperation with Advanced Technology Materials, Inc., Danbury, CT., Crystallume, Menlo Park, CA., and Rockwell International, Canoga Park, CA. Rocketdyne Div.

Keywords: *Meetings, *Chemical vapor deposition, *Diamonds, Thin films, Standards, Mechanical properties, Thermal conductivity, Raman spectroscopy, Thermal diffusivity, Quality assurance, Fourier transform spectrometers.

A workshop was held at NIST on February 27th and 28th to discuss specific topics deemed important to the characterization of diamond films made by chemical vapor deposition and to address the need for standards in diamond technology. The workshop was held in response to a recommendation in a recent report assessing diamond technology in Japan. The audience targeted for the workshop were the producers and potential users of CVD diamond technology in the United States. University scientists were invited as experts in property measurements. There were 35 attendees at the workshop. The workshop consisted of presentations in the areas of thermal conductivity measurement, mechanical properties measurement, and the need for standards.

201,318
PB92-236231 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Profile Refinement in Neutron Reflectivity and Grazing Angle Diffraction.
Final rept.
J. F. Ankner. 1992, 5p
See also PB92-170646.
Pub. in Springer Proceedings in Physics, Surface X-ray and Neutron Scattering, v61 p105-109 1992.

Keywords: *Neutron diffraction, Distorted wave theory, Grazing incidence, Polymers, Reprints, *Neutron reflectivity.

Using modern high-speed computers, one can now model specular reflectivity experiments with unprecedented precision. For thin film and multilayer systems exhibiting large characteristic interfacial roughness or interdiffusion and for polymeric materials with unusual density profiles, a discrete layer-modeling scheme is required for an accurate and physically meaningful interpretation of the modeled profile. The incorporation of such a layer-generating algorithm into a non-linear least squares fitting routine can greatly increase the quality of the information available in reflectivity measurements. Applying these techniques to the modeling of grazing-angle diffraction data is particularly important for neutrons since the characteristic penetration depths are, in general, some four times larger than for x rays. We will outline the grazing-angle analogue of reflectivity profile analysis using the distorted-wave approximation and discuss possible applications.

201,319
PB92-236330 Not available NTIS
National Inst. of Standards and Technology (CAML), Gaithersburg, MD. Applied and Computational Mathematics Div.
Using Multipoles Decreases Computation Time for Magnetostatic Self-Energy.
Final rept.
J. L. Blue, and M. R. Scheinfein. 1991, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics 27, n6 p4778-4780 Nov 91.

Keywords: *Domain walls, *Magnetic domains, *Magnetostatics, Mathematical models, Ferromagnetic materials, Magnetic films, Thick films, Thin films, Computation, Algorithms, Reprints, Micromagnetics.

The calculation of the magnetostatic self-energy and field is the most computationally intensive aspect of micromagnetics simulations. The computation time is proportional to N(sup 2), where N is the number of cells in the discretized problem. We have implemented an algorithm that uses multipole expansions of the field integrals for cells suitably far from the field evaluation point. The computation time is asymptotically proportional to NlogN. We demonstrate our implementation by computing the micromagnetic structure of domain walls in both thin and thick ferromagnetic films.

201,320
PB92-236371 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Temperature and Pressure Div.
Nuclear Magnetic Resonance on Oriented Rare-Earth Nuclei in Rare-Earth Hosts: Application to (160)Tb.
Final rept.
W. Brewer, P. Roman, M. Boettcher, B. Illerhaus, H. Marshak, K. Freitag, and P. Herzog. 1988, 19p
Pub. in Physical Review B 38, n16A p11019-11037, 1 Dec 88.

Keywords: *Oriented nuclei, *Nuclear magnetic resonance, *Terbium 160, Nuclear magnetic moments, Nuclear electric moments, Quadrupole moments, Dipole moments, Ferromagnetic materials, Implantation, Impurities, Single crystals, Reprints.

We summarize the application of nuclear magnetic resonance of oriented nuclei to rare-earth impurities implanted in ferromagnetic heavy rare earth host crystals. The experimental aspects are treated in some detail; we present results obtained on (160)Tb, and give a formal description of the experiments. A discussion of extension to other, similar systems with applications in nuclear, solid-state, and low-temperature physics is given.

201,321
PB92-236413 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.

Preparation of Bi-Pb-Sr-Ca-Cu-O Superconducting Composites Using Glass Technology.
Final rept.
C. K. Chiang, S. W. Freiman, W. Wong-Ng, L. P. Cook, and R. D. Shull. 1989, 2p
Pub. in Physica C 162-164, p901-902 1989.

Keywords: *Superconducting composites, *High temperature superconductors, X ray diffraction, Glass, Reprints, *Bismuth strontium calcium cuprates.

Superconductors of the Bi-Pb-Sr-Ca-Cu-O system were prepared by a quenching method. The quenched samples were black glassy solids whose x-ray powder patterns were only diffuse, poorly defined futures. After heat treatments at high temperatures, the glass crystallized into a glass-ceramic. The phases in the composite were mixtures of superconducting phases Bi2Ca1Sr2Cu2O(x) and Bi2Ca1Sr2Cu2O(x).

201,322
PB92-236660 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Magneto-Optic Characterization of Iron Garnet Crystals Using Photoelastic Modulation.
Final rept.
M. N. Deeter, and P. A. Williams. 1992, 1p
Pub. in Proceedings of International Magnetics Conference: 1992 Digests of the Intermag Conference, St. Louis, MO., April 13-16, 1992, pJQ-02.

Keywords: *Yttrium iron garnets, *Magnetooptics, Magnetic domains, Faraday effect, Magnetic fields, Depolarization, Ferrimagnetism, Photoelasticity, Glass, Reprints, Mueller matrices.

Depolarization phenomena in demagnetized bulk iron garnet crystals are investigated with the aid of a photoelastic modulator. An experimental configuration which simultaneously measures Faraday rotation and depolarization as functions of applied magnetic field is described. The technique is demonstrated with samples of SF-57 glass, which exhibits no measurable depolarization, and bulk yttrium iron garnet, which shows pronounced depolarization in the demagnetized state.

201,323
PB92-236686 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Magnetic Measurements on Polymer-High Tc Superconductor Composites.
Final rept.
A. S. DeReggi, C. K. Chiang, L. Swartzendruber, and G. T. Davis. 1989, 6p
Pub. in Proceedings of High Tc Superconductors: Magnetic Interactions, Gaithersburg, MD., October 11-13, 1988, p340-345 1989.

Keywords: *Superconducting composites, *High temperature superconductors, Magnetic measurement, Magnetic shielding, Polymers, Reprints, Yttrium barium cuprates, Vinylidene fluorides.

Composite materials made by dispersing powdered mixed-oxide superconductors in suitable polymers may become important new materials in superconducting applications where contact from one superconducting grain to another is not essential to the functions, such as magnetic shielding. The principal advantage of the composite over the undiluted superconductor is that it can be processed and fabricated like a polymer using existing polymer processing equipment and methods. Another advantage of the composite is that the polymer, if properly chosen, can protect the surface of the powder grains from exposure to environmental chemicals which might affect the oxides and degrade its superconducting properties. In this study, composite materials of the 1-2-3 mixed oxide superconductor Y1Ba2Cu3O(7-x) (BYCO), with x<0.1 and critical temperature T(c) about 92 K, and the vinylidene fluoride polymer, PVDF, with a glass transition temperature about 233K, were prepared with volume concentrations ranging from 5 to 25% superconductor. Magnetic data were obtained with an ac susceptometer and a vibrating sample magnetometer. Permeability data in the dilute superconductor range are compared to the predictions of a model analogous to the Lorentz model for dielectrics.

201,324
PB92-237064 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
High Tc Superconducting Films on Silicon Wafers.
Final rept.
K. Kreider, J. Cline, A. Shapiro, and J. Moreland. 1991, 9p
Pub. in Thin Solid Films 195, n1-2 p117-125 1991.

Keywords: *Superconducting films, *High temperature superconductors, Orthorhombic lattices, Electrical resistivity, Thin films, Substrates, Silicon, Wafers, Reprints, *Yttrium barium cuprates, *Gadolinium barium cuprates, *Europium barium cuprates, Sputtered films.

High Tc (>77 deg K) thin film superconductors have potential applications for use in high speed computers and in sensors. This work describes the approach we have used to form the thin films by sputter deposition on silicon wafers. The procedure includes planar magnetron sputtering of the 1:2:3 compounds from a single stoichiometric target using an intermediate reactively sputtered Zr02 barrier layer. YBa2Cu3O(x), GdBa2Cu3O(x), and EuBa2Cu3O(x) films were formed followed by heat treatments to form the perovskite and convert to the superconducting orthorhombic phase. The as sputtered converted films were examined by energy dispersive X-ray analysis (EDX) to confirm their composition and by X-ray diffraction to confirm the orthorhombic phase formation. The results of cryogenic testing of the resistivity versus temperature is also presented. Temperatures and conditions for annealing of the films is presented.

201,325
PB92-237106 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Magnetic Superlattices.
Final rept.
J. Kwo, D. B. McWhan, C. F. Majkrzak, P. Boni, J. Bohr, C. L. Chien, J. W. Cable, M. Hong, J. V. Waszczak, D. Gibbs, A. I. Goldmann, F. J. DiSalvo, R. M. Fleming, H. Grimm, and Y. Yafet. 1988, 5p
Pub. in Jnl. de Physique 49, NC-8, p1651-1655 1988.

Keywords: Molecular beam epitaxy, Single crystals, Metal films, Gadolinium, Yttrium, Dysprosium, Holmium, Interfaces, Reprints, *Magnetic superlattices, Magnetic ordering.

Single crystal magnetic rare earth superlattices were synthesized by molecular beam epitaxy. The studies include four rare earth systems: Gd-Y; Dy-Y; Ho-Y, and Gd-Dy. The magnetic properties and the long-range spin order are reviewed in terms of the interfacial behavior, and the interlayer exchange coupling across Y medium.

201,326
PB92-237163 Not available NTIS
National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.
Elastic Stiffness of Metal-Oxide Superconductors.
Final rept.
H. Ledbetter. 1989, 5p
Pub. in Proceedings of Japan International SAMPE Symposium and Exhibition (1st) New Materials and Processes for the Future, Tokyo, Japan, November 28-December 1, 1989, p441-445.

Keywords: *High temperature superconductors, Temperature dependence, Elastic properties, Young modulus, Lanthanum oxides, Yttrium oxides, Bismuth oxides, Thallium oxides, Cuprates, Reviews, Reprints.

The elastic constants are reviewed, especially the Young modulus, of the new copper-oxide superconductors discovered in 1986. Some results are given for copper oxides of La, Y, Bi and Tl. To compensate for fragmentary and contradictory measurement results, the author emphasizes the relationship to other, simpler oxides and the role of model calculations. Described are elastic-constant interrelationships, corrections to the void-free state to get intrinsic elastic constants, and elastic-constant temperature dependence.

201,327
PB92-237213 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Magnetic Order of the Cu Planes and Chains in RBa2Cu3O6+x.
Final rept.
W. H. Li, J. W. Lynn, and Z. Fisk. 1990, 14p
Pub. in Physical Review B 41, n7 p4098-4111, 1 Mar 90.

Keywords: *Superconductors, Neutron diffraction, Single crystals, Antiferromagnetism, Form factors, Copper ions, Reprints, *Magnetic ordering, *Neodymium barium cuprates.

Polarized and unpolarized neutron diffraction measurements have been taken to determine the magnetic structure of the Cu spins in the RBa2Cu3O(6+x) system as a function of temperature. Most of the results have been obtained on two (semiconducting) oxygen-deficient single crystals of composition NdBa2Cu3O(6.1) and NdBa2Cu3O(6.35). On the basis of the measured integrated intensities of over 40 magnetic reflections in both ordered phases, the results can be accounted for quantitatively with the assumption of 3d magnetic form factor on the Cu ions with no need for a significant moment on any of the oxygen ions.

201,328
PB92-237239 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Temperature and Pressure Div.
Magnetization of Single-Crystal Terbium at Very Low Temperatures by Nuclear Orientation.
Final rept.
H. Marshak, W. D. Brewer, and P. Roman. 1989, 8p
See also PB89-179204.
Pub. in Hyperfine Interactions 50, n1-4 p741-748 1989.

Keywords: *Terbium, *Magnetization, Temperature range 0000-0013 K, Oriented nuclei, Nuclear alignment, Terbium 160, 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 (b-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.

201,329
PB92-237346 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.
M. R. Scheinfein, J. L. Blue, and M. Aeschlimann. 1991, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics 27, n6 p5124-5126 Nov 91.

Keywords: *Magnetic domains, Scanning electron microscopy, Magnetic films, Thin films, Terbium alloys, Iron alloys, Cobalt alloys, Mathematical models, Polarization(Spin alignment), Reprints, Surface magnetism, Micromagnetics.

Domains written in thin films of TbFeCo were observed with scanning electron microscopy with polarization analysis (SEMPA). The SEMPA measurements revealed that the rare earth concentration has a direct effect on the orientation of the surface magnetization which is tilted with respect to the sample normal due to segregation and oxidation processes. We modeled the magnetic microstructure of domains in thermal equilibrium by solving the Landau-Lifshitz-Gilbert equations. Our simple model of the surface has a thin layer of Fe-rich material near the surface with magnetic properties different from those in bulk. We examine the surface micromagnetic properties for various surface layer thicknesses and magnetic parameters.

201,330
PB92-237411 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.

Magnetic Order of Cu in Nd2-xCexCuO4.
Final rept.
S. Skanthakumar, J. W. Lynn, J. L. Peng, and Z. Y. Li. 1992, 2p
Pub. in Jnl. of Magnetism and Magnetic Materials 104-107, p519-520 1992.

Keywords: Single crystals, Cerium additions, Neutron diffraction, Spin orientation, Antiferromagnetism, Reprints, *Neodymium cerium cuprates, *Neodymium cuprates, *Magnetic ordering.

The magnetic ordering in single crystals of Nd(2-x)Ce(x)CuO4 with x = 0.0 to 0.22 has been studied by neutron diffraction measurements. Long-range antiferromagnetic order for Cu is observed for crystals with small Ce concentrations. Both the ordered moment for Cu and the Neel temperature decrease with increasing Ce concentration x. Two Cu spin reorientation transitions are also observed for crystals with small Ce concentrations. The temperature dependence of the (1/2 1/2 0) magnetic Bragg peak shows that these spin reorientation transitions are sharp for the pure sample, while they are not as sharp for the doped samples due to the randomness of the Ce. The fraction of the Cu spins which participate in the spin reorientations also decreases with increasing x. In Nd2CuO4 both spin reorientation transition temperatures increase with magnetic field at the rate of about 1.2 and 0.8 K/T, respectively.

201,331
PB92-237452 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Measurement of Magnetic Properties in a Melt Cast Bi-Ca-Sr-Cu-O Superconductor.
Final rept.
L. J. Swartzendruber, L. H. Bennett, and C. F. Gallo. 1989, 6p
Pub. in Proceedings of High Tc Superconductors: Magnetic Interactions, Gaithersburg, MD., October 11-13, 1988, p303-308 1989.

Keywords: *High temperature superconductors, Magnetic hysteresis, Magnetic susceptibility, Magnetic measurement, Flux pinning, Reprints, *Bismuth strontium calcium cuprates.

Magnetic measurements were made to examine the superconducting properties of a crystalline chunk, consisting of many small crystals, prepared by casting from the oxide melt with a starting composition of Bi3Ca2Sr2Cu3O(x). AC susceptibility revealed an onset temperature of 82 K and a transition width of about 10 K. Hysteresis loops at 70 K showed a very small hysteresis, indicating a low density of effective flux pinning sites at this temperature, similar to the behavior observed for some superconducting samples of the Bi-Ca-Sr-Cu-O system prepared by other techniques. However, the magnetization at 10 K showed no hysteresis for fields greater than about 3.5 kOe, a much smaller value than we have previously observed for other samples of this material regardless of preparation method, or for any other material with a T(c) greater than 70 K. This critical field for flux depinning varies with temperature.

201,332
PB92-237601 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Two-Dimensional Bilayer Magnetic Order of Dy Ions in Dy2Ba4Cu7O15.
Final rept.
H. Zhang, J. W. Lynn, and D. E. Morris. 1992, 2p
Pub. in Jnl. of Magnetism and Magnetic Materials 104-107, p821-822 1992.

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-bilayer two-dimensional (2D) system in which the Dy spins within the a-b planes are coupled antiferromagnetically, with T(N)=1.25 K. The 2D order originates from the crystal 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 shifted along the b-axis by b/2, causing a cancellation of magnetic interactions which completely isolates the bilayers. We anticipate that a similar coupled-bilayer 2D behavior should occur in other R2Ba4Cu7O15 (R = rare earth element, except Er) in which nearest-neighbor spins within the a-b plane are coupled antiferromagnetically.

201,333
PB93-125250 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Neutron Powder Diffraction Study of the Crystal Structure of YSr2CoCu2O7 and Y1-xCaxSr2CoCu2O7.
Final rept.
Q. Huang, R. J. Cava, A. Santoro, J. J. Krajewski, and W. F. Peck. 1992, 11p
Pub. in Physica C 193, p196-206 1992.

Keywords: *Crystal structure, Neutron diffraction, Lattice parameters, Reprints, *Yttrium strontium cobalt cuprates, *Yttrium calcium strontium cobalt cuprates.

The structures of YSr2CoCu2O7 and Y(1-x)Ca(x)Sr2CoCu2O7 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 Co ions exclusively substitute for the copper ions located on the chain sites of the 123 parent structure (YBa2Cu3O(6+x)). The coordination of Co is tetrahedral. The CoO4 tetrahedra form chains running 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 YSr2GaCu2O7 showed that this type of disordering 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 Y(1-x)Ca(x)Sr2CoCu2O7, calcium substitutes for yttrium, but cobalt replaces copper both on the chain sites and in the CuO2 planar sites, thus explaining the lack of superconductivity in this material. The oxygen atoms on th Co layers are more disordered than in the undoped material.

201,334
PB93-125268 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 rept.
Q. Huang, P. Karen, V. L. Karen, A. Kjekshus, J. W. Lynn, A. D. Mighell, N. Rosov, and A. Santoro. 1992, 9p
Pub. in Physical Review B 45, n17 p9611-9619, 1 May 92.

Keywords: *Crystal structure, Neutron diffraction, Magnetic moments, Room temperature, Antiferromagnetism, Reprints, *Yttrium barium ferrates, 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) A. 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-chain 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 configuration were determined by polarized-neutron-diffraction measurements. The iron moments are coupled antiferromagnetically within each FeO2 layer, as well as along the c axis. The magnetic moments of all the iron ions are the same. This configuration results in the magnetic symmetry I(sub c)mm'm.

201,335
PB93-125516 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Magnetic Properties of a Chemically Synthesized Bi(Pb)SrCaCuO Superconductor.
Final rept.
D. R. Lundy, J. J. Ritter, L. J. Swartzendruber, R. D. Shull, and L. H. Bennett. 1989, 6p
Pub. in Proceedings of High Tc Superconductors: Magnetic Interactions Conference, Gaithersburg, MD., October 11-13, 1988, p263-268 1989.

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. To test if this is also the case for material prepared by a chemical method, a lead containing bismuth superconductor (Bi(1.5)Pb(0.5)Sr(1.5)Ca(1.75)Cu2O(x)) 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 110 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 depinning was found to occur at relatively low fields.

201,336
PB93-125524 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Two-Dimensional Behavior of the Rare Earth Ordering in Oxide Superconductors.
Final rept.
J. W. Lynn. 1992, 11p
Pub. in Jnl. of Alloys and Compounds 181, p419-429 1992.

Keywords: *Superconductors, High temperature superconductors, Two dimensional, Neutron scattering, Ising model, Rare earths, Antiferromagnetism, Reprints, Magnetic ordering, Erbium barium cuprates, Dysprosium barium cuprates.

Neutron scattering has been used to reveal the nature of the magnetic ordering of the rare earth ions in 1-2-3, 2-4-8, 2-4-7 and 2-1-4 oxide superconductors. The interactions are found to be antiferromagnetic in nature and quite weak, leading to ordering temperatures which are a few degrees Kelvin or 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 prototypical two-dimensional (2D) magnets. In the ErBa2Cu3O7 and DyBa2Cu3O7 systems, for example, a rod of scattering characteristic of 2D behavior is readily observed, while the order parameter obeys the exact solution of the S = 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 a-b layers. The system thus exhibits no 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
PB93-125573 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Magnetic Rare Earth Superlattices.
Final rept.
C. F. Majkrzak, J. Kwo, M. Hong, Y. Yafet, D. Gibbs, C. L. Chien, and J. Bohr. 1991, 91p
See also PB90-170341 and DE88003483. Sponsored by Department of Energy, Washington, DC.
Pub. in Advances in Physics 40, n2 p99-189 1991.

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 composed of alternating layers of a magnetic rare earth, such as Gd, Dy, Ho, or Er, and metallic Y, which has an identical chemical structure. The primary goal of this article is to review the new and interesting magnetic structures which have been discovered in these novel superlattice systems and to consider what implications the observed phases have on our understanding of the underlying microscopic magnetic interactions. In particular, the effects of the artificial periodicity or compositional modulation, finite layer thickness, and epitaxial strain on the resulting long range magnetic order of Gd-Y, Dy-Y, Ho-Y, Er-Y, and Gd-Dy superlattices are described.

201,338
PB93-125748 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Applied and Computational Mathematics Div.
Effect of a Crystal-Melt Interface on Taylor-Vortex Flow.
Final rept.
G. B. McFadden, S. R. Coriell, B. T. Murray, M. E. Glicksman, and M. E. Selleck. 1990, 6p
See also PB90-130261 and PB90-244401.
Pub. in Physics of Fluids A 5, n2 p700-705 1990.

Keywords: *Two phase flow, *Crystal growth, *Solidification, *Melting, Heat transfer, Vortices, Circular cylinders, Prandtl number, Stability, Couette flow, Reprints.

The linear stability of circular Couette flow between concentric infinite cylinders is considered for the case that the stationary outer cylinder is a crystal-melt interface rather than a rigid surface. A radial temperature difference is maintained across the liquid gap, and equations for heat transport in the crystal and melt phases are included to extend the ordinary formulation of this problem. 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 rigid-walled system. For increasing values of the Prandtl number, convective heat transport becomes significant and the system becomes increasingly less stable. Previous results in a narrow-gap approximation are extended to the case of a finite gap, and both axisymmetric and non-axisymmetric disturbance modes are considered. The two-phase system becomes less stable as the finite gap tends to the narrow-gap limit. The two-phase system is more stable to non-axisymmetric modes with azimuthal wavenumber n=1; the stability of these n=1 modes is sensitive to the latent heat of fusion.

201,339
PB93-125805 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Scientific Computing Environments Div.
Field-Ion Microscope Image Simulations for Icosahegral Al-Mn.
Final rept.
A. J. Melmed, H. B. Elswijk, and H. A. Fowler. 1989, 5p
Pub. in Jnl. de Physique 50, nNC8 p8259-8263 1989.

Keywords: *Aluminum manganese alloys, *Crystal structure, Computerized simulation, Computer graphics, Field ion microscopy, Image analysis, Models, Reprints, *Icosahedral phase, Quasicrystals.

New computer simulations of field ion microscope (FIM) images for the icosahedral phase of Al-Mn, using the Moore-shell 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 octahedral-motif decoration 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.

201,340
PB93-129559 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Fabrication of Nanometer Smooth Bi2Sr2CaCu208+delta Films by Reactive Co-Sputtering from Elemental Targets with Pure Ozone.
Final rept.
J. T. Kucera, L. M. Rubin, K. Uwai, J. D. Perkins, J. M. Graybeal, T. P. Orlando, J. B. VanderSande, A. Roshko, and J. Moreland. 1992, 8p
Sponsored by Department of Energy, Washington, DC.
Pub. in Physica C 192, p23-30 1992.

Keywords: *High temperature superconductors, *Superconducting films, Scanning tunneling microscopy, Surface roughness, Thin films, Sputtering, Ozone, Reprints, *Bismuth strontium calcium cuprates.

We describe the fabrication of superconducting Bi2Sr2CaCu2O(8 + delta) thin films having root-mean-square surface roughnesses of less than 5 nm as determined by scanning tunneling microscopy. Films are deposited in-situ by RF and DC triode magnetron sputtering from elemental metallic targets in the presence of pure ozone. As deposited, these films have transition temperatures as high as 68 K and zero-field critical current densities exceeding 1 million A sq cm at 4.2 K. The transition temperatures can be increased to 80 K by post-deposition annealing with only a slight increase in surface roughness.

201,341
PB93-130268 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Thermoremanance and Meissner Effect in QMG and Single-Crystal YBCO.
Final rept.
L. H. Bennett, L. J. Swartzendruber, D. L. Kaiser, F. W. Gayle, J. Blendell, J. M. Habib, and H. M. Seyoum. 1992, 2p
Pub. in Jnl. of Magnetism and Magnetic Materials 104-107, p539-540 1992.

Keywords: *High temperature superconductors, *Flux pinning, Meissner effect, Single crystals, Magnetization, Twinning, Comparison, Reprints, *Yttrium barium cuprates, Thermoremanance.

We compare flux pinning in a single crystal (twinned and detwinned) of YBa2Cu3O(7-x) (YBCO) with that in a quench-melt-growth (QMG) bulk YBCO sample using measurements of the thermoremanent magnetization and Meissner effect. For temperatures up to 50 K, there is practically no difference in the thermoremanent magnetization of the crystal in the twinned and detwinned states, while above 50 K the remanent flux in the twinned state is larger. The rate of decrease of thermoremanent magnetization with temperature is much lower for the QMG material. The QMG material has practically no Meissner effect over a wide range of applied fields, whereas a considerable difference in Meissner effect is seen between the twinned and detwinned states of the single crystal.

201,342
PB93-130276 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Surface and Microanalysis Science Div.
Antiferromagnetic Coupling in Fe/Cu/Fe and Co/Cu/Co Multilayers on Cu(111).
Final rept.
W. F. Egelhoff, and M. T. Kief. 1992, 10p
Contract N00014-91-F-0044
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Physical Review B 45, n14 p7795-7804, 1 Apr 92.

Keywords: *Antiferromagnetism, Kerr magnetooptical effect, Molecular beam epitaxy, Metal films, Cobalt, Copper, Iron, Substrates, Reprints, Multilayers.

The magneto-optical Kerr effect has been used to investigate the exchange coupling between Fe and Co bilayers through Cu spacer layers. The films were grown on a Cu(111) substrate by molecular-beam-epitaxy (MBE) techniques under a variety of conditions, including both high vacuum and ultrahigh vacuum, substrate temperatures of 80, 300, and 500 K, and in the presence of as well as in the absence of electron bombardment. None of these films showed consistent evidence of antiferromagnetic (AFM) coupling, and there was no evidence of any consistent trends attributable to oscillatory AFM coupling. These results stand in marked contrast to results recently reported on similar multilayers that were grown by magnetron sputtering methods and that exhibit the giant magnetoresistance effect. These magnetron-grown multilayers, which are reported to be (111) textured, exhibit pronounced oscillatory AFM coupling. One possible resolution of these conflicting observations lies in the fact that oscillatory AFM coupling does occur in MBE-grown multilayers on Cu(100).

201,343
PB93-130284 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Magnetic Order by Dy in DyBa2Cu3O7.
Final rept.
T. W. Clinton, J. W. Lynn, J. Z. Liu, Y. X. Jia, and R. N. Shelton. 1991, 3p
Pub. in Jnl. of Applied Physics 70, n10 p5751-5753, 15 Nov 91.

Keywords: Dysprosium ions, Neutron diffraction, Single crystals, Temperature dependence, Neel temperature, Antiferromagnetism, Reprints, *Dysprosium barium cuprates, *Magnetic ordering.

Neutron diffraction has been used to study the magnetic fluctuations and long range order of the Dy ions in single crystals of superconducting DyBa2CU3O7. The temperature dependence of the rod of scattering, characteristic of 2D behavior, has been measured above and below the 3D Neel temperature (T(N) approx = 0.9K). This rod intensity is observed to increase as the temperature decreases until T(N) is reached, and then the intensity decreases rapidly below T(N). The 2D magnetic correlation length, which is obtained from measurements of the width of the rod, grows continuously with decreasing temperature, then reaches a resolution-limited maximum at the Neel temperature when long range magnetic order sets in. At low T, two separate types of simple 3D antiferromagnetic structures are found, one characterized by a wave vector of (1/2 1/2 0), and the other by (1/2 1/2 1/2). We believe the two types of order occur because the (dipolar) energies for these two configurations are nearly identical. This behavior is analogous to the 2D and 3D magnetic order of Er observed in ErBa2Cu3O7.

201,344
PB93-135184 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Electron and Optical Physics Div.
Electronic Bonding of Buried Interfaced Determined by Soft-X-ray Emission-Spectroscopy.
Final rept.
R. C. C. Perera, C. H. Zhang, T. A. Callcott, and D. L. Ederer. 1989, 6p
Pub. in Jnl. of Applied Physics 66, n8 p3676-3681 1989.

Keywords: *Interfaces, X ray fluorescence, Emission spectra, Buried objects, Valence bands, Thin films, Silicon, Carbon, Reprints, Density of states, Multilayers.

A non-destructive technique to study the partial density of states of atoms at buried interfaces is presented. A high density of interface atoms has been mimicked by using a multilayer structure. The silicon-carbon interface was used as a test case. Fifty alternating silicon-carbon layers were laid down, in which silicon layers nominally between 3A and 30A in thickness alternate with carbon layers approximately 30A thick made by magnetron sputtering. The silicon L(2,3) emission spectra was excited by monochromatized synchrotron radiation and the s-like partial density of states of the silicon valence band was obtained. The spectrum of the thinnest silicon layer is similar to that of silicon as an impurity. When there are approximately two layers of silicon the spectrum resembles that of silicon carbide, and as the layers become thicker the spectrum is similar to that of amorphous silicon.

201,345
PB93-135192 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Superconducting Tl2.0Ba2.0CuO6+delta: A High Resolution Neutron Powder and Single Crystal X-ray Diffraction Investigation.
Final rept.
J. B. Parise, C. C. Torardi, M. A. Subramanian, J. Gopalakrishnan, A. W. Sleight, and E. Prince. 1989, 6p
Pub. in Physica C 159, n3 p239-244 1989.

Keywords: *High temperature superconductors, *Crystal structure, Orthorhombic lattices, X ray diffraction, Neutron diffraction, High resolution, Single crystals, Stoichiometry, Reprints, *Thallium barium cuprates, Rietveld method.

The structure of the orthorhombic form of Tl2Ba2CuO(6+delta)(T(c) = 90K), synthesized in sealed gold tubes using BaO2, has been refined using high resolution neutron powder diffraction data collected at 4K. No significant deficiency in metal stoichiometry could be inferred from the crystal structure analysis. The space group (Fmmm) used in this study gives essentially the same results as the alternatives (Abma, Amaa) proposed in earlier work. The large amount of disorder that exists in the Tl2O2 - slab is mirrored in the large thermal parameters for this structural unit compared to those for the CuO2 sheet. A site at (1/4 1/4 1/4) is occupied by an amount of oxygen to give overall stoichiometry Tl2Ba2CuO(6.10), suggesting that oxygen non-stoichiometry plays an important role in producing high T(c) superconductivity in this system.

PHYSICS

Solid State Physics

Analysis of single crystal X-ray diffraction data of tetragonal Tl2Ba2CuO(6+delta) is totally consistent with the neutron powder diffraction results.

201,346
PB93-135200 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Electron and Optical Physics Div.
Limitations on Electronic Mechanisms for High Temperature Superconducting Oxides.
Final rept.
D. R. Penn, M. L. Cohen, and T. W. Barbee. 1990, 4p
Pub. in Solid State Communications 75, n12 p971-974 1990.

Keywords: *High temperature superconductors, Electron pairs, Transition temperature, Isotope effect, Cuprates, Phonons, Reprints.

The effects of electronic mechanisms for electron pairing in high temperature superconducting oxides on both the transition temperature T(c) and the isotope effect parameter alpha are considered. It is shown that for the higher T(c) oxides, measured values of t(c) 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.

201,347
PB93-135390 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Effect of High Injection on the Density of States of Silicon.
Final rept.
J. R. Lowney. 1988, 3p
Pub. in Proceedings of Conference on Bipolar Circuits and Technology Mtg., Minneapolis, MN., September 12-13, 1988 (IEEE Cat. No. 88CH2592-4), p188-190.

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 of 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 Div.
Determination of the Polarization-Depth Distribution in Poled Ferroelectric Ceramics Using Thermal and Pressure Pulse Techniques.
Final rept.
A. S. DeReggi, B. Dickens, T. Ditchie, C. Alquie, J. Lewiner, and I. K. Lloyd. 1992, 10p
Pub. in Jnl. of Applied Physics 72, n2 p854-863, 15 Jan 93.

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.

Structural Mechanics

201,349
PB92-159771 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Accumulation of Creep Damage Under Varying Temperature Conditions.
Final rept.
L. Mordfin. 1991, 6p
Pub. in Proceedings of International Conference on Mechanical Behaviour of Materials-VI (6th), Kyoto, Japan, July 29-August 2, 1991, v4 p565-570.

Keywords: *Creep properties, *Cyclic loads, *Thermal stresses, Fracture mechanics, 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 is exact. Specific expressions were derived for a number of cases in which the temperature rises monotonically and also for cases in which the temperature cycles repetitively.

201,350
PB92-166057 Not available NTIS
National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.
Improved Strain Gage Method for Measuring K(sub ID) for a Propagating Crack.
Final rept.
R. J. Sanford, J. W. Dally, and J. R. Berger. 1989, 7p
Sponsored by National Science Foundation, Washington, DC., Naval Air Development Center, Warminster, PA., and Oak Ridge National Lab., TN.
Pub. in Proceedings of SEM Spring Conference on Experimental Mechanics, Cambridge, MA., May 29-June 1, 1989, p655-661.

Keywords: *Crack propagation, *Stress intensity factors, *Strain gages, Strain measurement, Fracture mechanics, Crack initiation, Steels, Cracking(Fracturing), Stress analysis, Stress measurement, Fractures(Materials), Reprints.

An improved strain gage method for measuring the dynamic stress intensity factor of a running crack is described. By orienting the gage relative to the crack propagation path the gage response is optimized for the analysis. Higher order terms in the dynamic strain field representation are demonstrated to be important in the analysis. An application of the method is illustrated in the measurement of the dynamic stress intensity factor for a very hard alloy of steel, 4340, with a crack propagating at 650 m/sec.

201,351
PB92-175850 Not available NTIS
National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.
Application of Time Dependent Green's Function Method to Scattering of Elastic Waves in Anisotropic Solids.
Final rept.
V. K. Tewary, and C. M. Fortunko. 1991, 7p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v10B p1415-1421 1991.

Keywords: *Ultrasonic tests, *Elastic waves, Nondestructive tests, Wave scattering, Greens function, Half spaces, Time domain, Anisotropy, Reprints.

A time dependent 3D Green's function method is described to study the propagation of elastic waves in a general anisotropic half space. The method is applied to calculate the scattering amplitude of elastic waves from a discontinuity in the half space. The discontinuity is represented as a perturbation on the Christoffel Matrix. The Green's function is obtained as a solution of the Dyson's equation. Exact results are obtained for a 3D pulse propagation in a general anisotropic half space containing an interior point or a planar scatterer. The results can be used in the design of ultrasonic scattering experiments. In particular, the theory is intended as an aid in defining spatial and time domain transducer responses that would maximize the detection reliability for specific flaw categories and material anisotropies.

201,352
PB92-236504 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Structures Div.
Green's Functions for Elastic Networks with Rigid Body Motion.
Final rept.
G. R. Cook, and E. Simiu. 1990, 6p
Pub. in Jnl. of Engineering Mechanics 116, n8 p1858-1863 Aug 90.

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 or impulse response functions of structural networks with rigid body degrees of freedom. Two systems are considered, both of which may be viewed as representative of certain large space structures. The first system consists of torsional members with no shear and bending capacity, and Timoshenko beams with no torsional capacity. The second system consists 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 using the procedure applied in this paper for the calculation of impulse response functions for relatively complex structural networks.

201,353
PB93-126027 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Structures Div.
Empirical Fluid-Elastic Models and Chaotic Galloping: A Case Study.
Final rept.
E. Simiu, and G. R. Cook. 1992, 22p
Pub. in Jnl. of Sound and Vibration 154, n1 p45-66 1992.

Keywords: *Structural vibration, *Structural analysis, Offshore structures, Mathematical models, Case studies, Structural engineering, Lift, Strouhal number, Dynamic response, Reprints, *Fluidelasticity.

To describe the behavior of bluff body fluid-elastic motions, analysts must in practice resort to empirical models based on a limited number of measured fluid-elastic behavior characteristics. To our knowledge the question of whether such models can predict reliably the actual occurrence of chaos has not yet been addressed. With a view to answering this question in a specific case, we present an exploratory experimental and numerical study of two paradigmatic fluid-elastic systems: (1) a single galloping square prism; and (2) a pair of elastically coupled galloping prisms which can exhibit apparently chaotic behavior of interest from a structural engineering viewpoint. We review various conventional empirical models and their capabilities, and develop a model that incorporates information on the dependence on angle of attack of the vortex-induced lift coefficient and the Strouhal number for the stationary prism. For appropriate values of the adjustable parameters and initial conditions, this model appears to be able to describe observed behavior at least qualitatively. However, the predictive capabilities of the model are poor, especially for apparently chaotic behavior. A possible approach to improving the reliability of the numerical detection of such behavior is suggested.

201,354
PB93-129674 Not available NTIS
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD. Structures Div.
Equivalence between Motions with Noise-Induced Jumps and Chaos with Smale Horseshoes.
Final rept.
M. Frey, and E. Simiu. 1992, 4p
Pub. in Proceedings of Engineering Mechanics Conference, College Station, TX., May 24-27, 1992, p660-663.

Keywords: *Structural vibration, *Noise(Sound), *Wave propagation, Dynamic response, Acoustic measurement, Degrees of freedom, Oscillations, Structural analysis, Sound transmission, Reprints, Smale Horseshoes.

For certain sets of parameters multi-stable oscillators excited by noise can exhibit irregular jumps. We consider one-degree-of-freedom near-integrable multistable systems whose unperturbed flows have homoclinic/heteroclinic orbits. For such systems we show that certain motions with noise-induced jumps are in fact chaotic motions with traveling Smale horseshoe sequences. Consequences of our result are that noise can, by itself, induce such chaotic motions. In the presence of periodic or quasiperiodic 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**/MF **A01**
National Inst. of Standards and Technology, Gaithersburg, MD.
Integration of the Schrodinger Equation on a Massively Parallel Processor.
J. Parker, S. Blodgett-Ford, and C. W. Clark. 22 May 92, 4p
This article is from 'Optical Society of America (OSA) Proceedings of the Topical Meeting (5th) on Short-Wave Length Coherent Radiation: Generation and Applications Held in Monterey, California on 8-10 April 1991. Volume 11,' AD-A252 973, p190-193.

Keywords: *Parallel processors, *Schrodinger equation, *Coherent optical radiation, Computer architecture, Atomic spectra, Short wavelengths, Coherent radiation, Photoelectrons, Harmonics, Ionization, Symposia, Component Reports.

We use a massively parallel computer to integrate the time-dependent Schrodinger equation for hydrogen in high-intensity radiation fields. Photoelectron and harmonic-radiation spectra are presented. The behavior of atoms in strong radiation fields depends critically upon the time evolution of the field. For example, it has been found that above-threshold ionization (ATI) spectra show radical changes as the duration of the exciting laser pulse decreases; there is also theoretical evidence for novel phenomena, such as population trapping, which occur only for relatively short pulses. In order to treat 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 Schrodinger equation. This would be an entirely noncontroversial approach if vast computational resources were not required to implement it in practice. To date there have been only a few reports of direct integration of the time-dependent Schrodinger equation for a three dimensional, one-electron atom in a radiation field.

201,356
AD-P007 257/9 PC **A01**/MF **A01**
National Inst. of Standards and Technology (PL), Gaithersburg, MD.
National Institute of Standards and Technology Metrology for Soft-X-Ray Multilayer Optics.
R. N. Watts, D. L. Ederer, T. B. Lucatorto, and M. Isaacson. 22 May 92, 3p
This article is from 'Optical Society of America (OSA) Proceedings of the Topical Meeting on Soft-X-Ray Projection Lithography Held in Monterey, California on 10-12 April 1991. Volume 12', AD-A252 998, p142-144.

Keywords: *Lithography, Facilities, Soft x rays, X rays, Metrology, Standardization, Component Reports.

We describe the capabilities of the existing NIST soft X-ray reflectometry program and outline our proposed new characterization facility.

201,357
AD-P007 258/7 PC **A01**/MF **A01**
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Precision Engineering Div.
Surface Figure Metrology for X-Ray Optics.
W. T. Estler, and C. J. Evans. 22 May 92, 2p
This article is from 'Optical Society of America (OSA) Proceedings of the Topical Meeting on Soft-X-Ray Projection Lithography Held in Monterey, California on 10-12 April 1991. Volume 12', AD-A252 998, p145-146.

Keywords: *Lithography, Accuracy, Analogs, Calibration, Diameters, Diffraction, Errors, Fluids, Images, Interferometers, Masks, Measurement, Mirrors, Optics, Paths, Phase, Resolution, Soft x rays, Spheres, Standards, Surfaces, Test and evaluation, Throughput, Uncertainty, Wafers, X rays, Component Reports.

A soft-X-ray projection lithography system will require diffraction limited performance at wavelengths near 13 nm. A typical conceptual design for such a system consists of an x-ray source, a reflecting mask, and a series of normal incidence, multilayer coated mirrors used to image the mask upon a resist-coated wafer. System throughput and image field flatness demands will require aspheric mirrors with figure accuracies of lambda/200 or better at 633 nm. Commercial phase measuring interferometers (PMIs) offer lambda/1000 resolution and, with care, lambda/300 repeatability. For flats and spheres, absolute figure accuracy is limited by one's knowledge of the reference optics, since such PMIs are differential devices. At the National Institute of Standards and Technology (NIST) our present absolute figure uncertainty is about lambda/20 for flats up to 150 mm in diameter and no better than lambda/10 or so for spheres. For an asphere, compared with a reference sphere of no more than a few waves of figure departure, we can perhaps attain an absolute accuracy of lambda/5 or so, but we are fundamentally limited by errors in the interferometer system due to non-common mode optical paths of the test and reference beams. At NIST, we are in the initial phases of a five-year program aimed at improving the accuracy of optical figure measurements as a part of an Institute Competence Program in support of X-ray projection lithography.

201,358
PB92-144252 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.
Modification of Electron and Positron Sources Due to the Reflection of Particles from Backing Materials.
Final rept.
M. J. Berger. 1990, 2p
Pub. in Transactions of the American Nuclear Society 62, p226-227 1990.

Keywords: *Electron sources, *Positron sources, Angular distribution, Energy losses, Monte Carlo method, Reflection, Reprints.

Suppose that a thin beta-emitting radionuclide source is placed next to a thick backing. Half the particles from the source are emitted directly into the air. The other half are emitted into the backing material, and a fraction of these are reflected from the backing and emerge into the air with their energy lowered and their direction changed. Taking into account reflection from the backing material, the problem is to determine what is the actual spectral and angular distribution of the particles from the source.

201,359
PB92-144328 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.
Electron Linear Accelerators for Fast Neutron Data Measurements in Support of Fusion Energy Applications.
Final rept.
K. H. Bockhoff, A. D. Carlson, O. A. Wasson, J. A. Harvey, and D. C. Larson. 1990, 16p
Pub. in Nuclear Science and Engineering 106, n2 p192-207 Oct 90.

Keywords: *Accelerator facilities, *Neutron physics, Electron accelerators, Linear accelerators, Fast neutrons, Neutron sources, Cross sections, Nuclear fusion, Fusion reactors, HELIOS facility, ORELA, Standards, Reprints, US NIST, GELINA.

The paper briefly reviews some of the electron linear accelerator facilities and their neutron measurement programs which provide nuclear data needed for fusion energy devices. (The document is one of a number of articles to be published in a special issue of Nuclear Science and Engineering. The title of the special issue is 'Neutron Sources for Fusion Technology and Fusion Materials Research.')

201,360
PB92-144450 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Monte Carlo Calculation of Multiple Scattering Effects in Thermal Neutron Scattering Experiments: Modification to Spherical Geometry.
Final rept.
J. R. D. Copley. 1991, 4p
Pub. in Computer Physics Communications 66, p403-406 1991.

Keywords: *Thermal neutrons, *Neutron scattering, Multiple scattering, Monte Carlo method, Spherical configuration, Computerized simulation, Reprints, MSCAT85 computer program.

The Monte Carlo program 'MSCAT85' is used to calculate multiple scattering effects in thermal neutron scattering 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
PB92-144468 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Scattering Effects Within an Absorbing Sphere Immersed in a Field of Neutrons.
Final rept.
J. R. D. Copley. 1991, 9p
Pub. in Nuclear Instruments and Methods in Physics Research A307, p389-397 1991.

Keywords: *Neutron flux, Neutron transport theory, Neutron absorption, Neutron scattering, Monte Carlo method, Activation analysis, Diffusion theory, Spheres, Reprints.

Considered is the flux distribution within an isolated sphere in a field of neutrons, in the one-speed approximation. The sphere is characterized by its radius R and its macroscopic scattering and absorption cross sections, Sigma(sub S) and Sigma(sub A) respectively. The ratio of the average flux within the sphere to the unperturbed flux (into which the sphere was placed) is designated f. It is shown that f is inddependent of the directional nature of the external neutron field; for example it is the same for a neutron beam as for an isotropic field. For a purely absorbing sphere f is well known and easily derived. For a purely scattering sphere it 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, in the context of prompt-gamma neutron activation analysis experiments with neutron beams, is that the use of spherical samples should be encouraged when working with strong scatterers such as hydrogenous material as the uncertainty in the correction for scattering effects is relatively small for this shape of sample.

201,362
PB92-144559 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Effect of Transverse Stress on the Critical Current of Bronze-Process and Internal-Tin Nb3Sn.
Final rept.
J. W. Ekin, S. L. Bray, and W. L. Bahn. 1991, 3p
See also DE89001497. Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Applied Physics 69, n8 p4436-4438, 15 Apr 91.

Keywords: *Niobium stannides, *Superconducting wires, *Critical current, Superconducting magnets, Microstructure, Stresses, Reprints.

The effect of transverse stress on the critical current of two substantially different Nb3Sn superconductors, a bronze-process conductor and an internal-tin conductor, has been measured. Photomicrographs of the two conductors reveal a basic difference in their microstructure. The bronze-process conductor exhibits columnar grains that are radially oriented within the Nb3Sn filaments, while the grains of the internal-tin conductor are more equiaxed and randomly oriented. The radial orientation of the bronze-process grains defines an anisotropy between the axial and transverse directions that might account for the greater sensitivity of the critical current to transverse stress reported previously. The effect of transverse stress measured on the internal-tin conductor, however, is comparable to that of the bronze-process conductor. Thus, these 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 Nb3Sn superconductors represents an important simplification for setting first-order quantitative limits on the mechanical design of large superconducting magnets.

201,363
PB92-144591 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Superconducting Detector for Minimum Ionizing Particles.
Final rept.
A. Gabutti, K. E. Gray, R. T. Kampwirth, R. G. Wagner, and R. H. Ono. 1989, 6p
See also DE90001985.
Pub. in Nuclear Instruments and Methods in Physics Research A 278, n2 p425-430 1989.

Keywords: *Superconducting colloid detectors, Transition temperature, Superconducting films, Ionizing radiation, KeV range 1-10, Thin films, X-rays, Reprints, Vertex 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. In the paper, experiments using approximately 6 keV x-rays, which deposit energies comparable to mips, are used to show that the switching probability is 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 low operating temperature (e.g., 4.2 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 rept.
J. J. McClelland, and M. R. Scheinfein. 1991, 13p
Pub. in Jnl. of the Optical Society of America B 8, n9 p1974-1986 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 nanometerscale spot diameters. The authors have analyzed the classical trajectories of atoms through a TEM(01)* mode laser beam, 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-diameter spots may be achieved 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 Div.
Resonance Lines 4p(6)-4p(5)4d of the Kr I Isoelectronic Sequence.
Final rept.
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, Xenon, 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 doped with elements Pd to Sb and I, Xe, Cs, and Nd. An electron temperature of 1.3 keV was achieved by operating the tokamak with He. Spectra in the range of 50-400 A were observed photographically with a 2.2-m grazing-incidence spectrograph. 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 rept.
J. Sugar, V. Kaufman, D. H. Baik, Y. K. Kim, and W. L. Rowan. 1991, 4p
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.

New measurements of the Cu-like and Zn-like resonance lines classified as 4s doublet S(1/2)-4p doublet P(1/2,3/2)(sup 0) and 4s(2) singlet S(0)-4s4p singlet,triplet P(1)(sup 0) transitions, respectively, have been made in the range of 90-335 A with a wavelength uncertainty of + or - 0.005 A for elements Pd to Dy. The light source was the TEXT tokamak at the Fusion Research Center in Austin, Texas. The transition energies for the Zn-like lines are compared with values calculated with the multiconfiguration Dirac-Fock code of Desclaux (Phys. Rev. A 42, 5139 (1990)), including QED corrections. Differences between corresponding theoretical and experimental 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 Tc to U.

201,367
PB92-145283 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.
Using Diode Lasers for Atomic Physics.
Final rept.
C. Wieman, and L. Hollberg. 1991, 20p
See also PB92-116904. Sponsored by Office of Naval Research, Arlington, VA., and National Science Foundation, Washington, DC.
Pub. in Review of Scientific Instruments 62, n1 p1-20 Jan 91.

Keywords: *Atomic physics, *Laser spectroscopy, Semiconductor lasers, Laser applications, Reviews, Reprints.

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.
Journal of Research of the National Institute of Standards and Technology, November-December 1991. Volume 96, Number 6.
1991, 153p
Also available from Supt. of Docs. as SN703-027-00043-1. See also PB92-149897 through PB92-149954 and PB92-126614.

Keywords: *Research, Radiometry, Irradiance, Microspheres, Particle size, Dimensional measurement, X rays, Counting techniques, Thermodynamic activity, Sodium chloride, Superconductors, Critical current, Liquid nitrogen, Specific heat, Toxicity, Air pollution effects(Humans), Air pollution detection, Chemical analysis, Standard reference materials, US NIST, Piperazine-N-ethane sulfonic acid/N-hydroxyethyl, Propane sulfonic acid/(N-morpholino)-hydroxy).

Contents:
- Results of a CCPR Intercomparison of Spectral Irradiance Measurements by National Laboratories;
- Certification of SRM 1960--Nominal 10 micrometer Diameter Polystyrene Spheres ('Space Beads');
- Construction and Calibration of the NIST Large-Area-Source X-Ray Counting System;
- Simulators of Superconductor Critical Current--Design, Characteristics, and Applications;
- Molar Heat Capacity (C (sub v)) for Saturated and Compressed Liquid and Vapor Nitrogen from 65 to 300 K at Pressures to 35 MPa;
- A Standard Reference Material for Calibration of the Cup Furnace Smoke Toxicity Method for Assessing the Acute Inhalation Toxicity of Combustion Products;
- Investigation of the Interaction of Sodium Chloride and Two Amino Sulfonic Acids, HEPES and MOPSO, by EMF Measurements.

201,369
PB92-149913
(Order as PB92-149889, PC **A08**)
National Inst. of Standards and Technology, Gaithersburg, MD.
Construction and Calibration of the NIST Large-Area-Source X-ray Counting System.
J. M. R. Hutchinson, M. P. Unterweger, and P. A. Hodge. 1991, 10p
Included in Jnl. of Research of the National Institute of Standards and Technology, v96 n6 p693-702 Nov/Dec 91.

Keywords: *Counting techniques, *X rays, *Calibration, Plutonium 238, NaI detectors, Alpha particles, Design.

The paper describes the construction and calibration of the NIST large area x ray counting system . 238Pu sources 8 in (20.32 cm) by 5 in (12.70 cm) thick, emitting L X rays in the range of 12-20 keV are calibrated for total emission rate and also for rate through a centrally located 3 in (7.63 cm) diameter aperture. Alpha particle emission rates are obtained using the known x ray to alpha particle abundances. The sources will be used to calibrate alpha-particle surface monitors.

201,370
PB92-154095 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Thermophysics Div.
Radiance Temperatures (in the Wavelength Range 522-906 nm) of Niobium at Its Melting Point by a Pulse-Heating Technique.
Final rept.
A. Cezairliyan, and A. P. Miiller. 1992, 17p
Pub. in International Jnl. of Thermophysics 13, n1 p39-55 Jan 92.

Keywords: *Niobium, *Temperature measurement, Pulse heating, High temperature, Near infrared radiation, Visible radiation, Melting, Reprints, *Radiance temperatures.

Radiance temperatures (at six wavelengths in the range 522-906 nm) of niobium at its melting point were measured by a pulse-heating technique. The method is based on rapid resistive self-heating of the specimen from room temperature to its melting point in less than 1 s and on simultaneously measuring the specimen radiance temperatures every 0.5 ms with a high-speed multiwavelength pyrometer. The melting-point radiance temperatures for niobium were determined by averaging the results at each wavelength for 10 specimens (standard deviation: 0.3 K), as follows: 2497 K at 522 nm, 2445 K at 617 nm, 2422 K at 653 nm, 2393 K at 708 nm, 2337 K at 809 nm, and 2282 K at 906 nm. Based on estimates of the random and systematic errors arising from pyrometry and specimen conditions, the total error in the reported values is about 5 K at 653 nm and 6 K at the other wavelengths.

201,371
PB92-154152 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Simulation and Analysis of the Transmission Properties of Curved-Straight Neutron Guide Systems.
Final rept.
J. R. D. Copley, and D. F. R. Mildner. 1992, 9p
Pub. in Nuclear Science and Engineering 110, p1-9 1992.

Keywords: *Neutron guides, Neutron beams, Ray tracing, Simulation, Reprints, Acceptance diagrams.

The spatial intensity distribution of neutrons emerging from a curved 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 to the problem. The intensity distribution within the straight 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 (NML), Gaithersburg, MD. Center for Radiation Research.
Estimate of the Neutron Transfer Fusion Rate.
Final rept.
M. Danos, and V. B. Belyaev. 1991, 4p
Pub. in Fusion Technology 20, p354-357 Nov 91.

Keywords: *Neutron transfer, *Cold fusion, Quantum electrodynamics, Room temperature, Nuclear chemistry, Coulomb field, Estimates, Reprints.

The e(sup 4) order quantum electrodynamic term for neutron transfer fusion is 10(sup 40) to 10(sup 50) times larger than the direct term, suggesting that room-temperature fusion does not contradict nonexotic physics.

201,373
PB92-154194 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Quantum Metrology Div.
X-ray Instrumentation for Analysis of Fluorescent and Scattered Radiation (Invited).
Final rept.
R. D. Deslattes. 1992, 6p
Pub. in Review of Scientific Instruments 63, n1 p1128-1133 Jan 92.

Keywords: *X-ray equipment, *X-ray analysis, Polarization(Waves), Angular distribution, X-ray fluorescence, X-ray scattering, Instruments, Reprints, Secondary spectra.

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.

201,374
PB92-154350 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Semiconductor Electronics Div.
Correcting for X-ray Energy Calibration Error Caused by Misalignment of a Right-Angle Linkage Monochromator.
Final rept.
K. H. Kim, M. I. Bell, C. M. Dozier, R. K. Freitag, and C. E. Bouldin. 1991, 4p
Sponsored by Department of Energy, Washington, DC.
Pub. in Review of Scientific Instruments 62, n4 p982-985 Apr 91.

Keywords: *Monochromators, Synchrotron radiation, Misalignment, Correction, Reprints, Extended x-ray absorption fine structure, Beamlines.

Small alignment errors of right-angle linkage monochromators typical to many x-ray absorption fine structure beamlines can cause significant errors in the energy calibrations. A 1 degree misalignment produces errors greater than 1 keV over the hard x-ray operating range of a typical monochromator. The energy error caused by such misalignments is analyzed and its mathematical form given. The error can be corrected by inverting the expression and the amount of misalignment determined by accurate energy measurements at a few points. The accuracy of the corrections is tested. The effects of the error on x-ray absorption fine structure data and their interpretation are also discussed.

201,375
PB92-154392 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Radiometric Physics Div.
Spin-Resolved Elastic Scattering of Electrons from Sodium Below the Inelastic Threshold.
Final rept.
S. R. Lorentz, R. E. Scholten, J. J. McClelland, M. H. Kelley, and R. J. Celotta. 1991, 3p
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review Letters 67, n27 p3761-3763, 30 Dec 91.

Keywords: *Electron-atom collisions, *Sodium, Electron scattering, Elastic scattering, Polarization(Spin alignment), EV range 01-10, Reprints.

A very stringent test of low-energy electron-atom collision theory is made in the most favorable energy regime for the close-coupling approximation. Data are presented as exchange asymmetries in angle-resolved elastic scattering of spin-polarized electrons from spin-polarized sodium atoms. Data are reported for two incident energies, 1.0 and 1.6 eV, both of which are below the first excited-state threshold. The angular range is 20 deg - 142.5 deg. The close-coupling approximation is found to give excellent agreement with experiment at both energies.

201,376
PB92-154467 Not available NTIS
National Inst. of Standards and Technology (PL), 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.
T. Mooney, E. Lindroth, P. Indelicato, E. Kessler, and R. D. Deslattes. 1992, 13p
Pub. in Physical Review A 45, n1 p1531-1543, 1 Feb 92.

Keywords: *X-ray spectra, *Xenon, Electron transitions, Forbidden transitions, K shell, L shell, M shell, Reprints.

Wavelengths of xenon L-series x-ray lines were measured with high accuracy using a double flat-crystal vacuum spectrometer. 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 eV, except for transitions involving 3s holes where it is 1 eV.

201,377
PB92-154699 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Electron and Optical Physics Div.
Atomic and Molecular Manipulation with the Scanning Tunneling Microscope.
Final rept.
J. A. Stroscio, and D. M. Eigler. 1991, 8p
Pub. in Science 254, p1319-1326, 29 Nov 91.

Keywords: *Scanning tunneling microscopy, Molecules, Diffusion, Surfaces, Atoms, Reprints, *Atomic manipulation, Field evaporation.

The prospect of manipulating matter on the atomic scale has fascinated scientists for decades. This fascination may be motivated by scientific and technological opportunities, or from a curiosity about the consequences of being able to place atoms in a particular location. Advances in scanning tunneling microscopy have made this prospect a reality; single atoms can be placed at selected positions and structures can be built to a particular design atom-by-atom. Atoms and molecules may be manipulated in a variety of ways by using the interactions present in the tunnel 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
PB92-159052 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.
Hg(+) Single Ion Spectroscopy.
Final rept.
J. C. Bergquist, F. Diedrich, W. M. Itano, and D. J. Wineland. 1989, 4p
See also PB90-187519. Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in Proceedings of International Conference on Laser Spectroscopy (9th), Bretton Woods, NH., June 18-23, 1989, p274-277.

Keywords: *Ion storage, *Mercury ions, Mercury 199, Frequency standards, Electron transitions, Ultralow temperature, Dye lasers, Metastable state, Line width, Spectroscopy, Reprints, Laser cooling, Paul traps.

A single (199)Hg(1+) ion is confined in a miniature rf trap and is laser-cooled to nearly 0.001 K. The authors have studied the spectrum of the narrow 5d(10)6s doublet S(1/2) - 5d(9)6s(2) doublet D(5/2) electric-quadrupole-allowed transition near 282 nm and obtain a linewidth below 80 Hz (FWHM). The measured lifetime of the metastable doublet D(5/2) state gives a natural linewidth limit for the transition of 1.8 Hz. The narrow linewidth, the ability to detect transitions with unit probability, and the small perturbations of a single laser-cooled ion make it an attractive candidate for an optical frequency standard. The authors' present resolution is limited by the spectral purity of the frequency-doubled dye laser at 563 nm. Optical heterodyne measurements between two laser beams locked to independent, high-finesse cavities give a beat note of less than 40 Hz (FWHM at 563 nm) that is dominated by noise in the frequency range from 0 to 10 Hz. This is caused by the insufficient isolation of the cavities from mechanical vibrations in this frequency range. Better isolation methods intended to improve the laser linewidth to about 1 Hz or less are being investigated. A linear Paul trap, in which it would be possible to trap and cool many ions unperturbed by rf micromotion, is being tested.

201,379
PB92-159078 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Quantum Metrology Div.
Determination of the Neutron Lifetime by Counting Trapped Protons.
Final rept.
J. Byrne, P. G. Dawber, J. A. Spain, M. S. Dewey, D. M. Gilliam, G. L. Greene, G. P. Lamaze, A. P. Williams, J. Pauwels, R. Eykens, J. Vangestel, A. Lamberty, and R. D. Scott. 1989, 4p
See also PB91-118026.
Pub. in Nuclear Instruments and Methods in Physics Research 284, n1 p116-119 1989.

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 which employs a Penning trap for decay protons as a mechanism for the detection of neutron decay events. A novel method for the accurate change in volume of the trap is discussed. Signal to noise ratios for 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
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Electron and Optical Physics Div.
Photon Excitation of Soft X-ray Emission Spectra.
Final rept.
T. A. Callcott, C. H. Zhang, D. L. Ederer, D. R. Mueller, and J. E. Rubensson. 1990, 6p
Pub. in Nuclear Instruments and Methods in Physics Research 291, n1-2 p13-18 1990.

Keywords: *X ray fluorescence, X ray spectra, Soft x rays, Synchrotron radiation, Radiation damage, Bremsstrahlung, Excitation, Semiconductors, Reprints, Multilayers.

The photon excitation of soft x-ray emission spectra using monochromatized radiation from a synchrotron light source provides important advantages compared with electron excitation. The equipment 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 Bremsstrahlung, the reduction in damage produced by energy deposition, the elimination 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 Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.
Neutron Cross Section Standards Evaluations for ENDF/B-VI.
Final rept.
A. D. Carlson, W. P. Poenitz, G. M. Hale, and R. W. Peelle. 1989, 2p
See also DE85015734.
Pub. in Transactions of the American Nuclear Society 60, p604-605 1989.

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, Reprints.

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 Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.
Microdosimetry of Radon and Radon Daughters.
Final rept.
R. S. Caswell, and J. J. Coyne. 1990, 4p
Sponsored by Department of Energy, Washington, DC. Office of Health and Environmental Research.
Pub. in Radiation Protection Dosimetry 31, n1-4 p395-398 1990.

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 Inst. of Standards and Technology (NML), Gaithersburg, MD. Quantum Metrology Div.
Self-Filtering Crystal Monochromators for Synchrotron X-Radiation.
Final rept.
P. L. Cowan, and S. Brennan. 1989, 4p
Pub. in Review of Scientific Instruments 60, n7 p1987-1990 Jul 89.

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 radiated power from the surface of the crystal. 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, and various considerations in implementation are discussed. Finally, the possibilities for exploiting the unused reflected x rays will be explored.

201,384
PB92-159250 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Radiation Source and Instrumentation Div.
Conceptual Design of a High Current Injector for the NIST-NRL Free Electron Laser.
Final rept.
R. I. Cutler, E. R. Lindstrom, and S. Penner. 1989, 3p
See also AD-A227 310.
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Particle Accelerator Conference, Chicago, IL., March 20-23, 1989, p328-330.

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 66.111 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 a high current injection system to produce this beam using a pulsed electron gun and sub- harmonic chopping and bunching is described, and the results of PARMELA calculations are presented.

201,385
PB92-159326 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Radiation Research.
Coulomb Assisted Cold Fusion in Solids.
Final rept.
M. Danos. 1990, 6p
Pub. in Fusion Technology 17, n3 p484-489 1990.

Keywords: *Cold fusion, Coulomb field, Palladium, Titanium, Neutrons, Helium, Reprints.

When taking into account the energy-momentum exchange with a catalyzing lattice nucleus, the Coulomb barrier penetrability becomes unity, in complete analogy with the Fabry-Perot resonator of optics.

201,386
PB92-165158 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Ionizing Radiation Div.
Standardization of Holmium-166 by the CIEMAT/NIST Liquid-Scintillation Efficiency-Tracing Method.
Final rept.
J. M. Calhoun, J. T. Cessna, B. M. Coursey, D. D. Hoppes, F. J. Schima, and M. P. Unterweger. 1992, 8p
Pub. in Radioactivity and Radiochemistry 2, n4 p38-45 1992.

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-tracing method. Standardized solutions were used to calibrate NIST ionization chambers; radiopharmaceutical manufacturers and other researchers can now submit ampoules 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
PB92-165174 Not available NTIS
National Inst. of Standards and Technology (EEEL), Boulder, CO. Electromagnetic Technology Div.
Demagnetizing Factors for Cylinders.
Final rept.
D. X. Chen, J. A. Brug, and R. B. Goldfarb. 1991, 19p
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, Cylinders, Reprints.

Fluxmetric (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 -1 = or < 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 -1 = or < chi < infinity. Demagnetizing factors for chi < 0 are applicable to superconductors. For chi = 0, suitable for weakly magnetic or saturated ferromagnetic materials, N(f) and N(m) were computed exactly using inductance formulas.

201,388
PB92-165331 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Quantum Metrology Div.
Projectile Spectroscopy in a Cooler Ring.
Final rept.
R. D. Deslattes. 1989, 5p
Pub. in Nuclear Instruments and Methods in Physics Research 43, n3 p333-337 1989.

Keywords: *Heavy ions, *Ion sources, Radiative corrections, Ion 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. At the same time, 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 deceleration) as a light source. Such a ring is currently under construction at GSI in Darmstadt, West Germany. 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
PB92-165372 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Quantum Physics Div.
Subroutines for the Evaluation of Cross Sections of One-Photon Radiative Processes Occurring in Fast-Electron H-Atom Collisions.
Final rept.
A. Dubois, and A. Maquet. 1990, 10p
Pub. in Computer Physics Communications 60, p271-280 1990.

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-photon processes occurring in the course of fast electron-hydrogen atom collisions: free-free transitions observed in the presence of an external laser source and bremsstrahlung. In spite of the presence of the Coulomb Green's function, a very compact and numerically convenient expression of the related amplitude has been derived so that the computations can be performed on a microcomputer.

201,390
PB92-165521 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Quantum Physics Div.
Spectra of Relic Gravitons and the Early History of the Hubble Parameter.
Final rept.
L. P. Grishchuk, and M. Solokhin. 1991, 6p
See also PB91-203125.
Pub. in Physical Review D 43, n8 p2566-2571, 15 Apr 91.

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 inflationary 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
PB92-165646 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.
Improved Kennedy-Thorndike Experiment: A Preliminary Report.
Final rept.
D. Hils, and J. L. Hall. 1989, 6p
See also PB90-241522.
Pub. in Proceedings of International Conference on Laser Spectroscopy (9th), Bretton Woods, NH., June 18-23, 1989, p376-381.

Keywords: *Special relativity, Optical measurement, Laser radiation, Lorentz transformations, Metrology, Tests, Reprints, *Kennedy-Thorndike experiment.

The report summarizes an improved Kennedy-Thorndike type experiment based on modern laser metrology. The heterodyne signal between a cavity-locked He-Ne laser and one stabilized on I2 shows a fractional frequency amplitude at the sidereal frequency of Delta nu(beat)/nu(c) $<$ 2 x 10 to the -13 power (90% confidence interval). This null result is more accurate by a factor of approx 300 than the previous best measurement, by R. J. Kennedy and E. M. Thorndike in 1932. Following the reasoning of H. P. Robertson (Rev. Mod. Phys. 21 (1949) 378), the Lorentz transform of special relativity can now be based on experimental facts at the 70 ppm level.

201,392
PB92-165703 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.
Atomic Ion Frequency Standards.
Final rept.
W. M. Itano. 1991, 7p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in Proceedings of the IEEE (Institute of Electrical and Electronics Engineers) 79, n7 p936-942 Jul 91.

Keywords: *Frequency standards, *Atomic clocks, *Ion storage, Beryllium ions, Mercury ions, Frequency stability, Reprints, Ion traps.

A new class of atomic frequency standard, based on ions trapped by electromagnetic fields, is under development. Such standards have the potential of achieving higher frequency accuracy than currently available standards. They are also capable of very good frequency stability. The history and status of trapped-ion frequency standards are reviewed. Prospects for future standards are discussed.

201,393
PB92-165711 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Atomic Transition Probabilities for the Ar I 4s - 5p Transition Array.
Final rept.
D. W. Jones, and W. L. Wiese. 1989, 5p
Pub. in Physical Review A 39, n1 p110-114 1989.

Keywords: *Argon, Atomic energy levels, Transition probabilities, Electric arcs, Line spectra, Reprints.

We have determined the transition probabilities for twenty-three lines of the Ar I 4s-5p array by the emission method using a wall-stabilized arc. The seven remaining lines of this transition array were either very weak and/or over-lapped strongly with other lines so that they could not be reliably measured. We placed our relative data on an absolute scale by applying the result of a recent critical analysis for the prominent 4s-5p line at 430.01 nm.

201,394
PB92-165729 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Laser Modification of Ultracold Atomic Collisions in Optical Traps.
Final rept.
P. S. Julienne. 1988, 4p
Pub. in Physical Review Letters 61, n6 p698-701 1988.

Keywords: *Atomic collisions, Ultralow temperature, Laser radiation, Ionization, Reprints, Sodium atoms, Ultracold atoms, Atom traps, Interatomic potentials.

Intense laser fields in optical neutral atom traps can have a profound effect on collision cross sections at ultracold temperatures, T $<$ 0.001K. A simple model is developed for the long range interatomic potentials of two field-dressed atoms. The associative ionization of two ultracold Na atoms is predicted to be fast in an optical trap, slow in optical molasses.

201,395
PB92-165778 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
BCS Quark Mass Matrix.
Final rept.
P. Kaus, and S. Meshkov. 1988, 9p
Pub. in Mod. Phys. Lett. A 3, n13 p1251-1259 1988.

Keywords: *Quarks, Kobayashi-Maskawa matrix, BCS theory, Interactions, Reprints, Mass gap.

The quark mass gap and quark mass hierarchy is obtained by introducing a BCS interaction among urquarks. A 3X3 quark mass matrix with equal matrix elements, i.e., with all ur-flavors interacting with the same strength, has eigenvalues 0, 0, and 3; both the quark charge -1/3 and charge +2/3 systems with one heavy quark and two almost massless quarks resemble these eigenvalues. The physical mass splittings between the two lightest quarks come from higher order corrections to the mass matrix which are obtained by fitting the Kobayashi-Maskawa matrix V(KM).

201,396
PB92-166081 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Div.
Bremsstrahlung Production by Electrons: Cross Sections and Electron-Photon Transport Calculations.
Final rept.
S. M. Seltzer. 1989, 22p
Pub. in Proceedings of Conference on the High-Energy Radiation Background in Space, Sanibel Island, FL., November 3-5, 1987, p103-124 1989.

Keywords: *Aerospace environments, *Electron bombardment, *Bremsstrahlung, Monte Carlo method, Radiation shielding, Radiation transport, Cross sections, Reprints.

The paper describes the rather accurate Monte Carlo model and cross sections that have been used to calculate effects from electrons and photons on measurement, electronic and biological systems in space. A number of applications are illustrated, with emphasis on effects from bremsstrahlung produced by electrons.

201,397
PB92-166164 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Watt Balance Method for Determination of Planck's Constant.
Final rept.
W. L. Tew, P. T. Olsen, and E. R. Williams. 1991, 1p
Pub. in Proceedings of Spring Meeting of the American Physical Society, Washington, DC., April 22-25, 1991, p1266.

Keywords: *Plancks constant, Fundamental constants, Superconducting magnets, Magnetic fields, Mutual inductance, Electrical measurement, Force, Reprints, Watt balance method.

Highly accurate voltage standards based on the AC Josephson effect have long been maintained at NIST. When such a standard is calibrated against a SI voltage as measured in terms of a known force, the Josephson constant, K(J) = 2e/h, may be determined in SI units. Likewise, the integral quantum Hall effect provides a very accurate representation of the ohm. Hence, resistance standards at NIST are now calibrated in terms of the VonKlitzing constant, R(K) = h/e squared. While these calibrations can be made accurate to 10(sup (-8)) or better, force determinations have heretofore been limited to about 10(sup (-6)). The watt balance method represents a significant improvement in force determinations by using a classical current balance, modified to allow vertical motion of the force coil through a static magnetic field gradient. A two part measurement determines the quotient of the SI watt to an electrical watt in terms of K(J) and R(K). The authors present preliminary measurements using the NIST watt balance with a special radial field superconducting magnet.

201,398
PB92-166172 Not available NTIS
National Inst. of Standards and Technology (EEEL), Gaithersburg, MD. Electricity Div.
Use of Magnetic Forces in the Alignment of a Radial Field Superconducting Magnet (Abstract).
Final rept.
W. L. Tew, P. T. Olsen, E. R. Williams, and C. G. Kim. 1991, 2p
Pub. in Proceedings of Joint MMM-Intermag Conference (5th), Pittsburgh, PA., June 18-21, 1991, p93-94.

Keywords: *Magnetic fields, Superconducting magnets, Europium sulfides, Picosecond pulses, Doped materials, Alignment, Precision, Transients, Terbium, Spin, Reprints.

Pulsed photoconductive gating of microlithographic coplanar transmission line structures on semiconductor substrates is used to produce quasi-step-function magnetic field transients for application to time-resolved investigations of a wide variety of ultrafast magnetic phenomena. Typical fields generated using a synchronously pumped, subpicosecond dye laser have risetimes of order 1 picosecond, durations of several hundred picoseconds, and magnitudes in the range of tens of Gauss. These parameters are largely determined by characteristics of the substrate material. In particular the mobility, carrier lifetime, and dielectric strength, which may be tuned (for example by ion implantation) to suit specific applications. The magnitudes and temporal profiles of the fields are monitored both magnetooptically and through time-resolved photoconductivity cross-correlation measurements. The fields may be applied either in-plane or normal to thin film samples. An illustration of the technique in an investigation of the ultrafast spin dynamics of Tb-doped EuS films is presented.

201,399
PB92-166255 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.
Determination of the Uniformity of Uranium Fission Deposits Using Rutherford Backscattering Spectrometry and Alpha-Particle Scanning.
Final rept.
O. A. Wasson, and R. A. Schrack. 1989, 5p
Pub. in Nuclear Instruments and Methods in Physics Research 282, n1 p194-198 1989.

Keywords: *Density measurement, Fission cross sections, Rutherford scattering, Uranium deposits, Helium ions, Backscattering, Reprints, Rutherford backscattering spectroscopy, Aerial density.

The uniformity of the areal density of uranium deposits used in neutron induced fission cross section measurements has been measured using Rutherford backscattering spectrometry (RBS) of 1 MeV He(1+) ions as well as by scanning the natural alpha-particle decay of the uranium. The RBS measurements used the 3-MV positive-ion accelerator at the National Bureau of Standards along with a versatile scattering chamber with numerous ports, five-axis goniometer, target ladder, and solid state detector. The variation in areal density of a 264 microg/sq cm UO2 deposit with a diameter of 75 mm was measured using the 1-MeV He(1+) beam. The results are in excellent agreement with those obtained from alpha-particle activity measurements. However, the RBS measurements provide better definition of the uniformity near the edge of the deposits. The authors' experience indicates that the RBS technique is useful for measuring variations of 1% in areal density but is less sensitive to the absolute areal density. The stoichiometry of the deposit was also measured with x-ray scattering.

201,400
PB92-170661 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Quantum Metrology Div.
Facilities for Fundamental Physics Research at the NIST Cold Neutron Facility.
Final rept.
M. Arif, R. D. Deslattes, M. S. Dewey, G. L. Greene, and I. G. Schroder. 1989, 4p
Pub. in Nuclear Instruments and Methods in Physics Research A284, p216-219 Nov/Dec 89.

Keywords: *Research facilities, *Cold neutrons, Interferometry, Uses, Reprints, US NIST.

A brief description of the new NIST cold neutron research facility is presented. The features of two fundamental physics research stations at this new facility are described in some detail. A list of proposed initial experimental programs for these two stations is also given.

201,401
PB92-170703 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Quantum Metrology Div.
Electric Dipole, Electric Quadrupole, and Magnetic Dipole Transition Probabilities of Na-Like Ions, 56 $<$ or = Z $<$ or = 92.
Final rept.
D. H. Baik, Y. G. Ohr, K. S. Kim, J. M. Lee, P. Indelicato, and Y. -K. Kim. 1991, 27p
Sponsored by Department of Energy, Washington, DC.

Pub. in Atomic Data and Nuclear Data Tables 47, n2 p177-203 Mar 91.

Keywords: *E1-transitions, *E2-transitions, *M1-transitions, Transition probabilities, Oscillator strengths, Radiative lifetime, Reprints, *Sodium-like ions.

Electric 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 for Na-like ions Ba(45+) through U(81+). For the theoretical energies, the Breit interaction and the Lamb-shift corrections were calculated perturbatively. Radiative lifetimes were obtained from the calculated transition probabilities.

201,402
PB92-170752 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.
Atomic Physics Tests of Nonlinear Quantum Mechanics.
Final rept.
J. J. Bollinger, D. J. Heinzen, W. M. Itano, S. L. Gilbert, and D. J. Wineland. 1991, 20p
See also PB92-116870. Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in Proceedings of International Conference on Atomic Physics (12th), Ann Arbor, MI., July 29-August 3, 1991, p461-480.

Keywords: *Quantum mechanics, Atomic physics, Atomic clocks, Hydrogen masers, Hyperfine structure, Nuclear spin, Nonlinear problems, Causality, Precession, Tests, Reprints, Ion storage.

Atomic physics experiments which test a nonlinear generalization of quantum mechanics recently formulated by Weinberg are described. The experiments search for a dependence of hyperfine transition frequencies or nuclear spin precession frequencies on the relative populations of the hyperfine or nuclear spin states. The experiments set limits less than 10 micro Hz on the size of the possible nonlinear contributions to these frequencies. In some cases this can be interpreted as a limit of less than about 10(sup (-26)) on the fraction of binding energy per nucleon that could be due to a nonlinear correction to a nuclear Hamiltonian. The possibility that a nonlinear addition to quantum mechanics violates causality is discussed.

201,403
PB92-170828 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Quantum Metrology Div.
Fundamental Physics Using Ultrahigh Resolution Gamma Spectroscopy.
Final rept.
M. S. Dewey, E. G. Kessler, G.L. Greene, R. D. Deslattes, H. Borner, and J. Jolie. 1989, 5p
Pub. in Nuclear Instruments and Methods in Physics Research A284, p151-155 1989.

Keywords: *Gamma ray spectroscopy, Gamma spectrometers, High resolution, MeV range 1-10, Reprints, Absolute wavelength program.

GAMS4, a double-flat-crystal spectrometer, is operated as a joint NIST/ILL facility at the High Flux Reactor at the Institut Laue-Langevin (ILL) in Grenoble, France. It was designed and has been used successfully for the absolute determination of gamma-ray energies in the region < 5 MeV. Such measurements can lead to a unification of the atomic mass scale and the wavelength scale. Recently, new directions of research that exploit details of measured line shapes have been identified. We discuss the status of the absolute wavelength program and these new programs.

201,404
PB92-170927 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Electron and Optical Physics Div.
Photoionization.
Final rept.
D. L. Ederer. 1991, 2p
See also PB82-234931.
Pub. in Encyclopedia of Physics, p912-913 1991.

Keywords: *Photoionization, Photon-molecule collisions, Photon-atom collisions, Ionization cross sections, Electronic structure, Photoemission, X rays, Reprints.

Photoionization is a process where a photon of frequency and energy h(nu) interacts with an atom or molecule to produce an ion and one or more electrons. The probability that an energetic photon will produce ionization is measured by the photoionization cross section sigma(nu), which has the dimension of an area. The cross section is the quantity that reflects the electronic properties of an atom.

201,405
PB92-170935 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Process Measurements Div.
High-Accuracy Dilatometer for the Range -20C to +700C.
Final rept.
R. E. Edsinger, and J. F. Schooley. 1991, 13p
Pub. in International Jnl. of Thermophysics 12, n4 p665-677 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 potassium-loaded heat pipe to provide a homogenous temperature environment for the sample and uses the Merritt-Saunders (optical interferometric) method of observing its expansion. The apparatus is similar in many respects to one described previously. Temperature regulation and measurement are accomplished through the use of a dedicated laboratory micro-computer operating with a simple program. Two platinum resistance thermometers, read automatically by a digital resistance bridge, provide, on command, 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 Pt-Rh alloy agree with results obtained both from the present apparatus and from the previous one, at the + or - 2 ppm level.

201,406
PB92-170943 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.
Study of Slab Transmissions and Reflection.
Final rept.
C. M. Eisenhauer. 1991, 15p
Pub. in Nuclear Science and Engineering 107, n1 p67-81 1991.

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 point source, through a plane slab of infinite extent, to a point detector, depends on the orientation of the slab but varies very little with the slab position. This statement 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 transition 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
PB92-171099 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.
Granular-Aluminum Superconducting Detector for 6 keV X-Rays and 2.2 MeV Beta Sources.
Final rept.
A. Gabutti, K. E. Gray, R. G. Wagner, and R. H. Ono. 1990, 9p
Pub. in Nuclear Instruments and Methods in Physics Research 289, n1-2 p274-282 1990.

Keywords: *X-ray detection, *Beta detection, MeV range 1-10, KeV range 1-10, Granular materials, Iron 55, Strontium 90, Aluminum, Performance, Reprints, *Superconducting detectors.

A 2-micrometer superconducting strip of granular aluminum was used to detect the superconducting to normal transitions induced by the absorption of (55)Fe, 6 keV X-rays or the passage of electrons from a (90)Sr, 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.

201,408
PB92-171263 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.
Absolute Neutron Counting Based on B-10 Alpha-Gamma Coincidence Methods.
Final rept.
D. M. Gilliam, G. L. Greene, and G. P. Lamaze. 1989, 3p
Pub. in Nuclear Instruments and Methods in Physics Research A284, n1 p220-222, 20 Nov 89.

Keywords: *Neutron counters, *Thermal neutrons, *Cold neutrons, Prompt gamma radiation, Coincidence methods, Neutron beams, Calibration, Boron 10, Alpha particles, Reprints.

A new absolute counter for thermal and cold neutron beams has been built, based on the counting of prompt gamma rays from a boron target that totally absorbs the impinging neutrons. The system is calibrated by two independent methods without reference to either the boron sample mass or the (10)B reaction cross section. Both calibration methods are potentially capable of approaching the accuracy level of + or - 0.1 % (1 sigma). In the calibration experiments, the totally absorbing boron target is replaced by a thin (10)B target, and either (1) alpha-gamma coincidence counting or (2) calibration by standard alpha sources is used to derive the efficiency of the gamma counter per neutron impinging on the totally absorbing target. Systematic corrections and estimated residual uncertainties are discussed.

201,409
PB92-171636 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.
Linear Trap for High-Accuracy Spectroscopy of Stored Ions.
Final rept.
M. G. Raizen, J. M. Gilligan, J. C. Bergquist, W. M. Itano, and D. J. Wineland. 1992, 10p
Sponsored by Office of Naval Research, Arlington, VA., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Modern Optics 39, n2 p233-242 1992.

Keywords: Double resonance methods, Microwave spectroscopy, Hyperfine structure, Mercury ions, Mercury 199, Ground state, Accuracy, Reprints, *Ion traps, Paul traps, Laser cooling.

In a linear r.f. Paul trap, 'crystallized' structures of laser-cooled (199)Hg(1+) ions are observed. The ground-state hyperfine transition at 40.5 GHz is observed in microwave-optical double-resonance spectroscopy. Future prospects are also discussed.

201,410
PB92-171768 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Atomic Physics Div.
Ionization of Lithium Vapor by CW Quasiresonant Laser Light.
Final rept.
D. Veza, and C. J. Sansonetti. 1992, 8p
Pub. in Zeitschrift fuer Physik D: Atoms, Molecules and Clusters 22, p463-470 1992.

Keywords: *Gas ionization, *Photoionization, *Lithium, Laser-produced plasma, Laser spectroscopy, Visible radiation, Dimers, Reprints, Collisional energy transfer.

We report measurements of the excitation and ionization of dense lithium vapor irradiated by CW dye laser light scanning the 2 doublet P - 3 doublet D lithium atomic transition at 610.3 nm. Lithium vapor with a density of 8 x 10 to the 16th power/cc was ionized by a 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, two 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. Simiu. Mar 92, 37p 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, Duffing-Holmes oscillators, Milnikov theory, Shinozvka noise.

The authors study the effect of additive noise on near-integrable second-order dynamical systems whose unperturbed flows have homoclinic or heteroclinic orbits. The noise is represented by a type of Shinozuka stochastic process capable of arbitrarily closely approximating Gaussian noise with any specified spectrum. The authors derive a formula for the flux factor applicable for any asymptotic mean stationary excitation. The derivation shows that, to first order, the effect of the external excitation on the system is mediated by a linear filter associated with the system 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 substantially equivalent roles in the promotion of chaos.

201,412
PB92-172824 PC **A09**/MF **A02**
National Inst. of Standards and Technology (PL), Gaithersburg, MD.
Physics Laboratory Technical Activities, 1991.
Final rept.
K. B. Gebbie. Feb 92, 181p NISTIR-4741
Presented to the Board on Assessment of NIST Programs, National Research Council, February 24-25, 1992. See also PB90-133158 and PB91-178855.

Keywords: *Physics, Atomic physics, Molecular physics, Fundamental constants, Frequency standards, Time standards, Quantum theory, Metrology, Radiometry, Electrons, Calibration, Optics, Ionizing radiation, Measurements, Astrophysics, Standard reference materials, US NIST.

The report summarizes research projects, measurement method development, calibration and testing, and data evaluation 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 rept.
A. DeMarchi, R. E. Drullinger, and J. H. Shirley.
1990, 5p
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 cyclindrical 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 H-field reverse its direction twice. The observed lineshapes show an interference structure similar to Ramsey interference. Theoretically derived lineshapes are in good agreement with the observations. A comparison is made between these lineshapes and corresponding Ramsey lineshapes. The effects of 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 Experiments at the University of Washington and at NIST in Boulder.
Final rept.
F. L. Moore. 1991, 10p
Pub. in Proceedings of INS Symposium (19th) Cooler Rings and Their Applications, Tokyo, Japan, November 5-8, 1990, p98-107 1991.

Keywords: Quantum chromodynamics, Quantum mechanics, Invariance principles, Frequency dividers, Fundamental constants, General relativity, Atomic clocks, 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 the work are tests of QED, CPT, general relativity, and quantum mechanics. Also mentioned are several measurements of fundamental constants, a laser cooled atomic clock, a frequency divider, and studies of non-neutral plasmas.

201,415
PB92-175611 Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Thermophysics Div.
Thermal Conductivity Surface of Argon: A Fresh Analysis.
Final rept.
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 Jnl. 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 coefficient, and the critical enhancement. The new surface exhibits a significant reduction in overall error compared to the authors' previous surface which was entirely empirical. The uncertainty in the new thermal conductivity surface is + or - 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 rept.
R. Radebaugh. 1991, 16p
Pub. in Proceedings of Conference on Superconducting Digital Circuits and Systems, Washington, DC., September 11-13, 1991, v1 p4.1-1-4.1-16.

Keywords: *Superconducting devices, *Cryogenic cooling, Joule-Thomson effect, Digital circuits, Reviews, Reprints, *Cryogenic refrigerators, *Cryocoolers, Gifford-McMahon refrigerators.

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, at present, most of these coolers have lifetimes or maintenance intervals of one year or less or require too much input power. The paper reviews the technology 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 electronic application are reviewed. The paper concludes that development work in refrigeration for superconductors should proceed in parallel with the development of superconductor devices.

201,417
PB92-175686 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Atomic Physics Div.
Laser-Produced Spectra of Copperlike Antimony and Tellurium, Sb(22+) and Te(23+).
Final rept.
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, *Copper-like ions.

Spectra of the copperlike ions Sb(22+) and Te(23+) were observed with a laser-produced plasma and a 10.7-m grazing-incidence spectrograph. Wavelengths, energy levels for all n = 4 and n = 5 configurations, and ionization energies were determined for each ion. For Sb(22+) the 6g levels were also determined. Wavelengths for the 4s-4p resonance lines are compared with recent measurements (J. Opt. Soc. Am. B 8, 1799 (1991)) obtained with a tokamak plasma and with semiempirical 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.
Accelerated lambda Iteration Method for Multilevel Radiative Transfer. 1. Non-Overlapping Lines with Background Continuum.
Final rept.
G. B. Rybicki, and D. G. Hummer. 1991, 11p
Grants NSF-AST88-02937, NASA-NAGW-766
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 transfer). 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 used 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. Applications of the method are made to several multilevel 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 (1)S Level of Helium.
Final rept.
C. J. Sansonetti, 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 states, Metastable state, Excited states, Laser spectroscopy, Electron transitions, Gas ionization, Binding energy, Tests, Reprints.

The authors have measured the absolute wave numbers of a series 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 the 2 singlet S level to 2.2 parts in 10 to the 10th 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, 32033.228855(7)/cm, confirms their earlier finding of a relatively large discrepancy with the predicted two-electron Lamb shift for the 2 singlet S level.

201,420
PB92-175835 Not available NTIS

National Inst. of Standards and Technology (PL), Gaithersburg, MD. Atomic Physics Div.
Improved Wavelengths for Prominent Lines of Ni X to Ni XXVI.
Final rept.
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, Soft X rays, Laser-produced 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 + or - 0.005 A. The light source was the TEXT tokamak at the University of Texas in Austin. Lines of Li-like to 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)S2 State of (17)O Using an AlGaAs Diode Laser at 777 nm(+).
Final rept.
G. M. Tino, L. Hollberg, A. Sasso, M. Inguscio, and M. Barsanti. 1990, 4p
Pub. in Physical Review Letters 64, n25 p2999-3002, 18 Jun 90.

Keywords: *Oxygen 17, Near infrared radiation, Hyperfine structure, Metastable state, 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)S2 state of (17)O. 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 (EEEL), Boulder, CO. Electromagnetic Fields Div.
Fields Radiated by Electrostatic Discharges.
Final rept.
P. F. Wilson, and M. T. Ma. 1991, 9p
See also PB90-128778.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electromagnetic Compatibility 33, n1 p10-18 Feb 91.

Keywords: *Electric fields, *Magnetic fields, Mathematical models, Time domain, Electric sparks, Dipoles, 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 (> or = 150V/m at a distance of 1.5 m for example) for short periods of time (a few nanoseconds), particularly for relatively low-voltage events (< or = 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 rept.
D. J. Wineland, J. C. Bergquist, J. J. Bollinger, W. M. Itano, D. J. Heinzen, S. L. Gilbert, C. H. Manney, and M. G. Raizen. 1990, 9p
Sponsored by Office of Naval Research, Arlington, VA., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Ultrasonics, Ferroelectrics, and Frequency Control 37, n6 p515-523 Nov 90.

Keywords: *Frequency standards, *Ion storage, Beryllium 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 sympathetically 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 Spin-Dependent Forces Using Stored-Ion Spectroscopy.
Final rept.
D. J. Wineland, J. J. Bollinger, D. J. Heinzen, W. M. Itano, and M. G. Raizen. 1991, 4p
Pub. in Physical Review Letters 67, n13 p1735-1738, 23 Sep 91.

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. These experiments also place strict limits on anomalous weights of spinning gyroscopes.

201,425
PB92-181106 PC **A04**/MF **A01**
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Ionizing Radiation Div.
Mass Energy-Transfer and Mass Energy-Absorption Coefficients, Including In-Flight Positron Annihilation for Photon Energies 1 keV to 100 MeV, 1992.
P. D. Higgins, F. H. Attix, J. H. Hubbell, S. M. Seltzer, M. J. Berger, and C. H. Sibata. Mar 92, 70p NISTIR-4812
See also report of 1991, PB92-126473. Prepared in cooperation with Cleveland Clinic Foundation, OH. Dept. of Radiation Therapy, and Wisconsin Univ.-Madison. 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-absorption coefficients are tabulated in units of sq cm/g for photon energies between 1 keV and 100 MeV for 29 elements (Z = 1-92), and 14 mixtures and compounds of general 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 positron annihilation, previously not applied in NIST calculations for energies above 10 MeV. Agreement with recently published data is good for energies above 1 MeV, but the authors find differences in mass energy-absorption 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.
Journal of Research of the National Institute of Standards and Technology, January-February 1992. Volume 97, Number 1. Special Issue: Reference Spectra and Energy Levels for Neutral and Singly-Ionized Platinum.
1992, 250p
Also available from Supt. of Docs. as SN703-027-00044-0. See also PB92-190198 through PB92-190214 and PB92-149889.

Keywords: *Atomic energy levels, *Energy levels, *Ultraviolet spectra, *Platinum, Atomic spectroscopy, Spectral lines, Neon, Atlases, Tables(Data), Hollow cathode lamp.

Contents:
Atlas of the Spectrum of a Platinum/Neon Hollow-Cathode Reference Lamp in the Region 1130-4330 A;
Energy Levels of Neutral Platinum;
Energy Levels of Singly-Ionized Platinum.

201,427
PB92-190198 (Order as PB92-190180, PC **A11**)
National Inst. of Standards and Technology, Gaithersburg, MD.
Atlas of the Spectrum of a Platinum/Neon Hollow-Cathode Reference Lamp in the Region 1130-4330 A.
J. E. Sansonetti, J. Reader, C. J. Sansonetti, and N. Acquista. 1992, 211p
Included in Jnl. of Research of the National Institute of Standards and Technology, v97 n1 p1-211 Jan/Feb 92.

Keywords: *Ultraviolet spectra, *Platinum, *Neon, *Atlases, Astronomical spectroscopy, Hubble space telescope, Spectral lines, Tables(Data), Graphs(Charts), Hollow cathode lamp.

The spectrum of a platinum hollow-cathode lamp containing neon carrier gas was recorded photographically and photoelectrically with a 10.7 m normal-incidence vacuum spectrograph. Wavelengths and intensities were determined for about 5600 lines in the region 1130-4330 A. An atlas of the spectrum is given, with the spectral lines marked and their intensities, wavelengths, and classifications listed. Lines of impurity species are also identified. The uncertainty of the photographically measured wavelengths is estimated to be + or - 0.0020 A. The uncertainty of lines measured in the photoelectric scans is 0.01 A for wavelengths shorter than 2030 A and 0.02 A for longer wavelengths. Ritz-type wavelengths are given for many of the classified lines of Pt II with uncertainties varying from + or - 0.0004 to + or - 0.0025 A. The uncertainty of the relative intensities is estimated to be about 20%.

201,428
PB92-190206 (Order as PB92-190180, PC **A11**)
Centre National de la Recherche Scientifique, Orsay (France). Lab. Aime Coton.
Energy Levels of Neutral Platinum.
J. Blaise, 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 p213-216 Jan/Feb 92.

Keywords: *Atomic energy levels, *Energy levels, *Platinum, Atomic spectroscopy, Electronic structure, Tables(Data).

All known energy levels of neutral platinum (Pt I) 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
PB92-190214 (Order as PB92-190180, PC **A11**)
Centre National de la Recherche Scientifique, Orsay (France). Lab. Aime Coton.
Energy Levels of Singly-Ionized Platinum.
J. Blaise, 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: *Atomic energy levels, *Energy levels, *Platinum ions, Atomic spectroscopy, Electronic structure, Tables(Data).

The analysis of Pt II is extended by using accurate wavelength measurements by Sansonetti et al. Forty-three new even and 104 new odd levels have been found. The Slater-Condon parametric method is used for the interpretation of the 5d(9), 5d(8)6s, and 5d(7)6s(2) low even configurations and the 5d(8)(7s + 6d) high even configurations with root mean square deviations smaller than 80/cm. The importance of the 5d(8)-5d(7)6s core interaction in interpreting the even-parity 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 92, 148p NISTIR-4838

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, Tables(Data).

A preliminary simultaneous least squares fit to measurements of 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 construction of the ENDF/B-V file imposed improbable shapes, particularly in the case of the (12)C(n,n'3(alpha)) reaction, which were incompatible with direct measurements of kerma and of the reaction cross sections. Consequently a new evaluation of the 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 of cross sections 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.
Journal of Research of the National Institute of Standards and Technology, March-April 1992. Volume 97, Number 2.
1992, 89p
Also available from Supt. of Docs. as SN703-027-00045-8. See also PB92-192087 through PB92-192129 and PB92-190180.

Keywords: *Research projects, *Standards, Combustion products, Smoke, Toxicity, Microspheres, Particle size, Electron microscopes, Calibration, Sommerfeld constant, Standard reference materials, Magnification standards, Antenna measurements, Fine structure constant, Electron charge.

Contents: The 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; Certification of NIST SRM 1962: 3 Micrometer Diameter Polystyrene Spheres; Optical Calibration of a Submicrometer Magnification Standard; Probe-Position Error Correction in Planar Near Field Measurements at 60GHz: Experimental Verification; Measuring the Electron's Charge and the Fine-Structure Constant by Counting Electrons on a Capacitor.

201,432
PB92-192129
(Order as PB92-192079, PC **A05**)
National Inst. of Standards and Technology, Gaithersburg, MD.
Measuring the Electron's Charge and the Fine-Structure Constant by Counting Electrons on a Capacitor.
E. R. Williams, R. N. Ghosh, and J. M. Martinis. 1992, 6p
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, v97 n2 p299-304 Mar/Apr 92.

Keywords: *Sommerfeld constant, Electron tunneling, Capacitors, Measurement, Counting, *Fine structure constant, *Electron charge.

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, V(s), across the capacitor. If V(s) 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. Recent developments 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.

201,433
PB92-197383 Not available NTIS
National Inst. of Standards and Technology (PL), Boulder, CO. Time and Frequency Div.
Single Ion Optical Spectroscopy.
Final rept.
J. C. Bergquist, W. M. Itano, F. Elsner, M. G. Raizen, and D. J. Wineland. 1991, 9p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in Proceedings of Light Induced Kinetic Effects on Atoms, Ions and Molecules Workshop, Marciana Marina, Elba Island-Italy, May 2-5, 1990, p291-299 1991.

Keywords: Temperature range 0000-0013K, Ion traps(Instrumentation), Ultraviolet radiation, Metastable state, Frequency standards, Mercury 199, Mercury ions, Line width, Reprints, *Single ion spectroscopy, Laser cooling, Paul traps.

A single (199)Hg(1+) ion is confined in a miniature rf trap and is laser-cooled to nearly 0.001 K. The authors have studied the spectrum of the narrow 5d(10)6s doublet S(1/2) - 5d(9)6s(2) doublet D(5/2) electric-quadrupole-allowed transition near 282 nm and obtain a linewidth below 80 Hz (FWHM). The measured lifetime of the metastable doublet D(5/2) state gives a natural linewidth limit for the transition of 1.8 Hz. The narrow linewidth, the ability to detect transitions with unit probability, and the small perturbations of a single laser-cooled ion make it an attractive candidate for an optical frequency standard. The authors' present resolution is limited by the spectral purity of the frequency-doubled dye laser at 563 nm. Optical heterodyne measurements between two laser beams locked to independent, high-finesse cavities give a beat note of less than 40 Hz (FWHM at 563 nm) that is dominated by noise in the frequency range from 0 to 10 Hz. This is caused by the insufficient isolation of the cavities from mechanical vibrations in the frequency range. Better isolation methods intended to improve the laser linewidth to about 1 Hz or less are being investigated. A linear Paul trap, in which it would be possible to trap and cool many ions unperturbed by rf micromotion, is being tested.

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.
Final rept.
J. A. Brennan, D. G. Friend, V. D. Arp, and R. D. McCarty. 1992, 3p
Contract NASA-C-32009-K
Sponsored by National Aeronautics and Space Administration, Cleveland, OH. Lewis Research Center.
Pub. in Cryogenics 32, n2 p212-214 1992.

Keywords: *Cryogenic fluids, *Thermophysical properties, *Computer applications, Computer calculations, Man computer interface, Input output processing, Reprints, MIPROPS computer program.

Modifications and additions to the MIPROPS computer program for calculating the thermophysical properties of 17 fluids are described. These changes include adding new fluids, new properties and a new user interface to the program. The new program allows the user to select the input and output parameters and the units to be displayed for each parameter.

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.
Final rept.
A. K. Ghatak, R. L. Gallawa, and I. C. Goyal. 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 configuration, WKB approximation, Bound state, 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 very 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 (NML), Boulder, CO. Time and Frequency Div.
Quantum Zeno Effect.
Final rept.
W. M. Itano. 1990, 2p
See also PB90-254715.
Pub. in Physics News in 1990, p17-18 1990.

Keywords: Beryllium ions, Beryllium 9, Optical pumping, Reprints, *Zeno 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 Low-Order Modes of a Non-Neutral Ion Plasma.
Final rept.
D. J. Heinzen, J. J. Bollinger, F. L. Moore, W. M. Itano, and D. J. Wineland. 1991, 4p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Physical Review Letters 66, n16 p2080-2083, 22 Apr 91.

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 radiation pressure from a laser beam and is continuously varied over the entire allowed range, including Brillouin flow. Excitation of an asymmetric plasma mode by a static field asymmetry is observed. 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.
L. R. Hughey. 1989, 3p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Particle Accelerator Conference Accelerator Science and Technology, Chicago, IL., March 20-23, 1989, p461-463.

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 beams of 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 injection system. The kicker magnet pulse and the 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, 0.59 on the orbital radius and larger at larger radii. The rf cable length is mechanically adjustable and at operating energy it is adjusted such that a beam induced radial-longitudinal oscillation is set up which may be responsible for the increased lifetime. A different cable length is used during injection and the energy ramp to achieve fewer losses during the ramp.

201,439
PB92-197763 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Silicon Photodiode Detector for Small-Angle X-Ray Scattering.
Final rept.
P. R. Jemian, and G. G. Long. 1990, 12p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Applied Crystallography 23, p432-433 1990.

Keywords: *X-ray scattering, X-ray diffraction, Small angle scattering, Synchrotron radiation, Silicon diodes, KeV range 1-10, KeV range 10-100, PIN diodes, Photodiodes, Reprints, *X-ray detectors.

A photodiode X-ray detector was built to measure small-angle X-ray scattering (SAXS) at a synchrotron-radiation source in conjunction with a double-crystal diffractometer SAXS camera at photon energies between 5 and 11 keV. The photodiode detector response in the energy range is linear at photon counting rates up to 10(sup 12) photons/s and thus it was not necessary to attenuate the monochromatic X-ray beam with calibrated foils. SAXS data taken with a scintillation counter and the photodiode detector are compared, demonstrating marked improvement in counting statistics, rate of data acquisition and signal-to-noise ratio.

201,440
PB92-197813 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Quantum Metrology Div.
Study of Low Energetic Atomic Collisions in Solids Using High Resolution (n,gamma) Spectroscopy.
Final rept.
J. Jolie, S. Ulbig, M. S. Dewey, G. L. Greene, S. J. Robinson, P. Schillebeeckx, K. P. Lieb, E. G. Kessler, and H. G. Borner. 1989, 6p
Pub. in Europhysics Letters 10, n3 p231-236 1989.

Keywords: *Atomic collisions, Neutron spectroscopy, Neutron capture, Thermal neutrons, EV range 100-1000, Gamma radiation, High resolution, Titanium carbide, Elastic scattering, Reprints, Femtosecond time.

The authors show how ultra high resolution (n, gamma) spectroscopy can be used to study atomic collisions at kinetic energies in the order of hundreds of eV. The recoil originating from gamma emission after thermal neutron capture causes Doppler broadening of subsequent gamma transitions. This allows the study of the slowing down process in the target time differentially with fs time resolution. As an example the authors investigated Ti recoiling in Ti and TiC.

201,441
PB92-197862 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Physics Div.
Theory of Ultracold Atomic Collisions in Optical Traps.
Final rept.
P. S. Julienne. 1990, 6p
Pub. in Proceedings of International Conference of Electronic and Atomic Collisions (16th), New York, NY., July 25-August 1, 1989, p580-585 1990.

Keywords: *Atomic collisions, Temperature range 0000-0013K, Neutral atoms, Metastable state, Gas ionization, Helium, Reprints, Ultracold atoms.

Ultracold collisions of neutral atoms can now be studied in the laboratory in the temperature range below 0.001 K. Rate coefficients for ultracold collisions of excited states are decreased by spontaneous emission during the long duration of the collision, but can be dramatically modified by intense laser effects on collision dynamics. Generalized MCDQT is used to develop criteria for the onset of quantum threshold behavior, which generally begins at temperatures above the Doppler cooling limit of light traps. Threshold Penning ionization of He metastable atoms in a light trap is predicted to occur with a rate coefficient larger than 5 x 10(sup-11)cc/sec.

201,442
PB92-197896 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Ionizing Radiation Div.
Gamma-Ray Dosimetry by Spectrofluorimetry of Phenylacetic Acid Solution.
Final rept.
H. M. Khan, and W. L. McLaughlin. 1992, 7p
Pub. in Radiation Physics and Chemistry 39, n3 p243-249 1992.

Keywords: *Gamma rays, *Gamma dosimetry, *Organic acids, *Chemical dosemeters, Fluorescence, Aqueous solutions, Reprints, *Phenylacetic acid, *Spectrofluorimetry.

Aqueous solutions of phenylacetic acid have been evaluated for possible use in gamma-ray dosimetry. When aerated aqueous phenylacetic acid solutions are irradiated, photofluorescent species are formed and identified as hydroxyphenylacetic acid. When excited by ultraviolet light at 280 nm, the radiation-induced product shows an emission spectrum with a maximum at 307 nm. The intensity of the emission peak at 307 nm is a linear function of absorbed dose from 0.5 to 25 Gy. The aqueous dosimeter is about ten times more sensitive than that of the conventional ferrous sulfate solution (Fricke) dosimeter. The differences in response at dose rates in the range 0.0055-67 Gy/min are negligible. Conversely, at higher dose rates (170 Gy/min), although the response is linear with dose up to 135 Gy and with proper calibration can be used up to 350 Gy, the photofluorescence signal is somewhat greater than in the lower dose rate range. The estimated random uncertainty limits of readings of absorbed dose by the dosimeter are approximately + or - 2% at a dose of 10 Gy. The radiation chemical yield of the fluorescing species is little influenced by moderate changes in the concentration of phenylacetic acid or by deaeration of the solution. The signal is stable up to at least four weeks, if the solution after irradiation is stored at low temperature (5C). However, when stored at room temperature, and in room light, the signal is stable only up to about four days.

201,443
PB92-236520 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Quantum Metrology Div.
Near Threshold K-Shell Absorption Cross Section of Argon-Relaxation and Correlation Effects.
Final rept.
J. W. Cooper. 1988, 8p
Pub. in Physical Review A 38, n7 p3417-3424 1988.

Keywords: *Argon, Absorption cross sections, Inner-shell ionization, Hartree-Fock approximation, K shell, Electron correlation, Resonance, Reprints.

A detailed theoretical study has been made of the effects of core relaxation and electron-electron correlation on the near-threshold absorption cross section of argon and the results are compared with previous calculations and experiment. The key results are the following: (a) within the Hartree-Fock approximation, core relaxation must be included to obtain realistic cross sections; (b) final state calculations are extremely sensitive to the way in which exchange effects are included in the calculations; (c) although electron-electron correlations produce only small changes in the single electron cross section, they can account for the two-electron resonances which have been observed immediately above the ionization threshold. In particular, the main resonance above threshold appears to be 1S3p(5)3d(2) which can be reached from the ground state via initial state correlation.

201,444
PB92-236553 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.
Standardization of Plutonium-241 and Nickel-63.
Final rept.
B. M. Coursey, L. L. Lucas, A. Grau Malonda, and E. Garcia-Torano. 1989, 8p
Pub. in Nuclear Instruments and Methods in Physics Research A279, n3 p603-610, 15 Jul 89.

Keywords: *Plutonium 241, *Nickel 63, Liquid scintillators, Beta particles, Calorimetry, Radioactivity, Standardization, Anticoincidence, Tritium, Reprints.

Solutions of the low-energy beta-particle emitters (241)Pu and (63)Ni have been standardized using the method of 4pi(beta) liquid scintillation (LS) efficienty tracing with (3)H. The (241)Pu has also been standardized by the method of 4pi(alpha)(LS)-gamma-coincidence and-anticoincidence counting of the (241)Am daughter to follow its ingrowth in a separated sample. The (63)Ni solution was previously standardized at NBS by calorimetry. The uncertainties in the radioactivity concentrations obtained using these methods are discussed.

201,445
PB92-236983 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Electron and Optical Physics Div.
Spin-Polarization, Orientation, and Alignment in Electron-Atom Collisions.
Final rept.
M. H. Kelley. 1990, 12p
Pub. in AIP (American Institute of Physics) Conference Proceedings Phys. Electron. At. Collisions, v205 p103-114 1990.

Keywords: *Electron-atom collisions, Spin orientation, Alignment, Electron scattering, Reprints, Electron spin polarization.

The use of state-selection techniques has added greatly to our fundamental understanding of electron-atom collision phenomena. In particular, measurements of atomic orientation and alignment in electron impact excitation, and measurements of spin dependence in both elastic and inelastic collisions, provide substantially more detail about collision processes than conventional measurements of differential cross sections alone. This work reviews recent experiments which, through the use of spin dependence and atomic orientation and alignment, attempt to provide the most complete characterization possible of electron-atom collision phenomena.

201,446
PB92-237049 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Electron and Optical Physics Div.
Silicon Photodiodes with Stable, Near Theoretical Quantum Efficiency in the Soft X-ray Region.
Final rept.
R. Korde, and L. R. Canfield. 1989, 7p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - X-ray Instrumentation in Medicine and Biology, Plasma Physics, Astrophysics and Synchrotron Radiation, Paris, France, April 25-28, 1989, v1140 p126-132.

Keywords: *X-ray detection, *Soft x rays, *Silicon diodes, *Photodiodes, Ultraviolet detectors, Quantum efficiency, Radiometry, Reprints.

Silicon photodiodes having practically no carrier recombination at the Si-SiO2 interface or in the front diffused region have been developed by defect-free n-type impurity diffusion into p-type silicon. These photodiodes exhibit very high quantum efficiencies in the 10 eV to 150 eV photon energy region, typically 37 electrons per photon at 150 eV, which is about 300 times the quantum efficiency of the more commonly used photoemissive type soft X-ray detectors. The quantum efficiency of the developed diodes has been found to be stable to a few percent after exposure to photons in the region of 5 eV to 200 eV, with fluences in excess of 10(sup 14,sq cm). No significant change in the quantum efficiency was observed after storage in air for several months.

201,447
PB92-237247 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Temperature and Pressure Div.
Nuclear Orientation of the Rare-Earth System 160-TbTb(sc).
Final rept.
H. Marshak, P. Roman, and W. D. Brewer. 1988, 9p
Pub. in Hyperfine Interactions 43, n1-4 p363-371 1988.

Keywords: *Terbium 160, *Oriented nuclei, Single crystals, Dysprosium 160, Hyperfine structure, Gamma radiation, Temperature measurement, Superconductors, Reprints.

We report precision nuclear orientation measurements on a bulk (160)TB single crystal sample. The results of these experiments allow us to determine the hyperfine parameters for this system, as well as precise multipole mixing ratios for 22 gamma rays from the (160)Dy daughter nucleus. Various methods of extracting the mixing ratios will be compared.

201,448
PB92-237296 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electrosystems Div.
Collisional Electron Detachment Cross Section Measurements for SF6(-), SF5(-), and F(-) in SF6: Implications for Interpretations of Existing Ion Transport and Breakdown Probability Data.
Final rept.
J. K. Olthoff, R. J. Van Brunt, Y. Wang, R. L. Champion, and D. L. Doverspike. 1988, 4p
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in Proceedings of International Conference (9th) on Gas Discharge and Their Applications, Venice, Italy, September 19-23, 1988, p363-366.

Keywords: *Sulfur fluorides, *Electron detachment, *Collision cross sections, Dielectric breakdown, Charge transfer, Sulfur hexafluoride, EV range 1-10, EV range 10-100, EV range 100-1000, Gas discharges, Reprints, Ion transport.

Collisional 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 3 to 250 eV. Apparent thresholds 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 long-lived, energetically-unstable states of collisionally excited SF6(1-) to explain the pressure dependence of previously measured detachment coefficients and the high apparent detachment thresholds implied by analysis of breakdown probability data for SF6. The present results also indicate the necessity to re-examine ion conversion rates determined in SF6 from drift-tube data.

201,449
PB92-237320 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Ionizing Radiation Div.
Limits on the Emission of Neutrons, gamma-rays, Electrons, and Protons from Pons/Fleischmann Electrolytic Cells.
Final rept.
M. H. Salamon, M. E. Wrenn, H. E. Bergeson, K. C. Crawford, W. H. Delaney, C. L. Henderson, Y. Q. Li, J. A. Rusho, G. M. Sandquist, and S. M. Seltzer. 1990, 5p
Pub. in Nature 344, p401-405, 29 Mar 90.

Keywords: *Cold fusion, Electron emission, Neutron emission, Gamma emission, Protons, Limits, Reprints.

Emissions of gamma-rays from the cold-fusion cells used by Pons and Fleischmann were monitored in Pons' laboratory at the University of Utah by NaI detectors nearly continuously over a five-week period. No evidence of fusion activity was observed above power limits varying between 10(sup -12) and 10(sup -6) W for the known fusion reactions. In addition, neutron-track detectors indicated an integrated upper limit of approximately 1 emitted neutron per second from any of the cold-fusion cells over a period of 67 hours.

201,450
PB92-237353 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Temperature and Pressure Div.
NBS Gas Thermometry from 0C to 660C.
Final rept.
J. F. Schooley. 1988, 14p
See also PB90-256827.
Pub. in Proceedings of National Conference of Standards Laboratories Workshop and Symposium on Competitiveness in a World Market, Washington, DC., August 14-18, 1988, p50-1-50-14.

Keywords: *Temperature measurement, *US NBS, Thermodynamics, Test methods, Ideal gas law, Accuracy, Temperature measuring instruments, Test facilities, Dilatometry, Manometers, Reprints, *Kelvin temperature scale.

Measurements of temperature on the Kelvin thermodynamic temperature scale can be performed with excellent accuracy by use of the Ideal Gas Law, providing that proper account is taken of deviations from the Law that arise from recourse to real substances in the construction of the experimental equipment. In the NBS gas thermometry program, constant-volume gas thermometers, a unique mercury manometer, and a highly accurate dilatometer have been employed to evaluate the thermodynamic temperatures associated with particular values of temperature on the 1968 International Practical Temperature Scale. In this paper, summaries are given of the apparatus and procedures that have been used in the NBS gas thermometry program over the past four decades; the differences that have been found between the two temperature scales; and the uncertainties that accompany the results.

201,451
PB93-125292 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Radiation Research.
BCS Mass Matrices.
Final rept.
P. Kaus, and S. Meshkov. 1989, 9p
See also PB92-165778.
Pub. in Proceedings of International Symposium Fourth Family of Quarks and Leptons (2nd), Santa Monica, CA., February 23-25, 1989, p353-361.

Keywords: *Quarks, *Leptons, Hamiltonian functions, Lagrangian functions, Standard model, BCS theory, Superconductivity, Reprints, Mass matrices, Mass gap.

The quark and lepton mass gaps and mass hierarchies are obtained by introducing a BCS interaction among ur-quarks. A 3 x 3 mass matrix with equal matrix elements, i.e. with all ur-flavors interacting with the same strength, has eigenvalues 0, 0, 1; the charged lepton and the charge -1/3 and +2/3 quarks, with one heavy generation (tau, b, t) and two almost massless generations (e(mu); ds; cu) resemble these eigenvalues. The mass matrix M(sub 0)=gamma Summation over i,j of ((q bar(sub i)) (q(sub j))) can be interpreted as a nonlinear self interaction of the ur-quarks, giving rise to the observed mass gap, or in terms of a composite model.

201,452
PB93-125300 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Proposed Search for States of Forbidden Permutation Symmetry.
Final rept.
D. E. Kelleher, J. D. Gillaspy, and K. Deilamian. 1989, 3p
Pub. in Proceedings of International Conference on Laser Spectroscopy (9th), Bretton Woods, NH., June 18-23, 1989, p332-334.

Keywords: Quantum mechanics, Forbidden transitions, Pauli principle, Parastatistics, Fermions, Reprints, *Permutation symmetry.

All known systems of identical particles are well described by wavefunctions which are either symmetric or antisymmetric under particle interchange. The fundamental status of these symmetries is codified in the symmetrization postulate. More restrictive still is the spin statistics theorem, which requires that half-integer spin particles are antisymmetric; such states satisfy the Pauli exclusion principle (PEP). Early on, however, Pauli pointed out that quantum mechanics does not constrain physics to two permutation symmetries. While the above symmetry principles are consistent with a broad range of physical experience, precision tests are practically nonexistent.

201,453
PB93-125326 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Radiation Research.
Long-Range Behavior of the Nucleon-Deuteron Interaction.
Final rept.
D. R. Lehman, L. C. Maximon, and B. F. Gibson. 1989, 1p
Contract DE-FG05-86-ER40270
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of International Conference on Few Body Problems in Physics (12th), Vancouver, B.C., Canada, July 2-8, 1989 pD51.

Keywords: *Nucleon-deuteron interactions, Asymptotic properties, Binding energy, Efimov effect, Schrodinger equation, Wave functions, Three-body problem, Two-body problem, Potentials, Reprints.

The objective of our work is to derive the asymptotic behavior of the effective n-d interaction within the bound 3N system without making specific assumptions about the 2N interactions (3N interactions are neglected) or the 3N wave function. We begin by projecting the 3N bound-state Schrodinger equation with a plane-wave n-d state. The aim is to obtain an equation for this effective n-d wave function, i.e., for the overlap amplitude of the n-d state and the 3N bound state. Except for the 'permuted-potential' terms, this falls out directly. In the latter terms, a complete set of nucleon-correlated-pair states is inserted to affect the sought after equation. It is then apparent that a coupled set of effective two-body equations arise, one corresponding to the effective n-d wave function and the other to the effective n-(np-continuum) wave function.

201,454
PB93-125565 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.
Neutron Flux Enhancement Using Spin-Dependent Interaction Potentials.
Final rept.
C. F. Majkrzak, and N. F. Berk. 1989, 8p
Pub. in Physical Review B 40, n1 p371-378 1989.

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 consisting of a periodic nuclear modulation and a magnetic spiral of a single chirality can be constructed so that a coherently reflected beam is polarized in one spin eigenstate and, at saturation, has one half the intensity of an unpolarized incident beam. Although this spin-dependent reflectivity is in itself certainly not unique, what is special is that the contributions to the reflected beam come equally from each of the two incident polarization states via spin-flip and non spin-flip processes. Consequently, equal fractions of 'spin-up' and 'spin-down' neutrons are transmitted. Thus reflected and transmitted beams can be combined incoherently to give an effective conversion of 0.75 of an incident unpolarized beam in to a single polarization state. Successive application of such a superposition in conjunction with a straightforward, spatial narrowing of the beam by reflection back into an unpolarized state results in a net flux enhancement.

201,455
PB93-125599 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Process Measurements Div.
New Temperature Scale: The International Temperature Scale of 1990.
Final rept.
B. W. Mangum. 1990, 15p
Pub. in Proceedings of Measurements Science Conference, Anaheim, CA., February 8-9, 1990, p1-15.

Keywords: *Temperature scales, Temperature measurement, International, Standards, Reprints, IPTS-68, ITS-90.

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 (IPTS-68), and the 1976 Provisional 0.5 K to 30 K Temperature Scale (EPT-76). This paper describes the new scale in detail.

201,456
PB93-125607 Not available NTIS
National Inst. of Standards and Technology (CSTL), Gaithersburg, MD. Process Measurements Div.
Standard Reference Materials for Use in Precision Thermometry.
Final rept.
B. W. Mangum. 1990, 10p
See also PB90-169798.
Pub. in Proceedings of Measurement Science Conference, Anaheim, CA., February 8-9, 1990, p1-10.

Keywords: *Temperature measurement, *Standards, Temperature scales, Thermometers, Precision, Reprints, *Standard reference materials, Fixed points, ITS-90, US NIST.

The National Institute of Standards and Technology (NIST) offers Standard Reference Materials (SRMs) for use in high-precision thermometry. These SRMs, available through the Office of Standard Reference Materials, include pure metals to be used in the precise realization of temperatures of some of the defining fixed points of the International Temperature Scale of 1990 (ITS-90) and some devices to be used directly in the precise realization of secondary fixed-point temperatures. The temperature range of these SRMs is from 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 (NML), Gaithersburg, MD. Quantum Metrology Div.
Threshold Photoelectron Spectrum of the Argon 3S Satellites.
Final rept.
L. J. Medhurst, A. Schach Von Wittenau, R. D. van Zee, S. Zhang, S. H. Liu, D. A. Shirley, and D. W. Lindle. 1990, 5p
See also DE89015338.
Pub. in Jnl. of Electron Spectroscopy and Related Phenomena 52, p671-675 Apr 90.

Keywords: *Photoelectron spectroscopy, *Argon, Ionization potentials, Photoemission, Reprints.

Lately a variety of techniques have studied the electron correlation satellites with binding energies between the Ar 3s ionization potential (29.24 eV) and the lowest 2p(sup -2) ionization potential (43.38 eV). One of these techniques, threshold photoelectron spectroscopy, with about 90 meV electron resolution, revealed at least 25 individual electronic states. All of these could contribute to any other satellite spectrum, and this observation helped explain some discrepancies between previous measurements. This technique has been applied here to the same region with higher resolution (<60 meV at the Ar 3s(sup -1) peak). In this higher resolution spectrum, 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. Ionizing Radiation Div.
Polarization Effects in Coherent and Incoherent Photon Scattering: Survey of Measurements and Theory Relevant to Radiation Transport Calculations.
J. H. Hubbell. Jul 92, 34p NISTIR-4881

Keywords: *Photon-electron collisions, *Polarization(Waves), Incoherent scattering, Coherent scattering, Rayleigh scattering, Compton effect, Radiation transport, Measurement, X rays, Gamma rays, Bibliographies, Surveys.

The report reviews available information on polarization effects arising when photons in the x-ray and gamma-ray energy regime undergo coherent (Rayleigh) scattering and 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. Electron and Optical Physics Div.
Increased Sherman Function in Electron Spin Analyzers Using a Bulk Thorium Target.
Final rept.
J. J. McClelland, M. R. Scheinfein, and D. T. Pierce. 1989, 1p
Pub. in Proceedings of International Conference (16th) on the Physics of Electronic and Atomic Collisions, (XVI ICPEAC), New York, NY., July 26-August 1, 1989, p805.

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 retarding Mott analyzer. At 20 and 100 keV the dependence on the maximum energy loss accepted by the detector has been measured. Comparison is made with scattering from a 1250 A gold film. Thorium is seen to have a S(eff) up to 30% higher than gold. This higher S(eff) can not only improve the figure of merit of a spin detector, but also lessen its sensitivity to instrumental asymmetries. Comparison is also made with preliminary theoretical results. Good agreement is seen in the thorium Sherman function relative to that of gold.

201,460
PB93-130391 Not available NTIS
National Inst. of Standards and Technology (PL), Gaithersburg, MD. Ionizing Radiation Div.
Studies of the Effect of the Properties of Neutron Producing Targets and Sample Backings on Neutron Cross Section Measurements.
Final rept.
O. A. Wasson, and R. A. Schrack. 1989, 5p
Pub. in Nucl. Instrum. Methods in Physics Research 282, n1 p194-198 Oct 89.

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, Stoichiometry, Reprints.

The use of pulsed-beam time-of-flight techniques to monitor the time dependence of the distribution of the neutron energy spectrum from lithium metal targets produced from the 7Li(p,n)7Be reaction is reviewed. The effect on the 14-MeV neutron angular distribution produced by the T(d,n)(4)He reaction by changes in the tritium distribution in the TiT 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. Ionizing Radiation Div.
Phenomenological Delta-Nucleus Potential from Inclusive Electron-Nucleus Scattering Data.
Final rept.
J. S. O'Connell, and R. M. Sealock. 1990, 5p
Prepared in cooperation with Virginia Univ., Charlottesville.
Pub. in Physical Review C, Nuclear Physics, v42 n6 p2290-2294 1990.

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 (4)He, C and Fe, approximately corrected for the effects of competing reaction mechanisms, to estimate 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 Div.
Thermodynamic Properties of Tungsten Ditelluride (WTe2). 2. Standard Molar Enthalpy of Formation at the Temperature 298.15 K.
Final rept.
P. A. G. O'Hare, and G. A. Hope. 1992, 9p
Pub. in Jnl. of Chemical Thermodynamics 24, p639-647 1992.

Keywords: *Thermodynamic properties, *Tungsten compounds, *Enthalpy, *Tellurium inorganic compounds, Heat of formation, Calorimetry, Tellurium, Vapor pressure, Chemical reactions, Reaction kinetics, Combustion, Reprints, Tungsten ditelluride, Tellurium hexafloride.

The standard molar enthalpies of formation of WTe2(cr) and TeF6(g) have been determined by combustion calorimetry in high-pressure fluorine. Two high-temperature investigations of the vaporization of WTe2(cr) give 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 TeF6(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.
H. J. Prask. 1990, 1p
Pub. in Neutron News, v1 n4 p21 1990.

Keywords: *NBSR reactor, Research reactors, Cold neutrons, 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, chemical 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 and industry. In 1988, over 350 scientists and engineers participated in research using the reactor facilities.

PROBLEM-SOLVING INFORMATION FOR STATE & LOCAL GOVERNMENTS

General

201,464
PB92-183698 PC **A07**/MF **A02**
National Inst. of Standards and Technology, Gaithersburg, MD. Office of Weights and Measures.
State Weights and Measures Laboratories: State Standards Program Description and Directory. 1992 Edition.
Special pub. (Final).
G. L. Harris. Mar 92, 128p NIST/SP-791-ED-1992
Also available from Supt. of Docs. as SN003-003-03145-3. Supersedes PB90-257650.

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 and local 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.

201,465
PB92-213339 PC **A05**/MF **A01**
National Inst. of Standards and Technology (CSL), Gaithersburg, MD. Advanced Systems Div.

Massively Parallel Neural Network Fingerprint Classification System.
C. L. Wilson, G. Candela, P. J. Grother, C. I. Watson, and R. A. Wilkinson. Jul 92, 77p NISTIR-4880
See also PB92-177296. Sponsored by Federal Bureau of Investigation, Washington, DC.

Keywords: *Classifications, *Pattern recognition, Identification systems, Massively parallel processors, Neural nets, Image processing, Accuracy, Models, Feature extraction, Data bases, *Fingerprints, FBI(Federal Bureau of Investigation).

The report describes a massively parallel fingerprint classification system developed at the National Institute of Standards and Technology (NIST) for the FBI that uses image-based ridge-valley features, K-L transforms, and neural networks to perform pattern level classification. The speed of classification is 0.5 seconds per fingerprint on a massively parallel computer. The system is capable of 88% classification accuracy with 10% rejects. As part of the development activity a sample of 4000 fingerprints, 2000 matched pairs, was collected and publicly released as NIST Special Database 4.

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.
A. Wavering, and R. Lumia. 1988, 8p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineering) - Space Station Automation IV, Cambridge, MA., November 7-9, 1988, v1006 p63-70.

Keywords: *Robots, *Control systems, Trajectories, Robot sensors, Algorithms, Reprints, *FTS(Flight Telerobotic 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 subtasks, 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 motion 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 either 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 generation module are 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.

201,467
PB93-135374 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Space Robotics: Evolution and Applications.
Final rept.
R. Lumia, and J. S. Albus. 1988, 7p
Pub. in Advances in Instrumentation, v43 pt4 p1737-1743 1988.

Keywords: *Robotics, *Control systems, *Space missions, Teleoperators, Robots, Systems engineering, Standards, Reprints, NASREM(NASA/NIST Reference Model).

One way to enhance man's presence in space is through the use of robots to perform the mundane actions which require limited intelligence. As technology advances, however, the robot should be able to perform an increasingly complex set of tasks. Consequently, it is clearly desirable to have a system architecture which can accommodate this evolution. NASREM, the NASA/NIST Reference Model for Telerobot Control System Architecture, provides the capability to increase the complexity of robot behavior without significant impact on the system architecture. This standard is presented and applications of the system resulting from the implementation of the standard are discussed.

Manned Spacecraft

201,468
PB92-175603 Not available NTIS
National Inst. of Standards and Technology (CSTL), Boulder, CO. Chemical Engineering Div.
Heat Transfer in a Compact Tubular Heat Exchanger with Application to the Engine Struts of the National Aerospace Plane.
Final rept.
D. A. Olson. 1991, 8p
Contract L7400C
Sponsored by National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
Pub. in Proceedings of ASME/JSME Thermal Engineering Joint Conference, Reno, NV., March 1991, p347-354.

Keywords: *Heat exchangers, *Heat transfer coefficients, *Aerospace planes, Heat transfer, Thermophysical properties, Heat flux, Reynolds number, Turbulent flow, Tubes, Convective heat transfer, Gas flow, Reprints.

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 heated on one side in a radiative furnace at heat fluxes 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 numbers of 3000 to 35,000 and 3.50 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 to within experimental uncertainty, when the authors accounted for the effects of variable thermophysical properties arising from the temperature difference between the tube wall and the gas.

201,469
PB92-238591 PC **A03**/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 NISTIR-4882, NASA-CR-189226
Contract NASA-C-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 tests, Test methods, Ignition, Burning rate, NASA, Reduced gravity, Safety engineering.

The final report summarizes the results of an assessment of the NASA flammability screening test (8060.1B) for materials to be used in manned spacecraft interiors. A set of materials was examined using the standard NASA test, a modified version of the test which incorporated external radiation and NIST tests which measure ignitability, rate of heat release and opposed flow flame spread behavior. Materials passing the standard NASA screening test showed widely varying degrees of flammability enhancement when subjected to external radiation (modified NASA test, NIST tests). Since such radiation is implicit in many normal fire scenarios, materials passing the standard NASA screening test should not be treated as nonflammable. The quantitative role of self-feedback of radiation remains to be fully clarified; an apparatus to examine the issue was built but no tests could be completed in 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.

201,470
PB93-130425 Not available NTIS
National Inst. of Standards and Technology (MEL), Gaithersburg, MD. Robot Systems Div.
Sensor-Based Robot Control Requirements for Space.
Final rept.
R. Lumia. 1990, 18p
Contract S-28187-D
Pub. in NATO ASI Series, Proceedings of NATO Advanced Research Workshop on Sensors, Maratea, Italy, August 26-September 3, 1989, vF63 p403-421 1990.

Keywords: *Space stations, *Robot sensors, Hierarchies, Control systems, Autonomy, Robotics, Teleoperators, Reprints, *FTS(Flight Telerobotic Servicer), NASREM(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 (NASREM) be used as the functional architecture for the control system. The quest for autonomy inevitably leads to the need for sophisticated sensors and sensory processing. This paper will explore the requirements for the tasks envisioned for FTS at first launch as well as during its evolution phase and show how those tasks impact research on sensors, sensory processing, and other parts of the FTS control system. Finally, the current state of the NASREM implementation at NIST will be presented.

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 Space Structures by Pulse Probing and Deconvolution.
Final rept.
A. S. Carasso, and E. Simiu. 1988, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in ICES '88, Proceedings of International Conference on Computational Engineering Science, Atlanta, GA., April 11-15, 1988, v2 p44.vii.1-44.vii.4.

Keywords: *Large space structures, Timoshenko beams, Dynamic response, Greens function, Integral equations, Linear systems, Pulses, Reprints, Ill posed problems, Deconvolution.

The paper outlines the mathematical and computational basis of a method for experimentally identifying the dynamic behavior of linear structural systems. The method consists of exciting the structure with specific pulses and reconstructing the Green's functions by deconvolution of the measured response. The reconstruction involves the solution of an ill-posed integral equation in the presence of noise. The reconstruction procedure is illustrated with a numerical experiment.

TRANSPORTATION

Marine & Waterway Transportation

201,472
PB92-172469 PC **A05**/MF **A01**
National Inst. of Standards and Technology (BFRL), Gaithersburg, MD.
Evaluation of the Visibility of Buoys and Topmarks.
B. L. Collins, and P. A. Sanders. Mar 92, 77p
NISTIR-4756
Sponsored by Coast Guard, Washington, DC.

Keywords: *Buoys, *Visibility, *Navigational aids, *Sight distances, Color, Visual perception, Marine transportation, Specifications, Shape, Visual navigation, Color codes, Buoy lights.

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
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Assessment Methodology for the Fire Performance of School Bus Interior Components.
Final rept.
E. Braun, J. H. Klote, S. Davis, B. C. Levin, M. Paabo, and R. G. Gann. 1991, 10p
Sponsored by National Highway Traffic Safety Administration, Washington, DC. Office of Vehicle Safety Standards.
Pub. in Proceedings of International Symposium on Fire Safety Science (3rd), Edinburgh, Scotland, July 8-12, 1991, p855-864.

Keywords: *Fire tests, *Buses(Vehicles), *Seats, *Transportation safety, Computerized simulation, Ignition, Toxicity, Flammability, Vehicle fires, Combustion products, Burning rate, Accident research, Hazards, Models, Reprints.

A full-scale fire performance protocol for the evaluation of school bus seat assemblies was developed. This protocol is based on the results of full-scale testing of end-use seat assemblies and computer fire modeling of the ignition source and burning item(s) in a single compartment enclosure. Tenability criteria were applied to the results of the full-scale tests and computer fire model calculations. The results showed that temperature is a suitable criterion for this application. Toxicity of the decomposition products plays a secondary role in determining occupant survivability. Occupant tenability limits are exceeded for ignition sources over 300 kW, independent of the type of seat assembly. Based on the full-scale test data, computer simulations were conducted to determine which tenability criteria were exceeded in the full-scale tests.

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PB93-131381 *200,901* PC **A07**

PB93-131399
Characterization of a Piston Displacement-Type Flowmeter Calibration Facility and the Calibration and Use of Pulsed Output Type Flowmeters.
PB93-131399 *200,884*
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PB93-131407
General Waveguide Circuit Theory.
PB93-131407 *200,613*
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PB93-131415
Resistive Liquid-Vapor Surface Sensors for Liquid Nitrogen and Hydrogen.
PB93-131415 *200,364*
(Order as PB93-131381, PC **A07**)

PB93-131423
Fracture Toughness of Advanced Ceramics at Room Temperature.
PB93-131423 *200,949*
(Order as PB93-131381, PC **A07**)

PB93-135135
Benchmark Tests for DARPA Resource Management Database Performance Evaluations.
PB93-135135 *200,469* Not available NTIS

PB93-135143
Construction Materials Reference Laboratory at NIST Promoting Quality in Laboratory Testing.
PB93-135143 *200,112* Not available NTIS

PB93-135150
Droplet Velocity Measurements in a Swirling Kerosene Spray Flame.
PB93-135150 *200,742* Not available NTIS

PB93-135168
Perturbation-Theory Study of High-Harmonic Generation.
PB93-135168 *201,230* Not available NTIS

PB93-135176
Volkov-Like Coulomb Continuum.
PB93-135176 *201,231* Not available NTIS

PB93-135184
Electronic Bonding of Buried Interfaced Determined by Soft-X-ray Emission-Spectroscopy.
PB93-135184 *201,344* Not available NTIS

PB93-135192
Superconducting Tl2.0Ba2.0CuO6+ delta: A High Resolution Neutron Powder and Single Crystal X-ray Diffraction Investigation.
PB93-135192 *201,345* Not available NTIS

PB93-135200
Limitations on Electronic Mechanisms for High Temperature Superconducting Oxides.
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PB93-135218
Hard Segment Unit Cell for MDI-BDO-Based Polyurethane Elastomers.
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PB93-135226
Sounding Rocket Measurement of the Absolute Solar EUV Flux Utilizing a Silicon Photodiode.
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PB93-135234
Phenomenological Delta-Nucleus Potential from Inclusive Electron-Nucleus Scattering Data.
PB93-135234 *201,461* Not available NTIS

PB93-135242
Determination of Electrical Conductivity Profiles from Multi-Frequency Impedance Measurements.
PB93-135242 *200,868* Not available NTIS

PB93-135259
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PB93-135259 *200,950* Not available NTIS

PB93-135267
What Can Solar and Stellar Ultraviolet Observations Tell About Chromospheric and Coronal Heating Mechanisms.
PB93-135267 *200,029* Not available NTIS

PB93-135275
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PB93-135275 *200,518* Not available NTIS

PB93-135283
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PB93-135291
Automatic Impedance Bridge for Calibrating Standard Inductors.
PB93-135291 *200,575* Not available NTIS

PB93-135309
Analysis of Large-Scale Fire Test Data.
PB93-135309 *200,113* Not available NTIS

PB93-135317
Optimization of Large Scale Chromatography for Biotechnological Applications.
PB93-135317 *200,186* Not available NTIS

PB93-135325
Measurement, Use, and Interpretation of the Temperature Coefficient of Resistance of Metallizations.
PB93-135325 *200,692* Not available NTIS

PB93-135333
Liquid-Vapor Surface Sensors for Liquid Nitrogen and Hydrogen.
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PB93-135341
Tribological Behavior of 440C Martensitic Stainless Steel from 184C to 750C.
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PB93-135358
Time Dependent Thermal Lensing in Lead Oxide-Modified Silicate Glass.
PB93-135358 *201,232* Not available NTIS

PB93-135366
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PB93-135366 *201,073* Not available NTIS

PB93-135374
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PB93-135382
Measurements of the Recoverable Compliance of Ring-Like Polystyrenes.
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PB93-135390
Effect of High Injection on the Density of States of Silicon.
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PB93-135408
Architecture to Support Autonomy, Teleoperation and Shared Control.
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PB93-135416
Tribological Characteristics of Synthesized Diamond Films on Silicon Carbide.
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PB93-135424
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PB93-135432
Application of a Numerical Procedure in the Calculation of the Atomic Number Correction in Electron Probe Microanalysis.
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PB93-135440
Reactor and Cold Neutron Facility at NIST.
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PB93-135457
Stress Relaxation in Sintering of Fiber Reinforced Composites Through Fiber Coating.
PB93-135457 *200,981* Not available NTIS

PB93-135465
Influence of Size Distribution Function on Mean Droplet Size Obtained by Ensemble Light Scattering.
PB93-135465 *201,187* Not available NTIS

PB93-135473
Vapor Pressure and Thermodynamics of Lithium Aluminates.
PB93-135473 *200,365* Not available NTIS

PB93-135481
Application of Process Analysis to a Separator-Solubilizer for Supercritical Fluid Extraction.
PB93-135481 *200,198* Not available NTIS

PB93-135499
Direct Sequence Spread-Spectrum Modem Design for Time Transfers via Geostationary Satellites.
PB93-135499 *200,466* Not available NTIS

PB93-135507
Neutron Scattering Study of Cs-Ammonia Intercalated Graphite.
PB93-135507 *200,366* Not available NTIS

PB93-135515
Determination of the Polarization-Depth Distribution in Poled Ferroelectric Ceramics Using Thermal and Pressure Pulse Techniques.
PB93-135515 *201,348* Not available NTIS

PB93-135523
Examination of Experimental Designs for In vitro Studies Using ELF Magnetic Fields.
PB93-135523 *201,130* Not available NTIS

PB93-135531
Effect of Gravity Modulation on Thermosolutal Convection in an Infinite Layer of Fluid.
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PB93-135549
Characterized Generator Extends Phase Meter Calibrations from 50 kHz to 20 MHz.
PB93-135549 *200,576* Not available NTIS

PB93-135556
Fuel Property Effects on Burning Rate and Radiative Transfer from Liquid Pool Flames.
PB93-135556 *200,743* Not available NTIS

PB93-135564
Relationship between Fractal Geometry and Fractography.
PB93-135564 *200,951* Not available NTIS

PB93-135572
Automatic Inductive Voltage Divider Bridge for Operation from 10 Hz to 100 kHz.
PB93-135572 *200,577* Not available NTIS

PB93-135580
Deviation from Mean-Field Behavior in a Low Molecular Weight Critical Polymer Blend.
PB93-135580 *200,392* Not available NTIS

PB93-135598
Investigation of the Morphology of Amorphous/Semicrystalline Nylon Blends Using Small Angle X-ray Scattering.
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PB93-135606
Parallel Bands of Cyclopropane in the 3.2mum Region.

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PB92-164698 *200,999* PC **A03**/MF **A01**

RL-TR-91-56

Spherical Near-Field Scanning: Experimental and Theoretical Studies.
AD-A243 489/2 *200,546* PC **A07**/MF **A02**

SHRP-C/UWP-91-527

Expert/Knowledge-Based Systems for Cement and Concrete: State-of-the-Art Report.
PB92-191865 *200,405* PC **A03**/MF **A01**

SHRP-ID/UFR-92-611

Development of a Technique for In situ Measurement of Water at the Asphalt/Model Siliceous Aggregate Interface.
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)
Jefferson State Community College James B. Allen Library (1970)
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 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. Leflar (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)

Palm Springs

Palm Springs Public Library (1980)

Pasadena

California Institute of Technology Millikan Memorial Library (1933)
Pasadena Public Library (1963)

Pleasant Hill

Contra Costa County Library (1964)

Redding

Shasta County Library (1956)

Redlands

University of Redlands Armacost Library (1933)

Redwood City

Redwood City Public Library (1966)

Reseda

West Valley Regional Branch Library Los Angeles Public Library (1966)

Richmond

Richmond Public Library (1943)

Riverside

Riverside City and County Public Library (1947)
University of California at Riverside Library (1963)

Sacramento

California State Library (1895) REGIONAL
California State University at Sacramento Library (1963)
Sacramento County Law Library (1963)
Sacramento Public Library (1880)
University of the Pacific McGeorge School of Law Gordon D. Schaber Law Library (1978)

San Bernardino

San Bernardino County Law Library (1984)
San Bernardino County Library (1964)

San Diego

San Diego County Law Library (1973)
San Diego County Library (1973)
San Diego Public Library (1895)
San Diego State University Library (1962)
University of San Diego Alcala Park School of Law Library (1967)

San Francisco

Golden Gate University Law Library (1979)
San Francisco Public Library (1889)
San Francisco State University J. Paul Leonard Library (1955)
Supreme Court of California Library (1979)
University of California Hastings College of Law Legal Information Center (1972)
University of San Francisco Richard A. Gleeson Library (1963)
U.S. Court of Appeals Ninth Circuit Library (1971)

San Jose

San Jose State University Clark Library (1962)

San Leandro

San Leandro Public Library Community Library Center (1961)

San Luis Obispo

California Polytechnic State University Robert F. Kennedy Library (1969)

San Mateo

College of San Mateo Library (1987)

San Rafael

Marin County Free Library (1975)

Santa Ana

Orange County Law Library (1975)
Santa Ana Public Library (1959)

Santa Barbara

University of California at Santa Barbara Library (1960)

Santa Clara

Santa Clara University Orradre Library (1963)

Santa Cruz

University of California at Santa Cruz McHenry Library (1963)

Santa Rosa

Sonoma County Library (1896)

Stanford

Stanford University Jonsson Library (1895)
Stanford University Robert Crown Law Library (1978)

Stockton

Public Library of Stockton and San Joaquin County (1884)

Thousand Oaks

California Lutheran University Pearson Library (1964)

Torrance

Torrance Public Library (1969)

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 (1884) REGIONAL
Department of the Interior Bureau of Reclamation Library (1962)
Regis University Dayton Memorial Library (1915)
University of Denver College of Law Library Westminister 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)
Equal Employment Opportunity Commission Library (1984)
Executive Office of the President Libraries (1965)
Federal Deposit Insurance Corporation Library (1972)
Federal Election Commission Law Library (1975)
Federal Energy Regulatory Commission Library (1983)
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)
Library of Congress Serial and Government Publications Division (1977)
Merit Systems Protection Board Library (1979)
National Defense University Library (1895)
Office of Personnel Management Library (1963)
Pension Benefit Guaranty Corporation Office of General Counsel Library (1984)
U.S. Court of Appeals for the Federal Circuit Library (1986)
U.S. Court of Appeals Judges' Library (1975)
U.S. Information Agency Library (1984)
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 Merl Kelce 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)

Atlanta

Atlanta-Fulton Public Library (1880)
Atlanta University Center Robert W. Woodruff Library (1962)
Emory University Robert W. Woodruff Library (1928)
Emory University School of Law Library (1968)
Georgia Institute of Technology Price Gilbert Memorial Library (1963)
Georgia State Law Library (unknown)
Georgia State University College of Law Library (1983)
Georgia State University William Russell Pullen Library (1970)
U.S. Court of Appeals Eleventh Circuit Library (1980)

Augusta

Augusta College Reese Library (1962)
Medical College of Georgia Greenblatt Library (1986)

Brunswick

Brunswick-Glynn County Regional Library (1965)

Carrollton

West Georgia College Irvine Sullivan Ingram Library (1962)

Columbus

Columbus College Simon Schwob Memorial Library (1975)

Dahlonega

North Georgia College Stewart Library (1939)

Dalton

Dalton College Library Resources Center (1978)

Macon

Mercer University Main Library (1964)
Mercer University School of Law Library (1978)

Marietta

Kennesaw State College Horace W. Sturgis Library (1968)

Milledgeville

Georgia College Ina Dillard Russell Library (1950)

Mount Berry

Berry College Memorial Library (1970)

Rome

Berry College Memorial Library (1970)

Savannah

Chatham-Effingham-Liberty Regional Library (1857)

Statesboro

Georgia Southern College Zoch S. Henderson Library (1939)

Valdosta

Valdosta State College Odum Library (1956)

GUAM

Agana

Nieves M. Flores Memorial Library (1962)

Mangilao

University of Guam Robert F. Kennedy Memorial Library (1978)

HAWAII

Hilo

University of Hawaii at Hilo Edwin H. Mookini Library (1962)

Honolulu

Hawaii Medical Library Incorporated (1968)
Hawaii State Library (1929)
Municipal Reference & Records Center (1965)
Supreme Court Law Library (1973)
University of Hawaii Hamilton Library (1907) REGIONAL
University of Hawaii School of Law Library (1978)

Laie

Brigham Young University Hawaii Campus Joseph F. Smith Library (1964)

Lihue

Lihue Public Library (1967)

Pearl City

Leeward Community College Library (1967)

Wailuku

Wailuku Public Library (1962)

IDAHO

Boise

Boise Public Library (1929)
Boise State University Library (1966)
Idaho State Library (1971)
Idaho Supreme Court State Law Library (unknown)

Caldwell

Albertson College N. L. Terteling Library (1930)

Lewiston

Lewis-Clark State College The Library (1991)

Moscow

University of Idaho College of Law Library (1978)
University of Idaho Library (1907) REGIONAL

Nampa

Northwest Nazarene College John E. Riley Library (1984)

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)
John Marshall Law School Library (1981)
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)

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 Moellering 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)

Pittsburg

Pittsburg State University Leonard H. Axe Library (1952)

Salina

Kansas Wesleyan University Memorial Library (1930)

Shawnee Mission

Johnson County Library (1979)

Topeka

Kansas State Historical Society Library (1877)
Kansas State Library (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-Wesleyan College Library Learning Center (1966)

Richmond

Eastern Kentucky University John Grant Crabbe Library (1966)

Williamsburg

Cumberland College Norma Perkins Hagan Memorial Library (1988)

LOUISIANA

Baton Rouge

Louisiana State University Middleton Library (1907) REGIONAL
Louisiana State University Paul M. Herbert Law Center Law Library (1929)

Southern University John B. Cade Library (1952)
Southern University Law Center Library (1979)
State Library of Louisiana (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 (1968)
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) REGIONAL

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

Maine Maritime Academy Nutting Memorial Library (1969)

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

Louis B. Goodall Memorial Library (1984)

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 (1980)
University of Maryland School of Law Library Marshall Law Library (1969)
U.S. Court of Appeals Fourth Circuit Library (1982)

Bel Air

Harford Community College Library (1967)

Beltsville

Department of Agriculture National Agricultural Library (1895)

Bethesda

Department of Health and Human Services National Library of Medicine (1978)
Uniformed Services University of Health Sciences Learning Resources Center (1983)

Catonsville

University of Maryland Baltimore County Albin O. Kuhn Library & Gallery (1971)

Chestertown

Washington College Clifton M. Miller Library (1891)

College Park

University of Maryland at College Park McKeldin Library (1925) REGIONAL

Cumberland

Allegany Community College Library (1974)

Frostburg

Frostburg State University Library (1967)

Patuxent River

Patuxent River Central Library (1968)

Rockville

Montgomery County Department of Public Libraries Rockville Regional Library (1951)

Salisbury

Salisbury State University Blackwell Library (1965)

Silver Spring

Department of Commerce NOAA Central Library (1993)

Towson

Goucher College Julia Rogers Library (1966)
Towson State University Albert S. Cook Library (1979)

Westminster

Western Maryland College Hoover Library (1886)

MASSACHUSETTS

Amherst

Amherst College Library (1884)
University of Massachusetts University Library (1907)

Boston

Boston Athenaeum Library (unknown)
Boston Public Library (1859) REGIONAL
Boston University School of Law Pappas Law Library (1979)
Northeastern University Snell Library (1962)
State Library of Massachusetts (unknown)
Suffolk University Law Library (1979)
Supreme Judicial Court Social Law Library (1979)
U.S. Court of Appeals First Circuit Library (1978)

Brookline

Public Library of Brookline (1925)

Cambridge

Harvard College Library (1860)
Harvard Law School Library (1981)
Massachusetts Institute of Technology Libraries (1946)

Chestnut Hill

Boston College Thomas P. O'Neill Jr. Library (1963)

Chicopee

College of Our Lady of the Elms Alumnae Library (1969)

Lowell

University of Massachusetts-Lowell O'Leary Library (1952)

Medford

Tufts University Wessell Library (1899)

Milton

Curry College Levin Library (1972)

New Bedford

New Bedford Free Public Library (1858)

Newton Center

Boston College Law School Library (1979)

North Dartmouth

University of Massachusetts-Dartmouth Library (1965)

North Easton

Stonehill College Cushing-Martin Library (1962)

Springfield

Massachusetts Trial Court Hampden Law Library (1992)
Springfield City Library (1966)
Western New England College School of Law Library (1978)

Waltham

Brandeis University Library (1965)

Wellesley

Wellesley College Margaret Clapp Library (1943)

Wenham

Gordon College 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 Public 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)

MICRONESIA

Pohnpei State

College of Micronesia-FSM U.S. Government Documents Library (1982)

MINNESOTA

Bemidji

Bemidji State University A. C. Clark Library (1963)

Blaine

Anoka County Library (1971)

Collegeville

Saint John's University Alcuin Library (1954)

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)

MISSISSIPPI

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)

MISSOURI

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)

Kirksville

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)

MONTANA

Billings

Montana State University Billings Library (1958)

Bozeman

Montana State University Renne Library (1907)

Butte

Montana Tech of the University of Montana Materials Processing Department/Documents (1901)

Havre

Montana State University-Northern Vande Bogart Library (1980)

Helena

Carroll College Corette Library (1974)
Montana State Library (1966)
State Law Library of Montana (1977)

Missoula

University of Montana Mansfield Library (1909) REGIONAL

NEBRASKA

Blair

Dana College C. A. Dana Life Library (1924)

Crete

Doane College Perkins Library (1944)

Fremont

Midland Lutheran College Luther Library (1924)

Kearney

University of Nebraska at Kearney Calvin T. Ryan Library (1962)

Lincoln

Nebraska Library Commission (1972)
Nebraska State Library (unknown)
University of Nebraska at Lincoln D. L. Love Memorial Library (1907) REGIONAL
University of Nebraska at Lincoln Marvin & Virginia Schmid Law Library (1981)

Omaha

Creighton University Reinert/Alumni Library (1964)
Creighton University Klutznick Law Library (1979)
Omaha Public Library W. Dale Clark Library (1880)
University of Nebraska at Omaha University Library (1939)

Scottsbluff

Scottsbluff Public Library (1925)

Wayne

Wayne State College U.S. Conn Library (1970)

NEVADA

Carson City

Nevada State Library and Archives (unknown)
Nevada Supreme Court Library (1973)

Elko

Elko County Library (1991)
Northern Nevada Community College Learning Resources Center (1992)

Las Vegas

Clark County Law Library (1988)
Las Vegas-Clark County Library District (1974)
University of Nevada at Las Vegas James Dickinson Library (1959)

Reno

National Judicial College Law Library (1979)
Nevada Historical Society Library (1974)
University of Nevada Libraries (1907) REGIONAL
Washoe County Library (1980)

NEW HAMPSHIRE

Concord

Franklin Pierce Law Center Library (1973)
New Hampshire Law Library (1994)
New Hampshire State Library (unknown)

Durham

University of New Hampshire Dimond Library (1907)

Hanover

Dartmouth College Baker Library (1884)

Henniker

New England College Danforth Library (1966)

Manchester

Manchester City Library (1884)
New Hampshire College H. A. B. Shapiro Memorial Library (1976)
Saint Anselm College Geisel Library (1963)

Nashua

Nashua Public Library (1971)

NEW JERSEY

Bayonne

Bayonne Free Public Library (1909)

Bloomfield

Bloomfield Public Library (1965)

Bridgeton

Cumberland County Library (1966)

Camden

Rutgers University Law School Library (1979)
Rutgers University Paul Robeson Library (1966)

East Brunswick

East Brunswick Public Library (1977)

East Orange

East Orange Public Library (1966)

Elizabeth

Free Public Library of Elizabeth (1895)

Glassboro

Rowan College of New Jersey Savitz Library (1963)

Hackensack

Johnson Free Public Library (1966)

Irvington

Irvington Public Library (1966)

Jersey City

Jersey City Public Library (1879)
Jersey City State College Forrest A. Irwin Library (1963)

Lawrenceville

Rider University Franklin F. Moore Library (1975)

Madison

Drew University Library (1939)

Mahwah

Ramapo College George T. Potter Library (1971)

Morristown

College of Saint Elizabeth Mahoney Library (1938)

Mount Holly

Burlington County Library (1966)

New Brunswick

Rutgers University Alexander Library (1907)

Newark

Newark Public Library (1906) REGIONAL
Rutgers University John Cotton Dana Library (1966)
Rutgers University Law School Ackerson Law Library (1979)
Seton Hall University Law Library (1979)

Newton

Sussex County Library (1986)

Phillipsburg

Phillipsburg Free Public Library (1976)

Plainfield

Plainfield Public Library (1971)

Pomona

Stockton State College Library (1972)

Princeton

Princeton University Firestone Library (1884)

Randolph

County College of Morris Sherman H. Masten Learning Resource Center (1975)

Shrewsbury

Monmouth County Library (1968)

South Orange

Seton Hall University Walsh Library (1947)

Teaneck

Fairleigh Dickinson University Weiner Library (1963)

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 Schaffer 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 Business Library (1984)
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 Onenonta 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 Southhampton 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)

NORTH CAROLINA

Asheville

University of North Carolina at Asheville D. Hiden Ramsey Library (1965)

Boiling Springs

Gardner-Webb University Dover Memorial Library (1974)

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 Everett 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-Lucus 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)

OKLAHOMA

Ada

East Central University Linscheid Library (1914)

Alva

Northwestern Oklahoma State University J. W. Martin Library (1907)

Bethany

Southern Nazarene University R. T. Williams Learning Resources Center (1971)

Durant

Southeastern Oklahoma State University Henry G. Bennett Memorial Library (1929)

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)

OREGON

Ashland

Southern Oregon State College Library (1953)

Bend

Central Oregon Community College Library/Media Center (1985)

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. Lazaro 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 (1893) 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 Sherrod 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 Tarlton 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

Nicholson Memorial Library System (1990)

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)

San Marcos

Southwest Texas State University Albert B. Alkek Library (1955)

Seguin

Texas Lutheran College Blumberg Memorial Library (1970)

Sherman

Austin College Gladys Abell Library Center (1963)

Texarkana

Texarkana College Palmer Memorial Library (1963)

Victoria

Victoria College University of Houston-Victoria Library (1973)

Waco

Baylor University Caston Law Library (1982)
Baylor University Moody Memorial Library (1905)

Wichita Falls

Midwestern State University Moffett Library (1963)

UTAH

Cedar City

Southern Utah University Library (1964)

Ephraim

Snow College Lucy A. Phillips Library (1963)

Logan

Utah State University Merrill Library (1907) REGIONAL

Ogden

Weber State University Stewart Library (1962)

Provo

Brigham Young University Harold B. Lee Library (1908)
Brigham Young University Law Library (1972)

Salt Lake City

University of Utah Eccles Health Science Library (1970)
University of Utah Law Library (1966)
University of Utah Marriott Library (1893)
Utah State Library (unknown)
Utah State Supreme Court Law Library (1975)

VERMONT

Burlington

University of Vermont Bailey/Howe Library (1907)

Castleton

Castleton State College Calvin Coolidge Library (1969)

Johnson

Johnson State College John Dewey Library (1955)

Lyndonville

Lyndon State College Samuel Reed Hall Library (1969)

Middlebury

Middlebury College Egbert Starr Library (1884)

Montpelier

Vermont Department of Libraries (1845)

Northfield

Norwich University Kreitzberg Library (1908)

South Royalton

Vermont Law School Library (1978)

VIRGIN ISLANDS

Saint Croix

Virgin Island Division of LIbraries c/o Florence Williams Public Library (1968)

Saint Thomas

University of the Virgin Islands Ralph M. Paiewonsky Library (1973)

VIRGINIA

Alexandria

Dept. of the Navy Office of Judge Advocate General Law Library (1963)

Arlington

George Mason University School of Law Library (1981)
U.S. Patent & Trademark Office Scientific Technology Information Center (1986)

Blacksburg

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 (1967)

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)

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)
U.S. Courts Library Ninth Circuit Library (1981)

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)

WEST VIRGINIA

Athens

Concord College J. Frank Marsh Library (1924)

Bluefield

Bluefield State College Hardway Library (1972)

Charleston

Kanawha County Public Library (1952)
West Virginia Library Commission (1975)
West Virginia Supreme Court Law Library (1977)

Elkins

Davis and Elkins College Booth Library (1913)

Fairmont

Fairmont State College Library (1884)

Huntington

Marshall University James E. Morrow Library (1925)

Institute

West Virginia State College Drain-Jordan Library (1907)

Montgomery

West Virginia Institute of Technology Vining Library (1985)

Morgantown

West Virginia University Library (1907) REGIONAL

Salem

Salem-Teikyo University Benedum Library (1921)

Shepherdstown

Shepherd College Ruth Scarborough Library (1971)

Weirton

Mary H. Weir Public Library (1963)

WISCONSIN

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)

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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

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University of Wisconsin-Superior Jim Dan Hill Library (1935)

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Wausau

Marathon County Public Library (1971)

Whitewater

University of Wisconsin-Whitewater Library and Learning Resources (1963)

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Natrona County Public Library (1929)

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Wyoming State Law Library (1977)
Wyoming State Library (unknown)

Gillette

Campbell County Public Library (1980)

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