

News Briefs

Developments

TURBULENCE WITHIN THE WALLS

Turbulence inside pipes makes the measurement of fluid flow difficult. The cost of inaccurate measurements to the petroleum and chemical process industries, for example, can amount to hundreds of millions of dollars annually. Probing this problem, two NIST researchers in the Center for Chemical Engineering have come up with a strategy to predict meter performance for non-ideal installation conditions. Their research could yield a more practical process to check or calibrate an installed flowmeter by determining in-situ the profile of the pipeflow entering the meter. NIST has formed an industry-government consortium to sponsor this research program on flowmeter installation effects.

Information on participating in the consortium is available from George E. Mattingly, 105 Fluid Mechanics Bldg., NIST, Gaithersburg, MD 20899; telephone: 301/975-5939.

NEW TECHNIQUE FOR MEASURING WAVEGUIDE LOSS

Scientists in NIST's Electromagnetic Technology Division, Boulder, CO, have developed a new technique for measuring propagation loss in optical channel waveguides used in optical communication, signal processing, and sensor applications. The technique is based on photothermal deflection effect which employs a laser beam to probe extremely small temperature changes resulting from the absorption of light. Other techniques used currently to measure waveguide losses risk damage to the guide, require special material preparation, or are subject to a large uncertainty due to randomly scattered light. The new technique avoids these difficulties and is applicable to a variety of waveguide materials.

For information, contact Aaron A. Sanders, Division 724.02, NIST, Boulder, CO 80303; telephone: 303/497-5341.

NIST, ARMY, AND GE TO COLLABORATE ON STANDARDS FOR REAL-TIME RADIOSCOPY

Thomas Siewert of the Fracture and Deformation Division and Leonard Mordfin of the Office of Nondestructive Evaluation (ONDE) negotiated an agreement with representatives of the Army Materials Technology Laboratory (MTL) and the General Electric Aircraft Engines Quality Technology Center for a joint effort to develop documentary standards (military and ASTM) on real-time x-ray radiography (RTR) for nondestructive evaluation (NDE). Real-time radiography and its companion technology, near-real-time digital radiography, constitute a powerful and rapidly emerging industrial inspection technique. Under the terms of the agreement, GE will develop drafts on the basis of their company Standards and MTL will provide funding to NIST to incorporate measurement considerations into the documentary standards.

This collaborative effort on documentary standards is expected to reinforce ONDE's project on measurement standards for RTR, which was initiated in FY 1987 with Siewert as the project leader. With help from Robert Placious, formerly of Center for Radiation Research, Siewert arranged a workshop and developed a questionnaire to identify industry's most pressing standards needs in RTR. The questionnaire generated considerable interest, including numerous invitations for Siewert to speak at NDE meetings, and leading to the collaboration. As a corollary benefit to NIST, Siewert has been granted access to MTL's and GE's RTR laboratory facilities for research purposes. GE's facilities in Cincinnati, Ohio, in particular, are among the most advanced in the country.

PATTERN-RECOGNITION TECHNIQUES APPLIED TO XRF ANALYSIS

Scientists from the NIST Center for Radiation Research and from NASA are experimenting with a new approach for the interpretation of x-ray fluorescence (XRF) spectra. XRF analysis is used widely in science and industry for the nondestructive determination of the chemical composition of a sample. In many field and quality-control applications, quantitative information on the composition is not needed. What is needed is the ability to monitor changes in the composition among samples or to select and classify samples with similar compositions. The need for XRF classification and collection of diverse geological samples by a rover vehicle on NASA's proposed Mars Sample Return Mission stimulated this investigation.

Traditionally, quantitative analysis of XRF spectra involved peak fitting (with background subtraction) to determine the areas of the characteristic x-ray peaks of interest and a time-consuming numerical conversion of these areas to chemical composition, taking into account alterations of the peak intensities by self-absorption and secondary emission in the sample. This method required knowledge of the excitation source spectrum and the peak intensities from a suite of known samples. The pattern-recognition method simply correlates selected peak regions of the raw XRF spectra with those from standard samples obtained with the same excitation source (information on the source spectrum is not needed), and this takes only a few seconds on a personal computer. A proof of principle has been demonstrated for geological and alloy samples using a field-quality system comprised of a small battery-operated x-ray generator and an energy-dispersive spectrometer.

FIPS FOR POSIX APPROVED

The Secretary of Commerce approved the Federal Information Processing Standard (FIPS) for POSIX (Portable Operating System Interface for Computer Environments). To be issued as FIPS 151, the standard has been adopted on an interim basis to enable the Federal Government to use the POSIX specification in procurements and in developing systems for applications portability.

FIPS 151 adopts draft 12 of the Institute of Electrical and Electronics Engineers (IEEE) Standard for POSIX. A FIPS adopting final voluntary standard specifications for POSIX will be proposed when those specifications are completed.

As currently defined, POSIX is the crucial first step in providing a vendor independent interface specification between an application program and an operating system. However, the current definition must be extended to provide interface specifications for full operating system functionality.

In addition to a fully extended POSIX that supports source code portability across many different machines and operating systems, there is a need for an architectural approach to applications portability. National Computer and Telecommunications Laboratory (NCTL)—formerly ICST—is working with industry and users to produce the needed specifications for both the extended POSIX and an Applications Portability Profile (APP).

The APP will be a group of standard elements including database management, data interchange, network services, user interfaces, and programming languages. Workshops were held in September, October, and November 1988 and others are scheduled for January and May 1989 to discuss the APP and the POSIX standard.

AGREEMENT WITH NCC FOR VALIDATION OF FIPS COBOL AND FORTRAN

The NCTL and the National Computer Centre (NCC) of the United Kingdom signed an agreement to recognize COBOL and FORTRAN test reports, and validation certificates issued by each other. As the basis for mutual recognition of test reports and validation certificates, NCTL and NCC agree to use the same test method, to follow equivalent validation procedures and to adopt equivalent certification criteria. Under the agreement, NCTL can also recognize testing done by other European Economic Community or the European Free Trade Association test centers that are sublicensed by NCC.

The test method used for mutual recognition of FORTRAN validations is NCTL's FORTRAN Compiler Validation System (FCVS) for testing FIPS 69-1 (ANS X3.9-1978) FORTRAN. The test method used for mutual recognition of COBOL validations is the COBOL Compiler Validation System (CCVS) for testing FIPS 21-2 (ANS X23-1985) COBOL. The CCVS was initially developed by the U.S. Government and later updated for the 1985 COBOL standard (FIPS 21-2) by NCC under a joint project with the U.S. Government, United Kingdom, France, and West Germany.

LARGE-SCALE CRACK-ARREST TESTS ON REACTOR STEEL COMPLETED

With the final test performed on Sept. 22, 1988, a 5-year program sponsored by the Nuclear Regulatory Commission involving the fracture of large plates of reactor grade steel was completed on schedule. The NIST work provided data required for the evaluation of one of the main concerns in nuclear plant operation: protecting the main pressure vessel against brittle fracture. Significant accomplishments by NIST: (1) extended the existing limits on crack-arrest databases to regions of current engineering interest; (2) clearly established that brittle crack-arrest does occur prior to ductile crack extension; (3) improved elastic and viscoplastic fracture mechanics models; and (4) developed improved dynamic fracture methods. Scientific advances were made in the area of measurement of crack inertia and plastic zone growth kinetics. A 2-year analytical program is planned to explore certain research issues that were raised by the completed testing program.

INDUSTRIAL WORKSHOP ON INTELLIGENT PROCESSING OF MATERIALS

A 2-day workshop was held at Gaithersburg, MD for more than 50 industrial representatives in order to assess the priorities for research in the important emerging technology of intelligent processing of materials. Another aim of the workshop was to initiate discussion on possible cooperative NIST/industrial projects. The workshop was sponsored by the Institute for Materials Science and Engineering and the Office of Nondestructive Evaluation with participation by the Ceramics, Metallurgy, Fracture and Deformation, and Polymers Divisions. The industrial participants, representing both materials producers and users, assessed the needs for intelligent processing technology for a range of advanced materials including ceramics, metal alloys and polymers. The proceedings of the workshop will provide valuable planning information for joint NIST industrial research on intelligent processing of materials.

EXPANSION OF THE NIST-DOD FLOWMETER TESTING PROGRAM

The national standards laboratories in Italy and the United Kingdom have joined the round-robin flowmeter testing program being conducted by the NIST Chemical Process Metrology Division and sponsored by the Department of Defense (DOD). Tests have shown that fluid flow measurements in two European laboratories—the Istituto di

Metrologia in Italy and the National Engineering Laboratory in Scotland—show such good traceability links to NIST results that overseas DOD labs, such as the U.S. Navy in the Mediterranean and the U.S. Air Force in the United Kingdom, can use these laboratories as sources for calibrations. The ultimate goal of the program is to quantify the traceability of all DOD flow measurements to NIST, which will provide DOD with more widely distributed and convenient sources of flow measurement services.

ACCESS CONTROL RESEARCH

Researchers are designing a prototype system to protect the confidentiality and integrity of information in local area networks (LANs) consisting of workstations and host computers. To gain access to network resources, users sign on automatically using smart tokens (smart cards, keys, or modules) inserted into a card reader/writer attached to the workstations and host computers. A passive token stores a password or cryptographic information to verify the user's identity. Smart cards with computation capabilities can be used in both user-to-host and host-to-user authentication processes.

Smart Card Technology: New Methods for Computer Access Control, (NIST Special Publication 500-157), describes the basic components of a smart card and provides background information on the underlying integrated circuit technologies. The capabilities of a smart card are discussed, especially its applicability for computer security. The report describes research being conducted on smart card access control techniques; other major U.S. and international groups involved in the development of standards for smart cards and related devices are outlined in the appendix.

APPROVAL OF FIPS PUB 152, STANDARD GENERALIZED MARKUP LANGUAGE

On Sept. 26, 1988, the Secretary of Commerce approved the standard for Generalized Markup Language (SGML) to be published as Federal Information Processing Standard Publication (FIPS PUB) 152. Effective March 31, 1989, the new standard adopts the International Standards Organization SGML (ISO 8879-1986) which specifies a language for describing documents to be used in office document processing, interchange between authors and between authors and publishers, and publishing. The language provides a coherent and unambiguous syntax for describing the elements within a document.

The new SGML standard provides a common markup language for a variety of document types and uses, permitting the portability of unformatted textual data among different installations and processing systems and promoting interchange of documents between systems of different manufacturers. The standard is appropriate for documents which are processed by any text processing system.

CCAM DEVELOPS INSULATION ECONOMICS PROGRAM

At the request of the U.S. Department of Energy, Steven Petersen of CCAM's Mathematical Analysis Division has developed and field tested the Zip-Code Insulation Program (ZIP), a microcomputer program for determining economic levels of insulation in new and existing houses. ZIP determines economic insulation levels for attics, walls, floors, basements, crawlspaces, and slab edges, based on local climate conditions, energy costs, and insulation costs, all keyed to the first three digits of the user's Zip Code. This program and supporting data files will be used by utilities, insulation manufacturers and vendors, energy specialists, and homeowners. ZIP will serve as the primary reference for DOE's insulation guidelines for homeowners.

CBT AND CCE HOST INDUSTRY WORKSHOP ON PROPERTY DATA FOR OZONE-SAFE REFRIGERANTS

Approximately 35 experts from industry, government, and universities met at NIST on Sept. 22, 1988, to identify needs for thermodynamic and transport property data for replacements for those refrigerants that damage the ozone layer in the upper atmosphere. The working fluids for much of small and large-scale heating and cooling equipment and foam blowing of thermal insulation are currently chlorofluorinated hydrocarbons (CFCs). Of the fully halogenated CFCs the most common are trichlorofluoromethane (R11) and dichlorodifluoromethane (R12). Leakage of R11 and R12 beyond the troposphere is destroying the ozone layer. The environmental ramifications of the continued use of R11 and R12 are so pressing that the United States signed the Montreal Protocol in December 1987 with 31 of the world's major producing and consuming countries. The agreement provides for a near-term freeze on the manufacturing of R11 and R12 followed by scheduled 50 percent reductions in their manufacture. It is unlikely that industry will be able to replace R11 and R12 in existing equipment without modifications to this equipment. The design of high-quality new equipment

will depend critically on the thermophysical properties of the replacement refrigerant materials.

MODIFICATIONS IMPROVE NIST GAS FLOW FACILITY

Sellers and buyers of natural gas and other gas products will have greater confidence in their transactions as the result of improvements to NIST's gas flow measurement facility at its Boulder, CO laboratories. The facility, first put into operation in 1979, measures the performance of flowmeters that assure the accuracy of transactions between sellers and buyers. As a result of the improvements, variability in gas temperature has been decreased by a factor of five and the precision of performance data on flowmeters has improved by a factor of two. This increased precision has made the facility much more useful and capable of performing a wide variety of research, says a recent report on the improvements. Major changes were made to the gas flow loop, calibration lines, and the regulator for the gas supply to the pneumatic controllers. In addition, a new minicomputer replaced three small computers to improve data-analysis capability, and an additional cooling line was installed to supply extra liquid nitrogen to the main heat exchanger, improving temperature control.

A copy of the paper outlining the improvements is available from Fred McGehan, Public Affairs Office, NIST, Boulder, CO, 80303. More information on the facility is available from Susan E. McFaddin, Chemical Engineering Science Division, NIST, Boulder, CO 80303.

ECONOMICS, EFFICIENCY OF INSULATION WITHOUT CFC

Two of the most efficient insulating products used in new building construction today are polyurethane and extruded polystyrene rigid foam insulation; both contain chlorofluorocarbons—CFCs. During the foam manufacturing process, CFCs are used to form gas cells or bubbles in the foam making it an excellent insulator. However, there is evidence that CFCs can break down the Earth's ozone layer, and their manufacture and use may be curtailed. In a study for the Department of Energy, NIST researchers looked at the cost-effectiveness and potential energy consequences of using expanded polystyrene (EPS) and fiberglass—neither contains CFCs. They found that both insulation materials typically cost less than most CFC-containing foams. But since they contain air bubbles instead of gas bubbles, they do not insulate as efficiently. And, because more of the material is

needed to achieve the same thermal performance, there may be an increase in cost if walls or roof areas must be expanded to accommodate the thicker insulation.

A report, Technical and Economic Analysis of CFC-Blown Insulations and Substitutes for Residential and Commercial Construction, is available from the National Technical Information Service, Springfield, VA 22161, for \$14.95 prepaid. Order by PB #88-243399.

QUANTUM EFFECTS DOMINATE 1989 GRANTS

NIST announced recently that it will award two 1989 Precision Measurement Grants to Randall G. Hulet of Rice University and to Edward Hinds and Malcolm Boshier of Yale University. The grants, for \$30,000 each for fiscal year 1989, will support Hulet's study of atomic collision processes at extremely low temperatures, and Hinds and Boshier's precision measurement of energy levels in hydrogen and helium atoms. Both experiments are designed to probe fine details of quantum theory. The NIST Precision Measurement Grants program was started in 1970. The awards are made annually to scientists in academic institutions for work in the fields of precision measurement and the study of fundamental constants of nature. Each grant is awarded for 1 year and may be renewed for up to 2 additional years at the discretion of NIST.

PROPOSALS WANTED FOR 1990 GRANTS

NIST is seeking project proposals for two research grants for fiscal year 1990 in the field of precision measurement and fundamental constants. The Precision Measurement Grants are for \$30,000 for 1 year, and may be renewed by NIST for up to 2 additional years. Prospective candidates must submit summaries of their proposed projects to NIST by Feb. 1, 1989, to be considered for the current grants, which will run from October 1989 through September 1990. NIST Precision Measurement Grants are awarded each year to scientists in academic institutions for work in determining values for fundamental constants, investigating related physical phenomena, or developing new, fundamental measurement methods. The grants were instituted in 1970 to augment NIST research programs in physical constants and fundamental measurements, and to encourage research in these fields at colleges and universities. To date, 44 grants have been awarded.

For further information, contact Dr. Barry N. Taylor, NIST Precision Measurement Grants Committee, B258 Metrology Bldg., NIST, Gaithersburg, MD 20899; telephone 301/975-4220.

Standard Reference Materials

STANDARD REFERENCE MATERIALS 3191-3195 AQUEOUS ELECTROLYTIC CONDUCTANCE STANDARDS

The Office of Standard Reference Materials announces the availability of a series of SRMs certified for aqueous electrolytic conductance. The series, SRMs 3191-3195, has nominal conductivities that range from 100 to 100,000 micro-siemens per centimeter at 25 °C. These SRMs are intended primarily for use as a control and in the calibration and standardization of conductivity cells and meters used in water purity determinations. Indications of water purity can be determined in this way since ionic impurities of only a few parts per million can be detected readily by measuring the conductivity of the water. The solutions are prepared by dissolving high-purity potassium chloride in deionized water in equilibrium with atmospheric carbon dioxide.

Certification of these conductance standards was performed in the Inorganic Analytical Research Division of the Center for Analytical Chemistry.

ELLIPSOMETRIC SRM A VIRTUAL SELL-OUT

Industrial firms have ordered nearly all of the first available 57 units of Standard Reference Material (SRM) 2530 for ellipsometrically derived thickness and refractive index of a silicon dioxide layer on silicon. SRM 2530 was developed by CEEE's Semiconductor Electronics Division in response to the needs of the semiconductor (and other) industries to evaluate the accuracy of ellipsometers, but it may also be used as aid in the calibration of various other optical and mechanical thickness monitoring instruments.

The SRM is available separately for three oxide thicknesses: 50 nm (2530-1), 100 nm (2530-2), and 200 nm (2530-3). All three thicknesses have proven to be about equally popular. The division has fabricated about 150 of the standards and in response to the continuing demand is completing the characterization of the remainder for certification using

the highly accurate ellipsometer designed and built in the division.

Each SRM consists of a 76-mm diameter silicon wafer on which a uniform silicon dioxide layer was grown, patterned, and partially covered with chromium. Certified values are provided for the derived values of thickness and refractive index of the silicon dioxide layer, as calculated by means of a model which postulates the existence of a thin silicon-rich oxide interlayer as well as the silicon dioxide layer. The SRM package includes a copy of Preparation and Certification of SRM 2530, Ellipsometric Parameters Delta and Psi and Derived Thickness and Refractive Index of a Silicon Dioxide Layer on Silicon (NIST Special Publication 260-109) and a FORTRAN program to aid the end-user in computing the ellipsometric parameters and the thickness of the oxide.

STANDARD REFERENCE MATERIALS 3171-3176—MULTIELEMENT SOLUTION STANDARDS

The Office of Standard Reference Materials announces the availability of high-purity Standard Reference Materials (SRMs 3171-3176) that should provide improved accuracy for multielement techniques or any technique that requires aqueous solutions for calibration and will enable better trace element analysis. These SRMs will complement the existing single-element SRMs (3101-3169) and are prepared from high-purity metals, salts, and reagents.

The first two multielement solutions, SRM 3171, Multielement Mix A Standard Solution, and SRM 3172, Multielement Mix B Standard Solution, were available in November, 1988 and each consists of 10 elements in a 5-percent nitric acid solution. The remaining four mixes were available in December 1988. The elements in the solutions are:

SRM 3171 - Al, V, Cd, Cr, Fe, Mg, Mn, Ni, K, Na
SRM 3172 - As, Be, Ca, Co, Cu, Pb, Se, Ag, Sr, Zn
SRM 3173 - Bi, B, Ce, Hg, P, Si, Tl, Th, V
SRM 3174 - Al, Be, Cd, Hf, Fe, Zr, Au, Ti, Pb, B
SRM 3175 - As, Be, La, Mo, P, Se, Te, Sn, Y
SRM 3176 - Sb, Be, B, Dy, Eu, Gd, Nd, Ru, Ti

Certification of these standards was performed in the Inorganic Analytical Research Division of the Center for Analytical Chemistry.

STANDARD REFERENCE MATERIAL 4339 RADIUM-228

Standard Reference Material (SRM) 4339 has been developed for accurate calibration monitoring of instruments for radium-228, following 5 years of extensive sample preparations and different calibration methods. The monitoring of this natural environmental radioactivity, the most significant radium contaminant in some areas, is required by the Clean Water Act.

The radium-228 in this SRM is from 25-year-old purified thorium oxide and contains no detectable radionuclides other than radium-228, <.01 percent radium-226 and their expected progeny. Activity measurements are difficult for the 5.75-year half-life radium-228 because of the low beta-particle energies and the high-energy emissions from daughter 6.13-h ²²⁸Ac and subsequent progeny. Rapid and simple chemical separations are complicated by the presence of 3.6-day ²²⁴Ra later in the chain.

This new Standard Reference Material consists of quantitative samples of calibrated radium-228 and 5-mL of carrier solution in a flame-sealed glass ampoule, with an overall uncertainty of less than 3 percent.

Certification of SRM 4339 was performed in the Ionizing Radiation Division, Center for Radiation Physics.

Standard Reference Data

CHEMICAL THERMODYNAMICS DATABASE AVAILABLE ONLINE

The computerized version of the NBS Tables of Chemical Thermodynamic Properties now is available worldwide to subscribers of STN International (Scientific and Technical Network). The numerical data in the new file provides researchers in chemistry, physics, and manufacturing, and environmentalists with rapid access to evaluated data on more than 15,000 inorganic substances. A complete description of the chemical system is given with values for six thermodynamic properties: enthalpy of formation, Gibbs energy of formation, heat capacity and entropy at 298.15 kelvin, enthalpy differences between 298.15 kelvin and 0 kelvin, and the enthalpy of formation at 0 kelvin. This is the second NIST database to be offered online through STN, a retrieval service jointly offered by the American Chemical Society, the

Fachinformationszentrum Karlsruhe (FIZ Karlsruhe, West Germany), and the Japan Information Center of Science and Technology.

For information on the availability of the database through STN, contact the Office of Standard Reference Data, A323 Physics Bldg., NIST, Gaithersburg, MD 20899, Telephone: 301/975-2208.

PROPOSALS REQUESTED FOR 1989 GRANTS PROGRAM ON STANDARD REFERENCE DATA

Project proposals are requested by the National Institute of Standards and Technology (NIST)—formerly the National Bureau of Standards—to compile and evaluate scientific reference data for scientists and engineers to use in research, development, and the design of industrial processes.

Established in 1980, the grants program is administered by the NIST Office of Standard Reference Data (OSRD), which will award approximately \$400,000 provided by the National Science Foundation and NIST. Typically, project proposals are funded at \$20,000-40,000 for 1- to 2-years. The closing date for receipt of the proposals is Feb. 28, 1989.

Proposals will be considered which are concerned with the physical, chemical, or materials properties of well-characterized substances or systems. Projects may cover several properties of a single substance or a single property of a coherent group of substances.

The work proposed should include the collection of data from the scientific literature and the critical evaluation of those data. Each project must lead to a publishable compilation, critical review, or computer database containing recommended values with stated uncertainties for the properties in question.

Because the program emphasizes the critical evaluation of published data, proposals which involve only the compilation of data without the exercise of scientific judgment will not be considered. Projects should not involve new experimental measurements.

Examples of appropriate subjects for the data compilations include: thermochemical data and properties of aqueous solutions; thermophysical properties of fluids; mechanical properties of metals, ceramics, polymers and composites; chemical kinetic data; atomic structure and collision data; molecular structure and dynamics data; data on surface characterization; corrosion-related data; semiconductor or superconductor properties; and spectral data for chemical analysis.

The projects are expected to have a well-defined goal and be sufficiently limited in scope to produce useful results in 1 or 2 years.

The 1989 grants program is open to researchers in any U.S. organization, academic or non-academic, non-profit or commercial. Judgments on the proposals will be made on the basis of the importance of the data to be collected, the feasibility of the project, the qualifications of the investigator, and the possibility of other support for the project. Those interested in applying for a grant under this program should contact the Office of Standard Reference Data, A323 Physics Bldg., National Institute of Standards and Technology, Gaithersburg, MD 20899, telephone: 301/975-2200.

Calendar

July 26-August 1, 1989

16th INTERNATIONAL CONFERENCE ON THE PHYSICS OF ELECTRONIC AND ATOMIC COLLISIONS

Location: Grand Hyatt Hotel
New York, NY

This biennial international conference seeks to promote the growth of scientific knowledge and its effective exchange among investigators of all nations in the field of electronic and atomic collisions and related areas of atomic and molecular physics. The conference deals with two-body interactions between ions, atoms, molecules, electrons, positrons, and photons. The conference is cosponsored by the International Union of Pure and Applied Physics, the National Institute of Standards and Technology, the American Physical Society, the U.S. Department of Energy, the U.S. Air Force Office of Scientific Research, the U.S. Office of Naval Research, and the National Science Foundation.

For further information about the conference, contact Thomas Lucatoro, A251 Physics Building, NIST, Gaithersburg, MD 20899, 301/975-3734.