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News Briefs

General Developments

GRAVIMETERS USED SUCCESSFULLY

Highly sensitive and portable instruments to measure the acceleration of gravity, developed by the NIST–University of Colorado Joint Institute for Laboratory Astrophysics (JILA), have performed successfully at various sites around the country in field tests by the National Geodetic Survey. The results of this initial year of field testing pave the way for a network of measurements made with these instruments, both in the United States and abroad. They will be used to monitor local variations in gravity, study vertical ground motions for earthquake detection, and assist in the determination of sea level changes. A paper describing the field test is available from Jo Emery, NIST, Division 104, Boulder, CO 80303.

DUCTILE-TO-BRITTLE FRACTURE BEHAVIOR OF STEEL STUDIED

Although the fracture behavior of steels is understood at high and at very low temperatures, the behavior at intermediate temperatures has been hard to characterize. In this ductile-to-brittle transition region, measurements of the fracture toughness as a function of temperature show a large scatter, and measurements of different-sized specimens at different loading rates give different results. A NIST guest scientist from West Germany has clarified the cause of this variability on a quenched and tempered pressure vessel steel (DIN 20 MnMoNi 55, similar to ASTM A533B). Four different types of fracture initiation sites have been identified, including cleavage facets, inclusions, clusters of inclusions, and local zones of ductile tearing. The fracture toughness depends on the distance from the crack tip to the initiation site. The study results are published in Fracture Behavior of a Pressure Vessel Steel in the Ductile-to-Brittle Transition Region (NISTIR 88-3099), available from the National Technical Information Service, Springfield, VA 22161 for $13.95, prepaid. Order by PB #89-189195.

CERTIFICATION OF ALUMINUM IN SERUM ALBUMIN FOR FDA

NIST scientists recently developed methods for the determination of aluminum in serum albumin. The serum albumin was provided by the Center for Biologics Evaluation and Research Division of the Food and Drug Administration (FDA) and will be used by FDA as a quality assurance material. The analytical procedures involve the use of atomic absorption spectrometry with electrothermal atomization, molecular fluorescence, and inductively coupled plasma atomic emission spectrometry.

The serum albumin will be used for quality control in the manufacture and analysis of parenteral materials. Parenteral materials enter the body through means other than the digestive tract, e.g., injections or implants. Aluminum levels in parenteral solutions are of increasing concern because trace quantities of aluminum have been correlated to diseases affecting nerve tissue and bone. One of the greatest impacts has been on patients with renal impairment or patients receiving large or frequent amounts of albumin. It is expected that this research will greatly aid the FDA regulatory program for parenterals.

CAC QA PROGRAM IMPROVES THE QUALITY OF MEASUREMENTS MADE IN CANCER CHEMOPREVENTION STUDIES

For the past 5 years, the Center for Analytical Chemistry has operated a quality assurance program for more than 40 laboratories that measure serum and plasma levels of selected fat-soluble vita-

mins as part of National Cancer Institute (NCI) supported investigations to determine the cancer-prevention benefits of selected micronutrients in human populations at high risk of contracting certain forms of cancer.

The QA program developed at NIST to support analytical measurements made in these studies has three main components: (1) development and critical evaluation of analytical methods for the determination of retinol (vitamin A), α-tocopherol (vitamin E) and β-carotene in serum; (2) interlaboratory measurement proficiency testing; and (3) development of serum based reference materials to serve as accuracy benchmarks.

By the spring of 1988 the first two components were well under way and a pilot batch of serum-based reference materials with assigned values for the concentrations of the three fat-soluble vitamins was developed and distributed to laboratories participating in the QA program. In 3 years prior to their development, interlaboratory precision improved from $\sim$50 to $\sim$25 percent in a regular fashion. With reference materials available for laboratories to validate and trouble shoot their methods, there has been a three-fold improvement in interlaboratory precision, to the point where the precision today is less than 8 percent.

NIST efforts are now being channeled toward improving measurement comparability for five new agents. A program is also being developed to transfer NIST measurement capabilities in two-dimensional electrophoresis to NCI grantee laboratories for measuring the appearance/disappearance of selected proteins as a function of the progress of various forms of carcinoma. This technology has the potential for use as a diagnostic tool as well as a means for screening prospective chemopreventive agents.

ATOMIC LIQUID AND SOLID BEHAVIOR OBSERVED IN PLASMAS

NIST scientists have made the first confirmation of the existence of condensed states in a plasma system. Their nonneutral plasmas consisted of up to 15,000 positive beryllium ions contained in an ion trap and cooled to a temperature below 10 mK. At sufficiently high density and low temperature the system undergoes a transition from a gaseous ion cloud to a set of concentric shells of ions. In this state, ions move freely within a given shell, but motion between shells is constrained. The system is liquid-like within a shell and solid-like between shells, as in a smectic liquid crystal.

There is high interest in this type of system. First, certain internal atomic transitions in the trapped ions may be used as the basis for a very high quality frequency standard. Second, the trapped beryllium-ion plasmas at low temperature may serve as a model of other interesting systems that exhibit similar behavior but are less amenable to systematic study. Some examples are dense, ionized states of matter found in astrophysical objects such as neutron stars, conduction electrons in semiconductors, and charged particles confined in high-energy storage rings.

NIST SERVICE FOR SETTING COMPUTER CLOCKS

The Time and Frequency Division of the Center for Atomic, Molecular and Optical Physics has just completed its first year of operation of a new service which provides computer and other digital systems with telephone access to NIST time at accuracies approaching 1 ms. Features of the service include automatic compensation for telephone-line delay, advanced (48-day) alert for changes to and from daylight savings time, and advanced (1-month) notice of insertion of leap seconds. Although the main application of this system is to set computer clocks, simple hardware can also be developed to set noncomputer clock systems. The NIST system, entitled Automated Computer Time Service (ACTS), involves transmission of a time signal, which is then echoed by the user, so that the telephone time delay can be measured by NIST. The system adjusts for this delay and advances the transmission so that the signal arrives at the user on time. User software for the service is sold through the SRM program as RM8101.

PROPOSED REVISION OF STANDARD FOR POSIX: PORTABLE OPERATING SYSTEM INTERFACE FOR COMPUTER ENVIRONMENTS

A proposed revision to Federal Information Processing Standard (FIPS) 151, POSIX, was announced in the Federal Register. The revision will adopt IEEE Standard 1003.1-1988, Standard for Portable Operating System Interface for Computer Environments which defines a C language source interface to an operating system environment. FIPS 151 was adopted on an interim basis, pending completion of the technical specifications by the IEEE standards committee, to enable federal agencies to begin specifying POSIX in procurements. The standard will assist agencies in achieving a more open software environment.

PRESENCE OF TOXIC S_2F_{10} CONFIRMED FOR FIRST TIME IN SF_6 EXPOSED TO DISCHARGE

NIST scientists have confirmed for the first time by direct measurement that the toxic gas disulfur-decafluoride (S_2F_{10}) is formed by corona discharges in compressed sulfur hexafluoride (SF_6), a gas increasingly used as an electrical insulation and current-interruption medium in power transmission and distribution equipment. The team of scientists also found that the observed formation rate of S_2F_{10} is consistent with predictions of a theoretical model for the discharge chemistry developed by NIST scientists. When SF_6 is subjected to an electrical discharge it decomposes to form various corrosive and/or toxic byproducts which are of concern in assessing the reliability and safety of power systems that use it. The suspicion, not proven until this work, had been that S_2F_{10} would be among these products.

NCWM TRAINING MODULE PUBLISHED

The National Conference on Weights and Measures (NCWM) has published the twelfth module of a planned set of training programs for state and local weights and measures officials that the NCWM is developing under a grant from NIST.

Module 24, Introduction to NIST Handbook 44, provides an overview of NIST Handbook 44, Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices, which has been adopted by all 50 states as the basis for regulation of these devices. The module includes information on the history of the handbook, its organization and format, and how to use it. It discusses some of the basic principles underlying the handbook, for example, the factors that are considered in establishing tolerances for weighing and measuring devices.

This module is the first to be issued by the NCWM in a self-study format. Earlier modules are intended to be taught by an instructor. Each training module includes an inspector's or student's manual and an instructor's manual or a course administrator's guide.

Copies of Module 24 have been distributed to each state weights and measures program. The NCWM also will have copies of the module available for sale.

HIGH-SPEED METALLIZING OF FIBERS

A small-scale pilot plant designed to test new experimental concepts in high-speed electrodeposition of metals and alloys on monofilament high-strength fibers is now complete and in operation to produce small quantities of metallized fiber for evaluation. This technology, developed at NIST, makes use of triaxial impinging jets of electrolyte to increase the deposition rate. Deposition of metals such as copper, nickel, and cobalt tungsten have been demonstrated. This experimental apparatus has allowed cost estimates to be made, and these indicate that metal and/or metallic composite precursors can be produced for about $130/kg. Currently available technology is more than an order of magnitude more expensive.

ELECTROCHEMICAL DEPOSITION OF Al-Mn QUASICRYSTALS AND INTERMETALLICS

Electrodeposition of aluminum alloys and intermetallics from molten salt electrolytes offers several advantages over other metals processing techniques. The span of operating temperatures possible with molten salt electrolytes (120–500 °C) allows for the deposition of a variety of structures. In addition, since the solidification is isothermal and alloy composition is rigorously controlled by the melt composition, the microstructure and composition of electrodeposited alloys are quite uniform and predictable. Amorphous, quasicrystalline as well as metastable and stable crystalline structures have been observed in binary aluminum-manganese alloys electrodeposited from an electrolyte containing $AlCl_3$ and NaCl with controlled additions of $MnCl_2$. Electrodeposited alloys can be formed under conditions far from equilibria where the deviation from equilibrium, as well as the degree of ordering, is defined by the concurrent processes of new layer formation and surface diffusion.

The metastable amorphous phase has been formed by low-temperature electrodeposition. The direct formation of quasicrystals, having a level of free energy between that of an amorphous and a stable crystalline phase, can be achieved by an increase in deposition temperature in a manner somewhat analogous to that reported for sputter deposition. A further increase in electrolyte temperature results in the formation of the stable intermetallic phases which appear on the equilibrium phase diagram. The ability to electrodeposit thick, uniform films of the icosahedral and decagonal phases, for instance, may lead to the first mechanical property measurements of these very important binary alloys.

STRUCTURAL CERAMICS DATABASE DEVELOPED

A prototype structural ceramics database has been developed in the Ceramics Division to provide materials property data for advanced applications of ceramics. The goal of the project is to provide a critical link between the development of new materials in laboratory research studies and the use of these materials in competitive product applications. Providing this link will accelerate the development of advanced technologies that require structural ceramics for higher temperature operation or greater durability. The project is funded in part by the Gas Research Institute, the Standard Reference Data, and the Ceramics Division.

The prototype is designed for DOS-based personal computers and emphasizes user-friendliness, flexible design, and evaluated data. Property values in the system are supplemented with measures of quality, method and procedures information, and significant cautions. Materials are described in considerable detail using a modification of the ASTM Committee E-49 recommendations, and a complete bibliography of the sources of data is included.

Currently, the prototype contains thermal and mechanical property data for monolithic silicon carbides and silicon nitrides. Preparations are now under way to test the prototype at selected industrial sites.

MAGNETIC ORDER OBSERVED IN ARTIFICIAL SUPERLATTICES

NIST scientists and guest researchers from the University of Notre Dame, have recently made the first neutron diffraction determination of magnetic order in artificial metallic superlattices. The specimens consisted of layers of dilute magnetic semiconductor materials and were produced by molecular beam epitaxy techniques which yielded 100-200 alternate layers of MnSe and ZnSe, each of thickness approximately 2-5 nm. The results of the neutron measurements clearly identified long-range antiferromagnetic order within the MnSe layers. In the direction perpendicular to the atomic planes the ordering is limited in extent by the interface with the nonmagnetic ZnSe layer. No evidence of magnetic propagation between MnSe layers was found, a result consistent with predictions of current magnetism theory.

COLLABORATIVE RESEARCH EFFORT ON MATERIALS RESEARCH RENEWED

A major manufacturer of semiconductor devices, has begun its fourth year of collaborative research with NIST on the study of materials used in the production of semiconductors. Using the neutron depth profiling facility (NDP) operated by the Center for Analytical Chemistry (CAC), researchers will continue investigations on the thin films that form the passivation layers on semiconductor devices. Elemental depth profiles are being determined to better understand and control the effects of processing in device fabrication. NDP, a quantitative and nondestructive technique, provides a means to make repetitive analyses of a single sample at various processing stages. Other techniques also can be used in conjunction with NDP on the same sample volume. Key experiments are now being designed to take advantage of both the improved detection limits for the technique and the improved research facilities being constructed as part of the Cold Neutron Research Facility.

NY FIRM JOINS WITH NIST TO INVESTIGATE CID SENSORS

A Liverpool, NY, firm has begun a twofold research program with researchers at NIST. One objective of the program is to improve chemical analysis accuracy and detection limits through the use of charge injection device (CID) sensors in analytical instrumentation. The second goal is to identify and investigate the effects of various forms of nuclear irradiation on the CID sensors and their associated camera systems.

The CID sensor is an imaging device that offers numerous technical advantages over related devices, such as the more commonly known Charge Coupled Device (CCD). For example, CID cameras typically allow excellent exposure control in low-light situations, and they also are more tolerant to intense light, producing accurate image detail even under extreme lighting conditions. This has made the devices ideal for purposes such as missile tracking, semiconductor pattern recognition, and factory process line inspection.

Scientists from industry and NIST will use the NBSR 20-MW reactor and other intense sources of radiation to expose the sensors and associated CID components to x-ray, gamma, beta, neutron, and charged particle environments to determine "radiation hardness" of the materials. The electronic characteristics of the devices will be gauged before, during, and after radiation exposure. The researchers will also explore the analytical instrumental uses of CIDs in a variety of spectroscopy applications where the signal intensity may vary greatly in magnitude during the analysis of a sample.

COLD NEUTRON WORKSHOP ON ANALYTICAL MEASUREMENTS WITH COLD NEUTRON BEAMS

The Center for Analytical Chemistry and the Reactor Radiation Division hosted the third in a series of meetings on the Cold Neutron Research Facility (CNRF). The recent meeting was held to inform the scientific community of this national facility and to solicit recommendations on the instruments being built. Two analytical measurement techniques, prompt gamma neutron activation analysis (PGNAA) and neutron depth profiling (NDP), were specifically highlighted for scientists, managers, and students from universities, industry, and other agencies from across the United States. Through invited talks and open discussions, the potential of the new instruments was explored. The participants reviewed the basics of the two techniques and discussed applications in a variety of areas, including semiconductors, polymers, metals, superconductors, biological materials, environmental monitoring, and fundamental physics. Additionally, the users policy for the CNRF was described, including required procedures for submitting proposals to gain access to the new instruments.

HIGH EFFICIENCIES OF SOFT X-RAY MIRRORS MEASURED AT SURF II

NIST scientists in collaboration with researchers from the University of Arizona, Goddard Space Flight Center, Lawrence Berkeley Laboratory, and Lawrence Livermore Laboratory, have recently measured the reflectivity of soft x-ray optical devices at angles of the incident radiation near normal to the surface and at wavelengths from 150-250 Å at SURF II. Reflectivities up to 47 percent were measured. The soft x-ray optics beamline at SURF II is one of the few facilities in the world capable of making these measurements. By working interactively with the few laboratories capable of making efficient soft x-ray mirrors, we are helping to develop the emerging technology of soft x-ray optics.

This high reflectivity at normal incidence allows scientists to make high-quality soft x-ray imaging systems used in the remote sensing and imaging of objects that emit strongly in this spectral region, e.g., the Sun and stars, with unprecedented spatial resolution. Because these devices are also wavelength selective, they act as "monochromatic" filters and discriminate against other wavelengths.

These wavelength selective, stigmatic mirrors are also being used to make efficient optical cavities for experimental soft x-ray laser systems. Other applications include: soft x-ray lithography to obtain linewidths on semiconductor chips substantially smaller than now attainable and soft x-ray microscopy to make real-time observations of living cells in the so-called "water window" between 24 and 45Å.

LASER ABLATION SOURCE FOR STRUCTURAL STUDIES

Recently, NIST scientists completed the development of a novel molecular beam source to be used in conjunction with a pulsed-beam Fourier transform microwave spectrometer for molecular structure studies. This new capability now makes it possible to examine the technologically important refractory materials and low vapor pressure metals for which very few studies have been possible. Perhaps even more exotic molecules, e.g., mixed metal compounds and metal-molecule clusters, can be investigated with this new method.

The laser ablation beam source uses a Nd-YAG laser to vaporize solid materials into a rare gas pulsed jet, which is then examined for rotational spectra by the Fourier transform spectrometer. This method for forming vapor phase refractory molecules for spectroscopic studies overcomes substantial limitations in the conventional method of brute force heating of solid samples of the starting materials. One of the most problematic limitations of the conventional approach is a materials problem, i.e., the ability to find high-temperature inert materials as a container for substances heated in excess of 2000 °C. The laser ablation method requires no container and heats only a small area of material, ~ 0.1 mm^3. The vapor is then entrained in a supersonic pulse of inert gas for delivery to the spectroscopic chamber. The initial studies with this instrument have included the examination of the rotational spectra from SiC_2, an important circumstellar molecular species, and the oxides of the transition elements Y, La, Zr, and Hf. The rotational transition frequencies are used to determine the bond distance between the metal and oxygen atom. Measurements of the shifts in these frequencies, when an external electric field is applied, yield the molecular dipole moment and provide important information on the electronic nature of the molecular bonding.

FREQUENCY TABLES FOR CARBON MONOXIDE LASERS

In collaborative work with the University of Bonn, NIST scientists have obtained new, highly

accurate values for the molecular constants of carbon monoxide. This was done by measuring the frequencies of spectral lines of a stabilized CO laser. Frequency-measured transitions are some thousand times more accurate than wavelength-measured ones. While some of the spectral lines are well-known from earlier, isolated experiments, most of them have been improved by about a factor of 1,000 in this work. The results contribute substantially to the list of unified wave number standards used by the scientific community to calibrate spectrometers. The increasing use of Michelson interferometers has increased the need for such standards in all parts of the spectrum. The results are also useful for spectroscopic studies of important molecules in space and in the upper atmosphere. The measurements were in the region from 1140 to 2100 wave numbers, i.e., 34-62 THz, or 4.7-8.7 μm.

NEW RECORD BEAM CURRENT, 300 mA, ACCELERATED TO FULL ENERGY IN SURF-II, THE NIST ELECTRON STORAGE RING

The performance of the Synchrotron Ultraviolet Radiation Facility's (SURF-II) electron storage ring has been improved. Electron beams exceeding 250 mA are being accelerated to operating energy on a regular basis, and a new record of 300 mA has been achieved. The light intensity at all wavelengths radiated by the relativistic electron beam is directly proportional to the beam current. The higher radiation output achieved results in improved signal-to-noise for the surface science, atomic and molecular physics, and optical properties measurements that are investigated at the facility. These investigations are done by various groups from NIST, other government agencies, universities, and private industry. The storage ring also serves as a primary irradiance standard in the far ultraviolet (4-300 nm) and this improvement has extended the dynamic range of spectral irradiance that is provided to groups who use the facility to make absolute calibrations of monochromators or spectrometers.

AGREEMENTS OF OPEN SYSTEMS INTERCONNECTION (OSI) PROTOCOLS PUBLISHED

A new National Computer Systems Laboratory (NCSL) publication records working implementation specification agreements of OSI protocols among the organizations participating in the NIST Workshop for Implementors of OSI. Issued as NISTIR 89-4082, the document is based on the proceedings of the NIST Workshop Plenary Assembly held March 17, 1989. While work described in this document is not advanced enough for use in product development or procurement reference, the work is intended as a basis for future stable agreements. As each protocol specification is completed and becomes technically stable, it is moved from this working document to the stable companion document, which records mature agreements. NIST Special Publication 500-162, Stable Implementation Agreements for Open Systems Interconnection Protocols, Version 2, Edition 1, is the current version of these mature agreements.

The NIST Workshop for Implementors of OSI accepts the specifications of emerging standards for protocols and produces agreements on the implementation and testing particulars of these protocols. This process expedites the development of OSI protocols and promotes interoperability of independently manufactured data communications equipment.

NCSL RELEASES REVISED STRUCTURED QUERY LANGUAGE (SQL) TEST SUITE

National Computer Systems Laboratory (NCSL) released Version 1.2 of the SQL Test Suite which helps users and vendors determine compliance with FIPS 127, Database Language SQL. The revised test suite adds the programming language interface Pascal and includes tests for features to be available in the next revision of FIPS 127, expected to be approved later in 1989. Version 1.2 replaces the original version of the SQL Test Suite released in August 1988. Over 30 companies presently utilize the SQL Test Suite.

OPTIONAL MODULE FOR INFORMATION RESOURCE DICTIONARY SYSTEM (IRDS) STANDARD TO BE DEVELOPED

In June 1989, ANSI's Technical Subcommittee X3 approved the development of an optional module for the IRDS standard in the area of Naming Convention Verification and assigned responsibility for the X3 Technical Report to Task Group X3H4.3, IRDS Naming Convention Verification. Approved in March as FIPS 156, the IRDS is a software system that records, stores, and processes information about an organization's data and data processing resources. NCSL's Special Publication 500-149, Guide on Data Entity Naming Conventions, is being used as the basis for developing the report.

NSF GRANT FOR NIST SENIOR RESEARCH FELLOWSHIP

National Science Foundation (NSF) has awarded a grant to the American Statistical Association for the support of a research fellowship program at NIST in the Center for Computing and Applied Mathematics. The research fellow will be selected competitively based on recommendations from an advisory group of leading industrial engineers and statisticians. The fellow will be a guest worker in the Statistical Engineering Division, leading a team effort in cross disciplinary research in process modeling and optimization as a basic approach to quality. NSF has approved this program for 3 years. During this period, several fellows are expected to collaborate with other NIST centers on a number of different processing research projects.

FIRST DEMONSTRATION OF SOLITON-LIKE COMPRESSION OF PULSES FROM OPTICAL FIBER LASER

NIST scientists have demonstrated for the first time that pulses from fiber lasers have the necessary power and spectral purity to produce soliton-like compression in external fibers. This soliton-like reduction in pulse width has previously been observed only in pulses from large, high-power lasers. An application of the work is the development of ultra-high-bit-rate lightwave communications systems. The team mode-locked an erbium fiber laser, formed by optically pumping various lengths of erbium-doped fiber. For a fiber cavity length of 20 m, the resulting pulses are 18 ps wide at a wavelength of 1536 nm and a peak power of 0.5 W. Using a streak camera, the team then measured the width of pulses from the erbium laser that had traversed 14 km of ordinary telecommunications-grade optical fiber and found that they were compressed to 5 ps. At the 0.5-W power level, the nonlinear component of the fiber refractive index is large enough to cause a "chirp" or variation of optical frequency during the pulse. At a wavelength of 1536 nm the group velocity dispersion in most fibers is negative, with the result that the trailing edge of the pulse travels faster than the leading edge, and pulse compression can result from propagation through a fiber.

EIA COMMITTEE ASKS NIST TO DEVELOP STANDARDS FOR FIBER GEOMETRY

Electronic Industries Association Committee FO6.6 on Fibers and Materials has expressed concern over the adequacy of present methods for fiber geometry and asked NIST to develop traceable standards. This request is a result of the committee's preliminary analysis of data from an international comparison of relevant measurement methods. NIST and the British Telecom Research Laboratories (BTRL) carried out an evaluation of the current state of methods for determining the geometry of optical fiber in response to a movement in the lightwave industry to reduce tolerances for physical dimensions of optical fibers. NIST administered the comparisons among U.S. and Japanese laboratories, while BTRL interacted with European laboratories. Twelve single-mode fibers were measured for outside diameter, ovality, and concentricity error. In total, 6 different techniques were evaluated, including microscopy with image processing, image shearing, microscopic interferometry, and Fizeau interferometry. Committees of the Electronic Industries Association (EIA) and the International Telegraph and Telephone Consultative Committee are now studying the results, which will be the subject of a joint NIST-BTRL report following a full analysis of the data.

GMAP SYSTEM ARCHITECTURE INSTALLED AT THE NATIONAL PDES TESTBED

In support of the National Product Data Exchange Specification (PDES) testbed project within the Factory Automation Systems Division of NIST, a guest worker from private industry, has installed the Geometric Modeling Applications Interface Program (GMAP) system architecture for supporting product data technology on the AMRF VAX 11/785. This work was done as part of the technology transfer tasks under the U.S. Air Force. Software tools to facilitate the testing of the current PDES specification are part of the GMAP system architecture and will be made available to the PDES community at large as part of the national PDES testbed.

The GMAP system architecture as installed at NIST supports every entity in the PDES/STEP Version 1.0 draft proposal, available from NTIS as document number PB 89-144794. However, the schema upon which the system currently operates

can be removed and replaced with future versions of PDES/STEP, utilizing the ability of the GMAP system architecture to maintain schema independence. PDES models and application programs can be created under the GMAP system to aid in testing the current draft proposal.

NIST QUALITY-IN-AUTOMATION PROJECT DRAWS MACHINE-TOOL COMPANY COLLABORATORS

The "Quality-in-Automation" project of NIST's Automated Manufacturing Research Facility (AMRF) has brought together senior engineers from a machine-tool company and a measurement-probe company to confer on a new measurement technique being developed within the AMRF.

As part of the AMRF project, CME researchers have developed an architecture for quality control in automated manufacturing, one aspect of which involves on-machine process-intermittent gaging, that is, high-speed automatic measurement of the dimensions of parts between the stages of the machining operations. The senior engineers conferred with CME researchers on configuring probes for machine tools to allow CME research on a generic technique for process-intermittent gaging. Both companies view the work of CME as invaluable in developing such advanced measurement techniques and demonstrating their feasibility on commercially available equipment such as theirs.

CBT DEVELOPS NEW DESIGN PROCEDURE FOR HEAT LOSSES FROM UNDERGROUND PIPING SYSTEMS

CBT has developed a new finite element computer model to estimate heat loss along structural supports for underground insulated steam and hot water pipes enclosed in shallow concrete trenches. Structural supports for these underground pipes are often in direct contact with the hot carrier pipes and form highly conductive heat flow paths through the pipe insulation to the concrete trench and the surrounding earth. The CBT model is based on two-dimensional steady-state heat conduction assuming a rectangular trench containing two insulated pipes with and without pipe supports. Two different configurations of typical structural supports were modelled. Sample calculations showed that heat loss per unit length in the vicinity of these structural supports could be as high as 17 times the value of the insulated pipe alone.

CBT MONITORS THE SOURCE STRENGTHS OF VOLATILE ORGANIC COMPOUNDS IN A MAJOR NEW FEDERAL OFFICE BUILDING

Volatile organic compounds (VOC) emitted into the air of modern office buildings that often lead to "sick building syndrome" are typically thought to be outgas from new materials when a building is first constructed or newly remodelled. CBT has discovered that this observation is not true for at least one new building. Over the last 14 months, CBT researchers have been monitoring the indoor air quality in a newly constructed 10-story federal office building in Portland, OR, beginning with the day of occupancy. They measured VOCs along with CO, CO_2 , respirable particulates, formaldehyde, and radon. In addition, they made measurements of air infiltration, ventilation rates, and interzone air movement. The study indicated that the level of VOCs did not decrease over the monitoring period as would be expected if the predominant source had been building and interior finish materials. The levels remained relatively constant and could be clearly related to occupant activities. The dominant compounds found were C_{10}–C_{11} branched alkanes emitted by 26 liquid process photocopiers and three liquid process plotters. In addition, a number of light hydrocarbons characteristic of vehicle exhaust were found and were traced to vehicles on the loading dock and in three levels of the underground garage. Although the concentration of some of these compounds was relatively high, the level of total organic carbon was three orders of magnitude below specified occupational threshold limit values for exposure to these carbon compounds. The potential for the measured concentrations of these carbon compounds to produce symptoms characteristic of the "sick building syndrome" (i.e., mucous membrane irritation, headache, nausea, and dizziness) is unknown and requires further study by health scientists.

X-RAY METHOD REMOVES AIDS VIRUS FROM EVIDENCE

Researchers at NIST, working with the Federal Bureau of Investigation and the National Cancer Institute, have tested an x-ray technique that wipes out the AIDS virus on criminal evidence without destroying important biological components. Workers in crime laboratories face a potential risk of accidental AIDS infection from exposure to criminal evidence—bloodstained clothing, for example—that may contain body fluids contaminated with the AIDS virus. Though steam

sterilization and related procedures can effectively inactivate the virus, these methods also can destroy important biological components, lessening or even canceling the value of the samples as criminal evidence. The researchers used an industrial radiographic instrument to produce the x rays and bombarded virus-tainted samples with varying intensities of x-ray radiation to determine the smallest amount needed to inactivate the AIDS virus at the lowest detectable concentration of the virus. They arrived at a dose that is about 25,000 times larger than a typical chest x ray but concluded that higher viral concentrations would require even larger radiation doses. The FBI is incorporating the new technique into its forensic labs, and other law enforcement agencies will likely follow suit.

BALDRIGE QUALITY AWARD PROGRAM SEEKS EXAMINERS

The Malcolm Baldrige National Quality Award Program currently seeks applications from individuals who can qualify as examiners. The award is offered annually to American companies that demonstrate the highest levels of total quality management. Information on the program and applications to serve as an examiner are available from the Malcolm Baldrige National Quality Award, NIST, A1123 Administration Bldg., Gaithersburg, MD 20899. As an examiner, the individual is responsible for reviewing and evaluating applications submitted for the award. Those chosen meet the highest standards of qualification and peer recognition and must participate in a preparation course based on the examination items, the scoring criteria, and the examination process. The Board of Examiners now numbers over 130 leading quality experts selected from industry, professional and trade organizations, and universities.

INTERNATIONAL DIRECTORY OF STANDARDS GROUPS UPDATED

The newly revised Directory of International and Regional Organizations Conducting Standards-Related Activities (NIST SP 767) provides information on 338 groups that conduct standardization, certification, and laboratory accreditation activities. The directory is designed to serve the federal agencies, standards writers, manufacturers, exporters, and others concerned with U.S. participation in international standards. With more than 60 new listings, the volume is one in a series to provide information on multinational standards-related endeavors. International and regional organizations are listed in alphabetical order. Information includes acronyms, national affiliations, U.S. participants, membership restrictions, scope of interest, and availability of standards in English. Copies of NIST SP 767 are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Order by stock no. 003-003-02937-8 for $22 prepaid. For a list of other NIST standards-related and certification directories, contact: Office of Standards Code and Information, NIST, A629 Administration Bldg., Gaithersburg, MD 20899; telephone: 301/975-4031.

EQUATION DEVELOPED FOR PREDICTING STEEL BEHAVIOR IN FIRE

NIST scientists have developed an equation for predicting the performance of ASTM A36 structural steel during and after a fire. Designed for personal computers (PCs), the equation predicts the performance of the most commonly used steel in the United States when the material is exposed to fire for periods from 2 min to 8 h over a temperature range from 350 to 650 °C. To assess deformation, an analysis of the various stresses, temperatures, and times involved are required in order to calculate the resulting strains. Each type of strain—elastic, recoverable; plastic, time-independent; and creep, time-dependent—has its own formula. The equation also can be used to construct "deformation mechanism" maps to show the dominant behavior of steel at any given temperature, time, and stress, and to compare the performance of A36 to foreign steels. A report, Elevated Temperature Deformation of Structural Steel (NISTIR 88-3899), with the new equation and information on the correlations between measured and predicted strains for ASTM A36, Australian AS A149, and Japanese SS41 structural steel steels, is available from the National Technical Information Service, Springfield, VA 22161. Order by PB# 89-172621/AS for $21.95 prepaid.

HIGH-QUALITY AMORPHOUS SILICON FILMS PRODUCED

Government, industry, and academia are working to develop an inexpensive source of solar electricity—amorphous silicon photovoltaic solar cells. NIST and University of Colorado researchers at the Joint Institute for Laboratory Astrophysics have produced high-quality hydrogenated amorphous silicon films by decomposing silane gas on a very hot surface and depositing it on a nearby relatively cool 210 °C substrate. The technique uses a

low-pressure feed gas that offers great potential for high deposition rates, above 1 nm/s. The results obtained in this work demonstrate a low incidence of defects, which interfere with the photovoltaic efficiency and electron transport mechanisms. While high deposition rates were not the goal of the research, a low-pressure feed gas can be efficiently dissociated into a large flux of depositing radicals so that the technique looks promising for more efficient production of solar cells. The low pressure also avoids the undesirable production of dust which introduces defects into the deposited layers. A paper describing the process is available from Jo Emery, NIST, Division 104, Boulder, CO 80303; telephone: 303/497-3237.

NON-TOXIC ACIDS ARE BASIS FOR NEW CLASS OF CEMENTS

A new family of nonaqueous dental cements have been developed based on nontoxic dimer and trimer acids. They can be used in temporary fillings, liners, and as a foundation for other restorative materials. The new patented formulations, developed by a NIST scientist, use a dimer and/or a trimer acid derived from the partial polymerization of simple unsaturated fatty acids. These liquids can be mixed with a variety of basic powders used in restorative materials such as zinc oxide and calcium hydroxide. When mixed with powders, the bulky, flexible, hydrophobic nature of the dimer and trimer acids with their relatively low carboxylic acid content produce cements that are tough, low shrinking, water resistant, hydrolytically stable, and nonirritating. These new materials can be replacements for the eugenol cements that are mechanically and hydrolytically weak. For information on the new nonaqueous dental cements, contact: Dr. Joseph M. Antonucci, NIST, A143 Polymers Bldg., Gaithersburg, MD 20899; telephone: 301/975-6794.

QUICK WAY TO MEASURE HEAT CONDUCTION

Researchers from the NIST Center for Building Technology and the Virginia Polytechnic Institute and State University have investigated a quick technique for measuring on-site the heat-conducting properties of building insulation materials. Generally, this information is obtained through laboratory testing. Once in place, however, the material can settle or accumulate moisture and lose some of its insulation value. The new technique uses a thermistor, a semiconductor device, as a probe along with a computer which controls the system and gathers data. Once inserted into the insulation, the probe acts both as a heater and a sensor to measure how the heat is being dissipated through the insulation over time. While the technique does have advantages, it also has limitations—primarily, a lack of suitable calibration materials. A report, Development of an Automated Probe for Thermal Conductivity Measurements (NIST-GCR-89-563), is available from the National Technical Information Service, Springfield, VA 22161. Order by PB# 89-209324 for $21.95 prepaid.

IS THERE A ROBOT IN YOUR FUTURE?

If you work in a federal building, there might be. The use of robotics in factories has exploded within the past decade with over 30,000 robots in use in the United States and more than 200,000 worldwide. Outside factories, using robots to perform tasks such as building operations and maintenance is receiving increased attention. In a study for the General Services Administration (GSA), which constructs, operates, and maintains federal buildings, the NIST Center for Building Technology conducted a state-of-the-art survey of robotic technology. The NIST researchers also identified potential barriers to using service robots in GSA buildings and suggested some changes to GSA's handbook of facility standards to accommodate robotic technology. Assessment of Robotics for Improved Building Operations and Maintenance (NISTIR 88-4006) is available from the National Technical Information Service, Springfield, VA 22161. Order by PB# 89-189237/AS for $15.95 prepaid.

PROPERTIES OF METHANE DEVELOPED

The thermophysical properties of methane have been tabulated by NIST for a large range of fluid states based on recently formulated correlations. The use of improved correlations is important economically because methane is the major constituent of natural gas. The tables include: thermodynamic properties at temperatures from 91 to 600 K and pressures less than 100 MPa, viscosity at temperatures from 91 to 400 K and pressures to 55 MPa, and thermal conductivity from 91 to 600 K and pressures to 100 MPa. Algebraic expressions and associated tables of coefficients are given to permit additional property calculations. A FORTRAN program is listed for the evaluation of methane thermophysical properties using the Schmidt-Wagner equation of state with separate correlations for the viscosity and thermal conductivity. Copies of Tables for the Thermophysical Properties of

Methane (TN 1325) are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Order by stock number 003-003-02947-5 for $23.00 prepaid.

FIBER LASER RESEARCH PROGRESSING

NIST researchers are investigating a laser consisting of a 90-cm length of optical fiber made of glass doped with erbium. The fiber, which has an 11-μm core, is pumped with green continuous-wave (CW) argon laser light at 528 nm. It produces CW infrared laser light at 1540 nm, suitable for transmission through optical fiber networks. NIST's work is aimed at reducing the linewidth of the infrared output to about 1 MHz, from the current 5 to 10 GHz, to realize a wavelength standard in this spectral range. A narrow bandwidth fiber laser could be used as a reference, or possibly the communication source, in a coherent communications system with increased channel capacity. Conventional pulse modulated communications over optical fibers require that the signal be amplified and reconditioned by repeaters at intervals of 30 to 60 km. Coherent communications, on the other hand, do not use wide bandwidth pulses to carry information but can use other techniques, such as closely spaced frequency modulation (FM) channels. Coherent communication signals are less affected by dispersion and do not need reconditioning as often. This means the repeaters could be spaced farther apart, which would reduce the cost of the network.

HAZARD I RELEASED TO HELP REDUCE FIRE DEATHS, COST

NIST released HAZARD I, a unique analysis method and computer program that promises to revolutionize fire safety practices and lead to marked reductions in fire losses and costs. HAZARD I can be used on a personal computer to predict the hazards to occupants in a burning building and the relative contribution of products, such as furniture, to those hazards. It is the first such comprehensive use of fire modeling in the world. HAZARD I can be used in a variety of ways in fields ranging from fire investigation and reconstruction and fire protection engineering to those concerned with product development, manufacturing, and marketing and architectural design. Also, it can be used to help building and fire codes officials evaluate new materials or design and construction techniques. A three-volume report and a set of computer disks are available for $225 from the National Fire Protection Association, One Stop Data Shop, Batterymarch Park, Quincy, MA 02269 or the National Technical Information Service, Springfield, VA 22161. Use PB# 89-215404 when ordering from NTIS.

NIST LAUNCHES CONSORTIUM TO DEVELOP FUTURISTIC LAB

With the goal of pooling the resources of industry, government, and academia to develop a totally automated analytical chemistry laboratory, NIST has instituted the Consortium on Automated Analytical Laboratory Systems (CAALS). Industry will likely welcome this futuristic laboratory, where automated devices—including robots—will perform the entire analytical procedure under the control of a sophisticated computer system. Analytical laboratory work often is labor intensive, performed by high-cost employees using expensive equipment. This makes the millions of yearly chemical analyses quite costly to industry and underscores the potential benefits of an automated laboratory. CAALS will pool the resources of a variety of experts to create a world-class team that will produce a viable robotics system that can be freely adapted. NIST welcomes consortium participants. For more information, contact Dr. H.M. (Skip) Kingston, NIST, A353 Chemistry Bldg., Gaithersburg, MD 20899; telephone: 301/975-4136.

INDUSTRY TO STUDY WEAR OF CERAMICS AT NIST

Private industry is sponsoring a Research Associate Program at NIST to study the tribological characteristics of ceramics and ceramic composites under various temperatures. Researchers will use a NIST high-temperature wear test facility and other special equipment to conduct studies on the friction, wear, and mechanical behavior of advanced ceramic materials. NIST currently is conducting a tribology research program that includes advanced ceramics, coatings, and composites as well as the lubrication requirements of these materials. For further information, contact: Dr. Said Jahanmir, NIST, A215 Metrology Bldg., Gaithersburg, MD 20899; telephone: 301/975-3671.

EVALUATION OF HIGH-FREQUENCY POWER METERS

Accurate power measurements are fundamental to assessing the performance of almost all radiofrequency, microwave, and millimeter wave equipment. Power considerations are also crucial for the design of efficient, cost-effective, and safe systems.

Measurements at these higher frequencies are affected by many factors. Impedance mismatch, interference, leakage, nonlinear effects, and other sources of error must be assessed and minimized. A NIST publication, Performance Evaluation of Radiofrequency, Microwave, and Millimeter Wave Power Meters (NIST TN 1310), describes measurement techniques for evaluating the electrical performance of certain commercially available power meters that use bolometric sensors and operate typically from 10 MHz to 26.5 GHz. TN 1310 is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Order by stock number 003-003-02931-9 for $8.50 prepaid.

PORTLAND CEMENT CLINKER MATERIALS AVAILABLE

Producers of Portland cement have three new cement clinker reference materials (RMs) for assessing the quality of materials during processing. Portland cements produced in the United States are evaluated by ASTM C150, "Standard Specification for Portland Cement" comprising chemical composition, fineness, and performance in physical tests. The materials selected for the RMs differ widely in phase abundance, crystal sizes, and distribution crystals. The phase abundances in weight percent, in RMs 8486, 8487, and 8488, respectively, are 58.47, 73.39, and 64.97 alite; 23.18, 7.75, and 18.51 belite; 1.15, 12.09, and 4.34 aluminate; and 13.68, 3.27, and 12.12 ferrite; along with concentrations of free calcium/oxide, periclase, and alkali sulfate. The phases were determined by point counting using reflected light microscopy. The other properties were determined by chemical analysis. Each RM consists of three hermetically sealed glass vials with approximately 10 grams of crushed clinker. For information on RMs 8486, 8487, and 8488, available for $96 each, contact the Office of Standard Reference Materials, NIST, B311 Chemistry Bldg., Gaithersburg, MD 20899; telephone: 301/975-OSRM (6776).

OH, SAY CAN YOU SEE?

Lighting can be soft or harsh or too dim or too bright or even just right. But, no matter how it is perceived, lighting greatly influences not only our ability to see but also our feelings and even our health. In an effort to understand how lighting affects human performance, researchers at NIST and the Lighting Research Institute studied energy consumption, brightness, and peoples' perceptions of their lighting systems. The researchers used data from 912 workstations in 13 office buildings. Among the findings: About 70 percent of the occupants surveyed were satisfied with their lighting. Of those who were dissatisfied, 37 percent had furniture-integrated task lighting combined with an indirect ambient lighting system. Energy consumption also was higher for this system. Dissatisfaction was related to the patterns of brightness—workstations with lower brightness were less successful. Copies of the report, Evaluating Office Lighting Environments: Second Level Analysis (NISTIR 89-4069), are available from the National Technical Information Service, Springfield, VA 22161. Order by PB# 89-189153 for $21.95 prepaid.

NEW NIST STANDARD REFERENCE DATABASE

NIST Standard Reference Database 17—NIST Chemical Kinetics, released earlier of this year, provides rapid access to kinetics data for gas phase reactions. The database contains more than 8,000 data items on 2,000 separate reactions. Searchable by reactants or by reference, retrievals provide surveys of the literature on a particular reaction, all or subsets of the reactions of a specific species, and the data available from a given paper. NIST Chemical Kinetics, which can function on any MS-DOS or PC-DOS, has rapidly become a best-seller.

CERAMIC POWDERS SYNTHESIS—MAGNETIC MEDIA

The Ceramics and Metallurgy Divisions are examining a new class of magnetic composite materials. These materials consist of ultrafine magnetic particles of less than 20 nm, and offer considerable potential for ultradense magnetic recording media.

Information transmission, storage, and retrieval technologies have experienced phenomenal growth within the past two decades. Thus, there exists a continuing need for new or improved approaches to support this expanding field. For example, the area of magnetic recording is highly dependent on magnetic particulate media.

Magnetic composite materials are generated using sol-gel techniques appropriate to the formation of diphasic iron-silica xerogels. These composites are synthesized by room temperature polymerization and curing of gels derived from solutions of tetraethylorthosilicate, ferric nitrate, and water. The hydrofluoric acid is used as a catalyst. The resulting composite is a homogeneous dispersion of ultrafine iron-containing particles in a silica-like matrix.

The chemical and magnetic states of the iron in these composites can be established in situ by exposure to gaseous reducing or oxidizing environments at temperatures less than 400 °C. Magnetic measurements and Mössbauer spectroscopy on these systems have established that these nanocomposites have magnetic regions with diameters <20 nm. Furthermore, the bulk materials can be controllably engineered to display paramagnetic, superparamagnetic, ferrimagnetic, or ferromagnetic behavior.

EXPERT SYSTEM FOR MATERIAL SELECTION ADVICE FOR THE PETROLEUM INDUSTRY

A knowledge base expert system has been developed in the corrosion data center at NIST in cooperation with the New Zealand Department of Scientific and Industrial Research (DSIR) and the National Association of Corrosion Engineers.

The program operates on personal computers and provides material selection advice for components of pumps used in the downhole environment (sucker rod pumps). Industry standards, together with corrosion advice and information obtained from oil and gas production companies and equipment manufacturers, provide a basis for assessing current industry practice and key environmental factors. The expert system considers a broad range of user-supplied chemical and physical parameters to characterize the anticipated corrosivity of complex downhole environments and the relative suitability of corrosion resistant engineering materials. The system defines the downhole environment by applying rules and inference procedures structured from the domain expertise derived from the information sources. The knowledge base encompasses over 600 rules and provides options of materials selection consultation, review of related domain information, and addition of custom rules to highlight user-specified in-house requirements.

SANDIA TO PARTICIPATE IN COLD NEUTRON FACILITY INSTRUMENT DEVELOPMENT

The Organic and Electronic Materials Department of Sandia National Laboratories (SNL) agreed to participate with NIST in the development and use of two high-resolution instruments at the Cold Neutron Research Facility (CNRF). This is the first such facility in the United States.

The instruments are the high-resolution neutron time-of-flight spectrometer and the back-reflection spectrometer, both of which are already in the preliminary design phase at NIST. Both instruments are for inelastic neutron scattering studies in which the dynamics and interactions of atoms and molecules are elucidated through the observation of their characteristic energy states and diffusive motions. This type of measurement has already proven highly important in studies of dynamic processes in a wide variety of materials and chemical systems; for example, as a probe of catalysis mechanisms, hydrogen interactions with metals, phase transformations, magnetic materials, and in studies of intermolecular potentials and rotational motions in molecules and macromolecules. The two spectrometers being developed at the CNRF will be equal to or better than similar instruments anywhere in the world.

INDUSTRY SUPPORTS RESEARCH ON THE DEVELOPMENT OF OPTICAL WAVEGUIDE SENSORS

A consortium of biotechnology companies has signed a 3-year cooperative research agreement with NIST to support research in the Organic Analytical Research Division of the Center for Analytical Chemistry. The investigation will entail the design, fabrication, and evaluation of planar and fiber optic waveguide phase-sensitive analytical sensors for real-time monitoring. The device will consist of a Mach Zehnder interferometer onto which analyte-specific antibodies have been immobilized. Analyte quantitation will be achieved by measurement of the enthalpy (heat) of the antigen-antibody binding reaction. The heat generated at the sensing arm of the interferometer will perturb the phase of the guided laser light with respect to the reference arm. Interferences common to both arms will be rejected.

The analyte chosen to evaluate the efficacy of the interferometric immunoassay system is BT toxin, a natural insecticide (entomopathogen) produced biotechnologically from a spore-forming bacteria. This mammalian-harmless toxin is used against larval gypsy moths, as well as mosquitoes and blackflies. To maximize the production of toxin, the sporulation cycle must be terminated before sporulation occurs and this requires a real-time, BT toxin-sensitive sensor. By the appropriate choice of antibody, this approach should be applicable to a broad range of analytes.

FEDERAL INFORMATION PROCESSING STANDARD (FIPS) PROPOSED FOR THE USER INTERFACE COMPONENT OF THE APPLICATIONS PORTABILITY PROFILE (APP)

A Federal Register notice announced and requested comments on a proposed FIPS which would adopt the X Protocol, Xlib Interface, XT Intrinsics, and Bitmap Distribution Format specifications of the X Window System, Version 11, Release 3 (X Window System is a trademark of MIT). The standard covers the data stream encoding, data stream interface, and subroutine foundation layers of the reference model for network-based bit-mapped graphic user interface standards, which is detailed in the appendix to the proposed standard.

The proposed standard is part of a series of specifications required for applications portability, the ability to move or port an application from one operating system environment to another. NCSL has proposed an application portability profile that provides an architectural approach to applications portability and consists of a group of standard elements including database management, data interchange, network services, user interfaces, and programming languages.

OPEN SYSTEMS INTERCONNECTION/ INTEGRATED SERVICES DIGITAL NETWORK (OSI/ISDN) TRIAL HELD

To demonstrate the use of ISDN as a lower layer technology for OSI applications, NCSL organized the OSI/ISDN trial as a necessary first step for including ISDN as a lower layer technology in the Government Open Systems Interconnection Profile (GOSIP) Version 2. Approved as Federal Information Processing Standard (FIPS) 146 in 1988, GOSIP specifies a set of OSI protocols for computer networking for use by government agencies in the procurement of products and services. GOSIP Version 1 supports the message handling systems and file transfer, access, and management applications; GOSIP Version 2 proposes additional functionality including Virtual Terminal Service, Office Document Architecture, and ISDN.

The OSI/ISDN trial was held June 20-21, 1989, at Mather Air Force Base, CA. Trial objectives were to support the inclusion of ISDN transport capabilities in the GOSIP Version 2, to demonstrate the operation of OSI applications using ISDN transport capabilities, and to demonstrate the interworking of ISDN and existing transport technologies. Among the ISDN functions tested were CLNP over ISDN X.25, X.25 D-Channel, and X.25 Preallocated B-Channel.

The trial successfully demonstrated two ISDN capabilities: ISDN as a transit subnetwork along an end-to-end communication path where neither source nor the destination are directly attached to the ISDN itself and the transit properties of an ISDN as an OSI subnetwork; and the interconnectivity capability of an ISDN subnetwork with other types of subnetworks and end-to-end communication across multiple interconnected subnetworks where one of the subnetworks is an ISDN.

NIST BREAK-JUNCTION MEASUREMENT PROVIDES FIRST DETERMINATION OF SIS TUNNELING GAP OF A THALLIUM-BASED HIGH-TEMPERATURE SUPERCONDUCTOR

A NIST scientist has carried out the first measurements of the superconductor-insulator-superconductor (SIS) tunneling energy gap in thallium-based high-temperature superconductors. Using the break-junction method he pioneered, the scientist measured crystals grown and characterized at Sandia National Laboratories. Energy gap is a fundamental characteristic of a superconductor and in this case is important to the ultimate understanding of the superconducting behavior in thallium-based and other high-transition-temperature materials. The measured gap value of 30 meV is consistent with the Bardeen-Cooper-Schrieffer theory of superconductivity, applied to the configuration of the break junction. The scientist was able to detect a supercurrent when the break junction was operated in a point-contact mode at temperatures as high as 95 K.

NIST TO PARTICIPATE IN CONSORTIUM ORGANIZED TO STUDY S_2F_{10}

NIST is a participant in a new consortium for studying the formation and detection of disulfurdecafluoride (S_2F_{10}) in electrical power systems. A cooperative investigation led by NIST staff recently confirmed for the first time the presence of this extremely toxic gas (threshold limit value of 10 parts per billion) in sulfur hexafluoride (SF_6) exposed to electrical discharge. Because SF_6 is used widely as an insulating gas in high-voltage electric power transmission systems, serious concern exists about the hazards associated with exposure to decomposed SF_6 during maintenance and repair of electric power equipment such as circuit breakers and gas-insulated transmission lines.

NIST MINIATURE BROADBAND ELECTRIC-FIELD PROBE DESIGN COMMERCIALIZED

Two U.S. organizations are offering commercial versions of the 8-mm electric field probe developed by NIST staff that have an isotropic response of better than ±0.3 dB from 100 kHz to 18 GHz. The NIST probe can measure fields between 1 and 1600 V/m from 1 MHz to 15 GHz, flat to ±2 dB. Probes are available from the Electro-Mechanics Company of Austin, TX and Denver Research Institute (DRI), affiliated with Denver University; the Italian aerospace manufacturer Aeritalia has also indicated its intention to market the probe. The probe's performance is achieved through the use of thin-film dipole elements having a precisely tailored resistive profile.

Calibration Services

NEW AUTOMATED GAGE BLOCK CALIBRATION SYSTEM AT NIST

A new calibration system has been successfully implemented by the NIST gage block laboratory. The new system allows NIST laboratory personnel to implement routinely a measurement assurance program for all NIST reference standard master gage blocks. With the new measurement design, typical estimates for the uncertainty of the calibrations by mechanical intercomparison have already been substantially reduced from between 2.0 and 4.0 μin (0.05 to 0.10 μm) to between 1.0 and 2.0 μin (0.02 to 0.05 μm) or less for gage blocks under 2 in (50 mm). Although uncertainty estimates for the longer gage block sizes have remained unchanged, improved and frequent surveillance of NIST gage block calibration history are expected to reduce presently reported uncertainty estimates for these sizes in the future. The new system includes a database and analysis software to record and monitor the measurement history of customers' gage blocks and, thereby, reduce risks of reporting inaccurate measurements and improving overall measurement confidence.