Volume 95, Number 4, July–August 1990
Journal of Research of the National Institute of Standards and Technology

News Briefs

General Developments

ELECTRIC-FIELD METER DEVELOPED

NIST researchers have developed a new isotropic, photonic electric-field meter capable of measuring continuous-wave electric fields from 10 to 15,000 V/m over a frequency range of 10 kHz to beyond 1 GHz. For pulsed fields, the minimum detectable field is 1,000 V/m. The probe uses electro-optic modulators and optical fiber leads to cause minimum perturbation of the fields being measured and to ensure immunity of the probe to electromagnetic interference. The probe's large bandwidth and its unusual ability to measure both amplitude and phase are its salient characteristics. Potential applications include electromagnetic pulse measurement, the precise measurement of any pulsed field of suitable intensity, and the measurement of fields with multiple frequency components. For a copy of paper no. 63-69, which describes the probe, contact Jo Emery, Division 104, NIST, Boulder, CO 80303; telephone: 303/497-3237.

1990 ANNUAL DIRECTORY OF NVLAP LABS PUBLISHED

The 1990 Directory of NVLAP Accredited Laboratories (NISTIR 90-4280) lists nearly 900 domestic and foreign laboratories that are accredited by the NIST National Voluntary Laboratory Accreditation Program (NVLAP) for specific test methods as of March 1, 1990. The current fields of testing are acoustics; asbestos fiber analysis; carpet; commercial products—paint, paper, plastic, and seals and sealants; computer applications; construction testing services—concrete, cement, aggregates, soil and rock, admixtures, geotextiles, road and paving; electromagnetic compatibility and telecommunications; personnel radiation dosimetry; solid fuel room heaters; and thermal insulation. The labs are listed alphabetically by field of testing. The asbestos labs are listed by state and city. To obtain a copy of the directory, send a self-addressed mailing label to: NVLAP, A124 Building 411, NIST, Gaithersburg, MD 20899; telephone: 301/975-4016. Information also is available by computer on the NVLAP bulletin board at 301/948-2058.

BIOPROCESSING RESEARCH IN SPACE

Since space flight began, effects of weightlessness on man, plants, and animals have been of interest. Initial studies aimed at identifying potential catastrophic consequences of space flight on humans found no serious, immediate effects. Subsequent research has focused on using the weightless environment to answer scientific questions about living matter and physical processes. The effects of gravity on single cells and biochemical purification methods have been studied by teams of scientists, including NIST scientists. In one project, a small fraction of human kidney cells that produce plasminogen activators (enzymes that help dissolve blood clots) was separated in an electric field on a space shuttle mission. The NIST group has analyzed enzymes from these and other fractions of kidney cells. The NIST group also carried out theoretical studies on gravity-related forces inside and outside living cells. The group has flown experiments on suborbital sounding rockets to study the transport of liquids and dissolved materials in biochemical purification processes. For information, contact Paul Todd at the Chemical Engineering Science Division, NIST, Boulder, CO 80303; telephone: 303/497-5563.

MEASURING THERMAL CONDUCTIVITY OF CERAMICS

NIST scientists have developed an instrument to determine thermal conductivity of materials at high temperature. The apparatus, a miniature guarded-

hot-plate, can measure thermal conductivity of ceramics and ceramic composites at temperatures between 700 and 1500 K in neutral or mildly oxidizing atmospheres. The apparatus is made of boron nitride and high-purity alumina. These materials were selected for their thermal and electrical properties as well as high-temperature compatibility with metallic components in the system. Thermocouple-grade platinum and platinum-rhodium wiring are used for both the heater and thermometry elements. Typical specimen diameter is 7 cm with a thickness between 1 and 8 mm. Specimens must be stable at high temperatures and chemically compatible with system components. For a copy of paper no. 68-89, describing the apparatus, contact Jo Emery, Division 104, NIST, Boulder, CO 80303; telephone: 303/497-3237.

COMMERCE REPORT TAGS 1990s "EMERGING TECHNOLOGIES"

Twelve of today's "emerging technologies" will represent a combined world market of about $1 trillion by the year 2000, according to a report issued by the Commerce Department's Technology Administration. Emerging Technologies: A Survey of Technical and Economic Opportunities assesses the competitive position of the United States vis-a-vis Japan and Europe and makes 13 recommendations for actions by industry and government to improve U.S. competitiveness. The emerging technologies cited are advanced materials, superconductors, advanced semiconductor devices, digital imaging technology, high-density data storage, high-performance computing, optoelectronics, artificial intelligence, flexible computer-integrated manufacturing, sensor technology, biotechnology, and medical devices and diagnostics. NIST contributed to the technical analysis sections of the report.

ASTM APPROVES NIST CONE CALORIMETER AS STANDARD

"How big is the fire?" is a question commonly asked by furniture manufacturers regarding the burning behavior of their product. ASTM, a U.S. voluntary standards organization, has approved a test method (E1354) that will help answer that question. Based on a device developed by researchers at NIST, it provides the data critical to predicting the fire hazard of a product from a small sample of material. Traditionally, manufacturers conduct full-scale burn tests on a new piece of furniture to determine its burning behavior. As a more efficient and less costly alternative, the NIST cone calorimeter provides more information than many full-scale tests and at a reduced cost. It measures the heat released and rate at which it is released, the time it takes for a material to ignite, the amount of smoke produced, and the amount of several known toxic gases.

NIST SEEKING PROPOSALS FOR COURSEWARE STANDARDS

Over the next several years, the federal government will invest millions of dollars on computer-based interactive training software, often called "courseware," and the hardware needed to run it. Currently, several manufacturers offer high-performance, low-cost hardware. However, because of proprietary interfaces, software written to run on one manufacturer's product often will not run on another's without expensive reprogramming. Standardizing the protocols that define how software modules communicate will help make it possible to use the courseware on any manufacturer's equipment. Researchers at NIST are considering a possible Federal Information Processing Standard for these protocols. For information, contact Systems and Software Technology Division, B266 Technology Building, NIST, Gaithersburg, MD 20899; telephone: 301/975-3345.

NEW PHASE NOISE MEASUREMENT SYSTEM DEVELOPED

NIST scientists have developed a more accurate system for measuring phase noise in oscillators, amplifiers, frequency synthesizers, and other electronic components. Of interest to military and civilian calibration laboratories and companies producing high-precision navigation and communications equipment, the new system has an accuracy 2 to 4 times that of current commercial equipment, and its frequency range is 25 times greater. It can directly measure phase noise at carrier frequencies from 5 MHz to 26 GHz and from 33 to 50 GHz. With external mixers, the measurement range can be extended beyond 100 GHz. Bandwidths vary from 0.1 Hz to 10 percent of the carrier frequency up to a maximum of 1 GHz. For a copy of paper no. 23-90 describing the system, contact Jo Emery, Division 104, NIST, Boulder, CO 80303; telephone: 303/497-3237.

NIST METHOD ALLOWS QUICKER, CHEAPER ANALYSES

Preparing samples of contaminated soils, sediments, and sludges for analysis of environmentally hazardous trace elements can be time consuming. Typically such preparations, in which the sample is immersed in acid and heated with hot plates and reflux systems, take 8 to 24 h to complete. Now a project of NIST and the Environmental Protection Agency (EPA) has produced a method that uses a heating device similar to a kitchen microwave oven to cut drastically the sample preparation time. Research at NIST has shown that by using microwave energy to heat a sample in acid within a closed vessel, the processing time can be shaved to 10 min. Because so much time is saved, the NIST/EPA method substantially lowers the cost of each analysis. Recent tests also indicate that the new technique will allow trace elements to be detected at lower levels. The method was accepted by EPA after a successful demonstration involving 15 laboratories and will be added to EPA's procedures for its Resource Conservation and Recovery Program and its "Superfund" program.

QUALITY SOFTWARE TO BE FOCUS OF UPCOMING LECTURES

The failure of software used to operate high-integrity systems—such as hospital equipment—can be more than annoying. It can result in injuries or even deaths and can cost businesses millions of dollars. In 1986, for example, several people were killed when a software-controlled radiation therapy machine exposed patients to a massive radiation overdose. To discuss software problems and potential solutions, NIST is sponsoring a lecture series to begin this fall. The first lecture is scheduled for October 23 at 2 p.m. at NIST headquarters in Gaithersburg, MD. Dr. Barry Boehm of the Defense Advanced Research Projects Agency will discuss software engineering and the major issues that must be addressed in developing and operating high-integrity systems. For information, contact Dolores Wallace at NIST, telephone: 301/975-3340.

FIRST LABS ACCREDITED FOR EMI TESTING

The first group of testing laboratories has been accredited under the National Voluntary Laboratory Accreditation Program (NVLAP) for selected test methods in a military standard (MIL STD-462) for measuring electromagnetic interference (EMI) characteristics. The labs, eight from the private sector and one U.S. Navy facility, are accredited under the Electromagnetic Compatibility and Telecommunications Testing Program managed by NIST. MIL STD-462 is the test method companion to MIL STD-461, "Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference." The U.S. Naval Air Systems Command (NAVAIR) has instructed the use of NVLAP accredited labs for certain NAVAIR procurement processes. The accredited labs had applied to NVLAP for accreditation in up to 25 test methods in radiated emissions, conducted emissions, radiated susceptibility, and conducted susceptibility. For information on this program, contact: Jeffrey Horlick, A124 Building 411, NIST, Gaithersburg, MD 20899; telephone: 301/975-4016; fax: 301/975-3839.

STANDARDS FOR LOW-TEMPERATURE SUPERCONDUCTORS

NIST has a highly successful program to develop standards for conventional (low-temperature) superconductors in support of Department of Energy large-scale applications such as the Superconducting Super Collider. Standardized measurement techniques developed by NIST have saved time and money and resulted in better communication among researchers, producers, and users of superconductors. The latest report on this program, covering 1988 and 1989, contains results of critical-current studies on a large conductor Reference Material, the effect of power supply current ripple, the measurements of large conductors, and an interlaboratory comparison of niobium-tin wires. It also discusses magnetic losses in multifilamentary niobium-tin and niobium-titanium wires. Development of Standards for Superconductors, Final Report, January 1988-December 1989 (NISTIR 90-3935) is available from the National Technical Information Service, Springfield, Va. 22161. Order by PB #90-196536 for $23 prepaid.

COMPUTER CONTROL TO ASSURE QUALITY WELDS

NIST scientists have developed a computer-aided system to study the behavior of a welding arc in real time and the transfer of the metal through the arc to the weld. Using a microcomputer, the researchers analyze the fluctuations in the current and voltage values as a function of various welding parameters such as power supply voltage setting. This analysis then allows them to control, in real

time, the stability of the arc and the uniformity of metal transfer from the wire to the weld joint. "Computer control that can achieve the same weld integrity and consistency as an experienced welder permits substantial automation and the resultant benefits," they report in Welding Journal. The work is part of on-going NIST research to develop measurement technology that improves the welding process. For a copy of the article, paper no. 25-90, contact Jo Emery, Division 104, NIST, Boulder, CO 80303; telephone: 303/497-3237.

MECHANICAL PROPERTIES AND PERFORMANCE GROUP ESTABLISHED

NIST has established a new group on mechanical properties and performance to address national needs for expanded capabilities in the mechanical characterization of engineering materials and components. Chief among these needs are industrial requirements for mechanical test methods for new kinds of materials (e.g., intermetallics and composites) and for mechanical property measurements from the micro scale (e.g., electronic solder connections) to multimillion pound-force scales (e.g., fracture behavior in pressure vessel steels).

The group has a twofold mission. The first is to develop new and improved test methods and standards that will facilitate reliable measurements of mechanical behavior under various kinds of severe environmental and operating conditions that are experienced both in processing and in service. The second is to provide expert analytical and mechanical testing services for other parts of NIST, for other government agencies, and, under certain conditions, for the private sector, too. The extensive facilities available for this work include a wide range of mechanical testing equipment with associated instrumentation for tensile, compressive, and torsion tests, and also for various combined load and fracture tests. In addition, separate, well-equipped laboratories are devoted to fatigue, creep, impact, and hardness testing. The staff has experience in all of these areas as well as in the related fields of analytical fracture mechanics, failure analysis, quantitative metallography, stress analysis, and modeling of mechanical processes.

OXYGEN COMPATIBILITY OF ALUMINUM-LITHIUM ALLOYS

Aluminum-lithium alloys offer significant advantages for aerospace applications due primarily to their high strength-to-weight ratio. In considering aluminum-lithium alloys for the advanced launch system (ALS), the Air Force was concerned about their oxygen compatibility. Initial tests indicated that aluminum-lithium was extremely reactive and not suitable for use in an oxygen environment. The Air Force asked NIST to conduct oxygen compatibility tests on aluminum-lithium alloys in accordance with NASA standards. Subsequent testing revealed that aluminum-lithium alloys and currently used alloys are about equally reactive in oxygen-compatibility, mechanical impact tests, but less flammable as indicated in promoted combustion tests. Since these new alloys are still under consideration for possible use in the ALS program, the mechanical performance of aluminum-lithium alloys is now being evaluated.

OAK RIDGE NATIONAL LABORATORY AND NIST COLLABORATE ON SUPERMIRRORS

Oak Ridge National Laboratory (ORNL), NIST, and industry are currently conducting a joint program of research and development of the neutron optical devices known as supermirrors. These thin-film, layered structures are vapor deposited in a particular sequence with appropriate materials so that the critical angle for total external reflection for neutrons is significantly enhanced. Supermirror guides transport neutron beams from reactor (or other) source to experimental station with significantly increased intensity relative to conventional guides.

NIST scientists are measuring the reflectivity of the supermirrors using a neutron reflectometer at the NIST reactor. The effect of interfacial roughness and diffusion between layers is also being studied by analyzing the diffuse scattering of neutrons and x rays by the supermirrors. To complement the diffraction data, real space images of the multilayers in cross section will be obtained by NIST's microanalysis research group using transmission electron microscopy. The interfacial roughness decreases neutron specular reflectivity and consequently the transport efficiency of the guide tube. It is, therefore, important to determine which manufacturing processes and which materials minimize this roughness. Because neutrons make many reflections in a typical guide tube, high reflectivities ($\geqslant$98%) are required. Thus far, supermirror reflectivities have been produced with critical angles about twice that obtained using an ordinary Ni film, which is two-thirds of what is sought.

NIST INSTALLS NEW HIGH-CURRENT 420 kV X-RADIOGRAPHY FACILITY

NIST has installed a new high-current, high-energy, industrial radiography source. The new facility, available to all NIST researchers as well as outside industry users, greatly expands NIST's on-site capabilities for industrial radiographic applications. The high energy (420 kV) and high current (10 mA) will permit imaging through 10 cm of steel. In a recent application for the American Dental Association Paffenbarger Research Center, zirconium alloy ingots were radiographed to select specimens free of internal casting defects prior to machining.

The x-ray tube is mounted on a movable gantry to permit various beam orientations. The source is rated for 100 percent duty cycle and provides for automatic timing of exposures from 1 to 100 min or may be operated manually for any period. The stable high-current device is also well suited for x-ray fluorescence studies in basic physics. For example, NIST scientists plan to use the source to stimulate fluorescence from actinide elements.

DECOMPOSITION OF ENERGETIC MOLECULES FROM METASTABLE VIBRATIONAL STATES

Energetic molecules important for rocket fuels or explosives are in many cases unstable at room temperature. This instability occurs because a few vibrationally excited molecules, always present in chemical systems at thermal equilibrium, have sufficient energy to decompose; under certain conditions such unimolecular fragmentation events trigger violent chain reactions. Experiments performed at NIST take advantage of the unimolecular decomposition process to obtain new insight into the nature of the forces that bind energetic molecules and determine their stability.

The experiments provide an extraordinary microscopic view of the motion of individual atoms as vibrationally excited molecules evolve into fragments. The measurements allow NIST scientists to deduce the geometry, energy, and forces acting within molecules at the instant of fragmentation. Specific vibrational motions were excited in HN_3 using ps and ns pulsed visible lasers. Subsequent evolution of these energized molecules was observed using time-delayed ultraviolet laser pulses to excite fluorescence from emerging NH fragments.

The product states and appearance rates are highly dependent upon the initial vibrational motion and energy. For example, molecules energized to $v_{NH}=5$ and 6 decompose to produce exclusively $NH(X^3\Sigma)$ fragments (called the spin-forbidden channel), while at higher energies, when $v_{NH}=7$ is excited, $NH(a^1\Delta)$ products prevail (the spin-allowed channel). Characteristic lifetimes for fragmentation of vibrationally excited HN_3 range over 4 orders of magnitude, from 200 ns for $v_{NH}=5$ to approximately 10 ps for $v_{NH}=7$. The rapid increase of dissociation rate with increasing vibrational energy was completely unexpected and has forced a rethinking of the decomposition process. The lifetime data are important for understanding the stability of many energetic molecules and have never before been experimentally obtained.

REVISED POSIX STANDARD APPROVED

The Secretary of Commerce approved a revision to Federal Information Processing Standard (FIPS) 151, POSIX: Portable Operating System Interface for Computer Environments. Effective September 28, 1990, the revised FIPS 151-1 adopts IEEE Standard 1003.1-1988, which defines a C language source interface to an operating system environment. FIPS 151-1 will permit federal agencies to exercise more effective control over the production, management, and use of information resources by promoting the portability of computer applications at the source code level.

GLOBAL POTENTIAL OF OPEN SYSTEMS INTERCONNECTION (OSI) TECHNOLOGY DEMONSTRATED

OSINET, a regional OSI research and demonstration network administered by NIST, joined forces with four other regional networks to demonstrate the worldwide interoperability achievable using OSI products. The March 1990 CeBit trade show in Hanover, West Germany, was the site of the launch event for a global collaboration effort called OSIone, which includes regional networks from Australia (OSIcom), Europe (EurOSInet), Japan (INTAPNET), and Singapore (OSNET) in addition to OSINET.

The OSIone demonstration featured a business transaction using OSI electronic mail services to transfer data and documents between the OSIone platform at CeBit and satellite locations around the world served by the OSIone networks. Participants in the demonstration included Digital Equipment Corporation, Hewlett-Packard, Xerox, and NCR Corporation. Each OSIone network will host a similar demonstration in the next 18 months.

HYPERTEXT STANDARDIZATION WORKSHOP PROCEEDINGS PUBLISHED

NIST Special Publication 500-178, Proceedings of the Hypertext Standardization Workshop January 16-18, 1990, presents the results of the first workshop sponsored by NIST's hypertext project. The workshop, which attracted about 65 participants, provided a forum for presentation and discussion of existing and proposed approaches to hypertext standardization. The workshop goals were to consider hypertext system definitions, to identify viable approaches for pursuing standards, to seek commonality among alternatives whenever possible, and to progress towards a coordinated plan for standard development, i.e., a hypertext reference model. Future workshops are planned.

NIST BEGINS STRUCTURED QUERY LANGUAGE (SQL) VALIDATION SERVICE

NIST opened an SQL validation service to provide an independent source of analysis of vendor conformance to FIPS 127-1, Database Language SQL. Performed on a cost-reimbursable basis, the service will review the supplier's conformance testing procedures, witness the testing, and evaluate test results. Using version 2.0 of the SQL test suite, the validation service will produce a registered SQL validation report. NIST will publish a listing of validated implementations on a quarterly basis.

HIGH-QUALITY IN-SITU $YBA_2CU_3O_7$ FILMS FABRICATED USING A NEW STATE-OF-THE-ART DEPOSITION SYSTEM

NIST has put into operation a multiworkstation deposition system for thin films and used it to produce epitaxial films of the ceramic high-critical-temperature superconductor $YBa_2Cu_3O_7$. These films have been measured to show zero resistance at temperatures over 88 K. The process is an in-situ sputter process on MgO substrates. The films were made in the unusually short time of within 3 weeks of acceptance of the new system, which was specified by NIST to have the capability for carrying out a number of processing steps without a requirement for breaking vacuum between steps. Other specified capabilities include the deposition of a large variety of contact layers, in-situ anneals, ion beam cleaning and edge milling, and provision for vacuum transfer of specimens to other systems, i.e., for surface analysis. The substrate temperature can be controlled over a range of 77 to 1200 K. NIST plans to use the system to develop ultra-low-resistivity thin-film contacts for both superconducting and semiconducting cryogenic electronics, to produce thin-film weak-link structures for magnetic field detectors, and to fabricate superlattices.

U.S./CANADA RENEW SI UNIT AGREEMENTS, ADD OTHERS

NIST and the Canadian National Research Council (NRC) have renewed statements recognizing the equivalency of their national standards for five units of physical measurement as defined by the International System of Units (SI). NIST director John W. Lyons and NRC president Pierre O. Perron signed agreements on June 11, 1990, in Ottawa, renewing the recognition of equivalency of standards for electric capacitance, electric resistance, length, time, and voltage. New statements also were signed to recognize the equivalency of the national standards for the SI units of mass and luminous intensity, and for the measurement of temperature, as well as the national time scales of the United States and Canada. The statement for the measurement of temperature reflects the new International Temperature Scale adopted by the International Committee of Weights and Measures effective Jan. 1, 1990. The official equivalency of these units is important for improving trade between the two countries. For information contact: Dr. Barry N. Taylor, B160 Physics Building, NIST, Gaithersburg, MD 20899, 301/975-4220.

COOPERATIVE PROGRAM TACKLES AUTOMATED INSPECTION

Six industrial firms have joined forces with NIST in a cooperative research program to develop an automated inspection system for manufactured parts. The six firms will provide software, machines, and researchers to the NIST "Quality in Automation" program. Researchers use the contributed software and machines for three-dimensional computer-aided design of parts, graphic selection of inspection paths, and examination of the actual manufactured product. Engineers compare the manufactured parts with the original computer-aided design. NIST shares research results with the respective firms, providing suggestions for improvements, compatibility, and expansion of the products. For information on the program, contact Steven D. Phillips, A107 Metrology Building, NIST, Gaithersburg, MD 20899, 301/975-3565.

DATE SET FOR UNIFORM GAS PUMP PRICING

The nation's weights and measures officials set January 1, 1999 as the target date for establishing national uniformity in motor-fuel dispensers used in multi-tier pricing. The decision affects gasoline service station pumps and other motor-fuel dispensers that use different prices for the fuel depending on whether it is paid for in cash or by credit card. The decision was made at the 75th Anniversary Annual Meeting of the National Conference on Weights and Measures (NCWM), in Washington, DC. This concludes action for implementing a policy adopted by the conference in 1989 requiring that all dispensers used in the multi-tier pricing of motor fuels must either be able to compute the accurate total sale price for each unit price used—generally cash or credit—or must be dedicated to sell only at one unit price. For information on NCWM and the annual meeting, contact the National Conference on Weights and Measures, P.O. Box 4025, Gaithersburg, MD 20855, 301/975-4012.

DESIGN FOR A RADIOSCOPIC IMAGE QUALITY INDICATOR

A long-established way to test the quality of a weld is to x-ray it and analyze the film for flaws and imperfections. More recently, this process has been computerized and digitized so that film can be replaced by an electronic system that projects the image on a video screen. This permits real-time examination of the weld and improves productivity by allowing the object to be rotated during inspection. But the procedure has been inhibited by lack of an indicator that evaluates image quality as the specimen and its associated image quality indicator (IQI) are rotated. NIST scientists have developed a design for an indicator that has spherical symmetry and provides the same image quality information independent of rotation. "Preliminary investigations, including image analysis of film radiographs, indicate that the central portion of the IQI can be used to measure thickness sensitivity to the 1 percent and 2 percent levels," the scientists report. Future work will be aimed at developing a technique to give quantitative measurements of quality. For a copy of paper no. 24-90, which describes the design, contact Jo Emery, Division 104, NIST, Boulder, CO 80303, 303/497-3237.

NOVEL PROCESS FOR GROWING CRYSTALS

NIST scientists have developed a novel process, called osmotic dewatering, for growing single crystals of inorganic and organic materials, including proteins. Osmotic dewatering occurs when two aqueous salt solutions are separated by a semipermeable membrane through which only water can pass; the osmotic pressure difference causes slow transport of water from the dilute solution containing a protein to a concentrated salt solution. The process removes water, and only water, from the mother liquor in which crystals are grown. The method permits slow and controllable nucleation and growth needed to form large, single crystals suitable for study by x-ray crystallography. Using this method, the NIST scientists have grown crystals of lysozyme, a protein, to about 1 mm in size and of high quality for x-ray crystallography. They also have grown crystals of triglycine sulfate, a material used in electronic applications. A paper, no. 35-90, describing the process is available from Jo Emery, Division 104, NIST, Boulder, CO 80303, 303/497-3237.

SECURITY FOR "OPEN" NETWORKS

In addition to their many advantages, computer networks have opened up new opportunities for mischief and crime. Through the National Security Agency's (NSA) Secure Data Network System (SDNS) project, NIST is working with NSA and private industry to help make networks secure as well as "open." Their goal is to develop a framework of computer security standards that manufacturers can use in network products incorporating Open Systems Interconnection protocols. NIST has compiled 10 documents from phase one of the SDNS project into three publications, which include specifications for controlling access to the network, security protocols for protecting data in networks, and procedures for managing the keys needed to encrypt and decrypt information. NIST would like potential users and vendors of security products to comment on these three documents: Secure Data Network System (SDNS) Network, Transport, and Message Security Protocols (NISTIR 90-4250); Secure Data Network System (SDNS) Access Control Documents (NISTIR 90-4259); and Secure Data Network System (SDNS) Key Management Documents (NISTIR 90-4262). They are available from the National Technical Information Service, Springfield, VA. Call 703/487-4600 for ordering information.

NIST GATT STANDARDS CODE ACTIVITIES REPORTED

GATT Standards Code Activities of the National Institute of Standards and Technology (NIST) 1989 (NISTIR 4314) describes the role of the NIST Standards Code and Information Program (SCI) in support of the GATT Agreement on Technical Barriers to Trade (GATT Standards Code). The annual report also gives statistics on 10 years of the code's implementation in the United States. SCI staff operate the U.S. GATT inquiry point for information on standards and certification activities that might affect U.S. trade. SCI also coordinates comments on foreign regulations, arranges for translations of foreign texts, and maintains the GATT "hotline" (301/975-4041, not toll free) that provides the latest information on notifications of proposed foreign regulations issued by the GATT Secretariat in Geneva. To obtain a copy of the report, send a self-addressed mailing label to Standards Code and Information Program, A629 Administration Building, NIST, Gaithersburg, MD 20899, 301/975-4037.

COMPUTERIZED WELDING DATA AVAILABLE

Persons interested in the computerization of welding data will want to get a new publication from NIST that includes the proceedings of a 1988 conference on this subject. The publication presents an overview of computers and databases, papers on applications software, and various case studies. Specific topics include application of artificial intelligence to welding, on-line access to worldwide sources of materials performance data, a weld improvement program, and expert systems for diagnosing problems in welding power sources. The publication also includes the proceedings of a workshop on future computerization needs in the welding industry and an informal survey of registrants' use of computers on the job. Computerization of Welding Data—Proceedings of the Conference and Workshop (NIST Special Publication 781) is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Order by stock no. 003-003-03006-6 for $5 prepaid.

IMPROVED TESTING FOR EM SUSCEPTIBILITY

Two new NIST publications discuss improved methods for testing aircraft, large operational systems, and electronic equipment for susceptibility to electromagnetic (EM) fields. Recent Improvements in Time-Domain EMC Measurement System (NISTIR 89-3927) describes techniques for determining critical resonant frequencies and the current response of internal wiring of helicopters due to external EM fields. The measurement method uses a train of low-level radiated pulses that do not disturb other spectrum users, are safe, and can be used in a noisy EM environment. Facilities for Improving Evaluations of Electromagnetic Susceptibilities of Weapon Systems and Electronic Equipment (NISTIR 89-3928) discusses the preliminary design of a facility for EM susceptibility testing that combines features of the transverse electromagnetic cell for low- frequency testing and the reverberating chamber for high-frequency operation. Both publications are available from the National Technical Information Service, Springfield, VA 22161. Order NISTIR 89-3927 by PB #90-155821 for $15; order NISTIR 89-3928 by PB #90-155862 for $15.

NEAR-FIELD GAIN OF PYRAMIDAL HORNS

Calibrations of electromagnetic probes, electromagnetic interference and compatibility tests, and antenna measurements are carried out in the NIST anechoic chamber. They require that a transmitting antenna in the chamber generate a known field throughout a certain volume. At NIST, a series of pyramidal transmitting horns are used above 450 MHz. NIST has published a comparison of the theoretical and measured near-field gains of these horns for frequencies from 18 to 40 GHz. Near-Field Gain of Pyramidal Horns from 18 to 40 GHz (NISTIR 89-3924) describes the theory and measurement techniques used and shows that the discrepancy between theory and measurement is typically within ± 0.3 dB for distances between 0.5 and 4 m from the horn aperture. NISTIR 89-3924 is available from the National Technical Information Service, Springfield, VA 22161. Order by PB #90-155854 for $15.

Calibration Services

NOISE CALIBRATIONS EXTENDED

Coaxial noise sources can now be calibrated by NIST in the additional frequency range of 1 to 2 GHz, and sources with APC3.5 precision connectors can now be accommodated in the 2- to 12-GHz range. With these new services, NIST can now calibrate sources from 1 to 12 GHz with precision N, APC7, GR900, and various rectangular waveguide flange connectors. Sources with APC3.5 connectors can be calibrated at 2 to 12 GHz for all noise power spectral densities up to 18,000 K. The frequency range for APC3.5 connectors is expected to be extended down to 1 GHz by the end of September 1990. Measurement uncertainties typically range from 1 to 3 percent. Noise calibrations are needed by manufacturers and users of microwave equipment because noise is the ultimate limiting factor in electromagnetic system performance. Low-noise products are specified so that the equipment itself doesn't distort the signal being processed. Test equipment must be calibrated to determine if the products meet specifications. For information, contact George J. Counas, Division 723.02, NIST, Boulder, CO 80303; telephone: 303/497-3664.

Standard Reference Materials

LOW-ALLOY STEEL STANDARDS AVAILABLE FOR PRODUCERS

Two new standard reference materials (SRMs) are available from NIST for producers to use in determining the carbon and sulfur content in metals. The SRMs should be particularly useful in calibrating automated combustion analyzer systems as well as for other quality control procedures, including specification testing to meet industry and government requirements. The low-alloy steel standards are in the form of pins that are 4 mm in diameter, 12 mm in length, and approximately 1 g each in weight. SRM 2159 is certified for 0.016 percent of carbon and 0.0023 percent sulfur by weight, and SRM 2160 is certified for 0.584 percent carbon and 0.012 percent sulfur by weight. SRMs 2159 and 2160 are available in units of 200 g for $200 from the Standard Reference Materials Program, Room 204, Building 202, NIST, Gaithersburg, MD 20899; telephone: 301/975-OSRM (6776), FAX: 301/948-3730.

AQUEOUS SOLUTIONS VALUABLE FOR CALIBRATING INSTRUMENTS

To ensure accurate measurements, chemists frequently need single-element standard solutions that can be used to calibrate instruments for analytical techniques such as atomic absorption spectrometry, optical emission (plasma) spectrometry, or spectrophotometry. For several years, NIST has sold individual aqueous solutions of several elements for these purposes. Now the agency is making available separate spectrometric standard solutions for the metals lanthanum and scandium. These standard reference materials (SRMs) are each certified to contain an elemental concentration of 10 mg/mL in a 50-mL solution. The materials, SRM 3127 (lanthanum) and SRM 3148 (scandium), are available for $76 and $144, respectively, from the Office of Standard Reference Materials, Room 204, Building 202, NIST, Gaithersburg, MD 20899; telephone: 301/975-6776.

Standard Reference Data

PC DATABASE AVAILABLE FOR BIOCHEMISTS

A new computerized database for biochemists in industrial laboratories and universities worldwide brings together for the first time all of the published information on the successful crystallization of proteins and nucleic acids. This important research tool for the design of new drugs and chemical processes was developed by a NIST research chemist. The database is designed for personal computers and contains crystal data and the crystallization conditions for more than 1,000 crystal forms of over 600 biological macromolecules. For each crystal entry there is a complete description of crystallization conditions and related crystallographic data. Also provided are evaluated critical data on the physical characteristics of known crystals, including unit cell parameters, space group, crystal density, and diffraction limit. NIST/CARB Biological Macromolecule Crystallization Data-

base, Standard Reference Database 21 is available for $300 from Standard Reference Data Program, A323 Physics Building, NIST, Gaithersburg, MD 20899; telephone: 301/975-2208.

PC DATABASE FOR EVALUATING REFRIGERANTS ANNOUNCED

Refrigeration engineers, chemical and equipment manufacturers, and others who use chlorofluorocarbons have a new research tool. A new personal computer (PC) software package enables users to assess several environmentally acceptable refrigerants and mixtures as possible replacements for currently used materials. The NIST Thermodynamic Properties of Refrigerant Mixtures (REFPROP) Database can produce rapidly tables of the thermodynamic properties for 15 partially and fully halogenated chlorofluorocarbon refrigerants and 20 of their mixtures. Users also have the option to calculate other mixtures of the 15 refrigerants by using their own data. The refrigerants in the REFPROP program are: R11, R12, R13, R13B1, R14, R22, R23, R113, R114, R123, R124, R134, R134a, R142b, and R152a. The database is designed to be stored on a hard disk of any AT or XT-class PC and occupies 250 kilobytes. To order NIST Standard Reference Database 23, REFPROP, available for $225, contact: Standard Reference Data Program, A323 Physics Building, NIST, Gaithersburg, MD 20899; telephone: 301/975-2208.

NEW VEEL PC PROGRAM OFFERS RAPID ACCESS TO DATA

A new personal computer (PC) program gives chemists, environmentalists, combustion engineers, and researchers in industry rapid access to all important published information available on the vibrational and electronic energy levels of short-lived molecules important to many complex reactions. The program consists of two searchable databases that contain experimental data on the vibrational fundamentals of ground-state transient molecules with 3 to 16 atoms, excited-state transient molecules with 3 to 6 atoms, and the electronic energy levels of transient molecules with 3 to 6 atoms, along with associated index and reference files. Search paths are available by molecule (formula or Chemical Abstract Service registry number), by transition wavenumber (vibrational fundamental or electronic band origin), and by wavelength range for electronic transitions. To order NIST Vibrational and Electronic Energy Levels of Small Polyatomic Transient Molecules Database (VEEL), Standard Reference Database 26, contact Standard Reference Data Program, A323 Physics Building, NIST, Gaithersburg, MD 20899, 301/975-2208.

MAJOR EXPANSION ANNOUNCED FOR MASS SPECTRAL DATABASE

More than 4,000 new analytical mass spectra have been added to the NIST/EPA/MSDC Mass Spectral Database, a major international resource used by analytical chemists and environmental scientists to identify unknown substances. The database now contains complete spectra for approximately 54,000 chemical compounds. A major research effort has corrected several thousand errors that had crept into the data collection over the years. Mass spectrometry is an analytical technique used widely in pharmaceutical, biological, and environmental research as well as in the chemical industry. EPA requires environmentalists to use this database for analyzing "tentatively identified compounds" at hazardous waste sites. The database is available on standard diskettes for personal computers (PCs) or on magnetic tape. To order PC Version 3.0, or to obtain a license agreement for the database in magnetic-tape form, contact the Standard Reference Data Program, A323 Physics Building, NIST, Gaithersburg, MD 20899, 301/975-2208.

NEW MASS SPECTRAL DATABASE OF COMMON COMPOUNDS

The NIST Mass Spectral Database of Common Compounds (Standard Reference Database 1B) is a new personal computer-based (PC) collection of 10,215 complete spectra and data for the most commercially available chemical compounds, widely used drugs, and environmentally important compounds. Diagrams showing the molecular structures of 97 percent of the chemicals are included. The database uses the same fast software for data searches that was developed for the larger NIST /EPA/MSDC Mass Spectral Database. The new database will be useful as a teaching aid, or for researchers with limited disk storage space. The database does not qualify under EPA regulations for reporting "tentatively identified compounds" at hazardous waste sites. Standard Reference Database 1B is available for $350 from the Standard Reference Data Program, A323 Physics Building, NIST, Gaithersburg, MD 20899, 301/975-2208.