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News Briefs

General Developments

Inquiries about News Briefs, where no contact person is identified, should be referred to the Managing Editor, Journal of Research, National Institute of Standards and Technology, Building 820, Room 126, Gaithersburg, MD 20899-0001; telephone: 301/975-3577.

NIST'S OPEN ARCHITECTURE CONTROLLER SEALS THE DEAL BETWEEN TWO SMALL MACHINE SHOPS

NIST's Enhanced Machine Controller (EMC) freeware recently "sealed-the-deal" in the sale of a private company's refurbished milling machine to a second private company. These two local small machine shops are taking advantage of NIST-developed low-cost/high-tech open-architecture technology to enhance their business.

NIST engineers have been working with industry groups to develop and validate standards for open architecture control of machine tools and other manufacturing equipment. The EMC project has supported the validation effort by establishing testbeds on machine tools at a major automotive company and a major aircraft manufacturer. A pilot installation investigating low-cost implementations of open architecture concepts was installed at a small job shop in Randallstown, MD. This testbed demonstrated the feasibility of complete PC-based control, eliminating much of the costly special-purpose hardware typically required for real-time control. The EMC was installed on a three-axis vertical-milling machine, replacing the original controller that had broken. The resulting system proved so cost effective that it led to the subsequent sale of the machine to a York, Pa. compnay, which makes heat exchangers. Technicians at the York company are running the machine daily, using it for drilling and milling operations. One significant benefit of an open architecture is the use of commodity PC components and the ability to easily network the controller with the York company's Windows 95 office PCs. As a result, programmers can use PC-based computer-aided design/computer-aided manufacturing software to write programs in their offices, which are transferred directly to the EMC on the shop floor.

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FIRE DETECTION CALIBRATOR COMES ONLINE

NIST is providing the measurement technology for the future of fire detection. Current smoke detectors provide a go/no-go signal in the presence of fire-generated particles. Unfortunately, similar aerosols are produced from other sources such as cooking and condensing shower steam. In residences, these nuisance alarms often lead to disregard of real fire signals and disconnection of the sensors. In the cargo holds of commercial aircraft, they can force a pilot to undertake an emergency landing. Now, manufacturers are developing a new generation of fire monitors with two different features: they will contain more than one type of sensor and they will interpret the responses of the sensors.

NIST scientists have developed a device to measure the response of both current and future fire product sensors. Built as a result of meetings with fire equipment manufacturers, the fire-emulator/detector-evaluator (FE/DE) is a laboratory wind tunnel that reproduces the fire environment that a sensor will experience. The FE/DE can also simulate the non-fire signals that can lead to nuisance alarms. Thus a manufacturer can obtain data on sensitivity to both the fires of concern and the stimuli to be ignored. These performance data on sensors of different types and designs will enable the industry to produce smart fire detectors both for stand-alone use and for integration into intelligent buildings.

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NIST'S CRYPTOGRAPHIC MODULE VALIDATIONS APPROACH TWENTY

On June 29, 1998, the DS1954 Cryptographic iButton™, became the 19th cryptographic module to be validated by NIST's Cryptographic Module Validation Program (CMV) for use by Federal agencies. The module was validated as conforming to FIPS 140-1, Security Requirements for Cryptographic Modules. FIPS 140-1 specifies four separate levels of security provided by Cryptographic Modules, with each level providing increased security and assurance. The iButton™ was validated to an overall FIPS 140-1 Level 2, with Physical Security and EMI/EMC at Level 3. Additionally, the module met the Environmental Failure Protection requirements of Level 4.

This new validation impacts Federal agencies by further increasing the number of cryptographic products available for use in securing sensitive information. The Cryptographic iButton™ provides hardware cryptographic services such as secure private key storage, a high-speed math accelerator for 1024 bit public key cryptography, and secure message digest (hashing). Services are provided using a single silicon chip packaged in a 16 mm stainless steel case. Thus, the iButton™ can be worn by a person or attached to an object for up-to-date information at the point of use. The steel button is rugged enough to withstand harsh outdoor environments and is durable enough for a person to wear everyday on a digital accessory like a ring, key fob, wallet, or badge.

The CMV program is a joint effort between NIST and the Communications Security Establishment (CSE) of the Government of Canada. NIST's security technology group together with CSE, serves as the validation authorities for the program. Currently, there are three National Voluntary Laboratory Accreditation Program accredited laboratories that test cryptographic modules: InfoGard Laboratories of San Luis Obispo, CA; CygnaCom Solutions Laboratory of McLean, VA; and DOMUS Software Limited ITSEC Laboratory of Ottawa, Ontario, Canada.

For more information on FIPS 140-1, validated modules, and the accredited laboratories, see the web site at http://csrc.nist.gov/cryptval.

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NIST RESEARCHER SPEARHEADS DEVELOPMENT OF FIRST FLAT-PANEL DISPLAY MEASUREMENT STANDARD

The Video Electronic Standards Association (VESA) has just published a new standard whose development has been led by a NIST researcher entitled "Flat Panel Display Measurement (FPDM) Standard, (version 1.0)." Both hard-copy and CD-ROM formats are available. The NIST researcher chairs the VESA FPDM working group that developed the standard; in addition, he developed many of the measurement procedures (and associated cartoons!) included in the document. The standard is designed to provide workers in the field of flat-panel displays a basis for making good measurements, using a wide variety of instrumentation and using as inexpensive instrumentation as possible. In addition to measurement procedures for flat-panel displays, the standard incorporates a tutorial section on photometry and colorimetry intended to help the novice gain familiarity, by means of worked problems and discussions, with a difficult system of measurements and units. The document also contains diagnostic procedures to help ensure that measurements are made properly.

The standard is intended to define display metrology so that everyone around the world will measure the same things the same way. Working from the standard, manufacturers of good displays can state what they have to offer unambiguously, original equipment manufacturers can carefully specify what they need, and end users can apply tools to measure the quality of their investment. A secondary result is to limit the effectiveness of misleading advertisements so that they are more likely to be an embarrassment than a success.

The standard was developed with the assistance of display-measurements working groups of both the International Organization for Standardization (ISO) and the Electronics Industries Association of Japan. Discussions are currently ongoing between VESA and ISO committees regarding adoption of the VESA standard as an ISO standard.

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REFRIGERANT PROPERTIES DATABASE RELEASED

A new version of NIST Standard Reference Database 23—Thermodynamic and Transport Properties of Refrigerants and Refrigerant Mixtures (REFPROP)—has been released. Previous versions of this database have become the *de facto* standard in the refrigeration industry as well as in research labs for providing the property data needed to evaluate the new refrigerants and to optimize the energy efficiency of heat pumps and other refrigeration equipment.

Version 6.0 of this database is a complete revision based on the most accurate pure fluid and mixture models currently available. The models are implemented in a suite of Fortran subroutines that have been completely rewritten from earlier versions of REFPROP. Routines

are provided to calculate thermodynamic and transport properties given a wide variety of possible input conditions.

A separate graphical user interface, designed for the Windows® operating system, provides a convenient means of accessing the models. Tables and/or plots for any of 33 pure fluids and for mixtures with up to five components may be calculated. Commercially available refrigerant blends are predefined in the database. An on-line help system provides information on how to use the program. Information screens that display fluid constants and documentation for the property models can be called up at any time. Numerous options to customize the output are available as well as copy and paste capabilities to and from other applications.

Funding for the development of REFPROP was provided, in part, by DoE and a joint DoE/industry research program administered by the Air-Conditioning and Refrigeration Institute (ARI). A provision of the ARI support provides free copies of the database to the more than 200 ARI-member companies.

Further information is available from the NIST Standard Reference Data Program at (301) 975-2208 or on the web at http://www.nist.gov/srd/nist23.htm.

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FIRE EXPERIMENTS IN A 13-STORY BUILDING

NIST, in cooperation with the Prince Georges County, MD Fire Department, has conducted fire experiments in a 13-story apartment building in Oxon Hill, MD, to measure fire behavior in a realistic setting. Members of the large fire research group reconstructed and instrumented four apartments. Twenty fire experiments were conducted using a computer-controlled gas burner to provide a reproducible growing fire. The data from these experiments will be used for validation of NIST's fire models, such as CFAST and the Industrial Fire Simulator.

In addition, eight experiments were conducted burning fully furnished living rooms and bedrooms. Two of the apartments had automatic fire sprinkler systems installed; two did not. The results from these experiments are aimed at improving residential fire safety and firefighter safety. The International Association of Arson Investigators and the Bureau of Alcohol, Tobacco and Firearms conducted post-fire investigations on the burned apartments. NIST is cooperating with these organizations in an effort to improve scientific methods used in arson investigation.

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QUALITY ASSURANCE STANDARDS FOR FORENSIC DNA TESTING LABORATORIES

On July 15, 1998, the director of the FBI formally signed a document known as "Quality Assurance Standards for Forensic DNA Testing Laboratories." This compendium of standards has been developed and reviewed over the past 3 years by the National DNA Advisory Board.

The document sets forth a set of specific quality assurance obligations required by all forensic DNA laboratories that received federal funding. An underlying premise of the document is that laboratory accreditation will be required to demonstrate compliance with the standards and, therefore, assure quality control and a quality program. Standard 9.5 of the document requires that "The laboratory shall check its DNA procedures annually or whenever substantial changes are made to the protocol(s) against an appropriate and available NIST Standard Reference Material or standard traceable to a NIST standard." These standards took effect Oct. 1, 1998.

The DNA Advisory Board charter defines its membership composition to include representatives from Federal, state, and local crime laboratories as well as a NIST scientist. The inclusion of NIST in the nations coordinated DNA testing comes as a result of nearly 10 years of close working relationships with the FBI in developing needed standards for DNA testing. A third Standard Reference Material or SRM (SRM 2392) for DNA testing soon will be released, complementing two other SRMs (SRM 2390 and 2391) used to assure accurate measurements in human identity testing.

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NIST MEASUREMENTS HELP INDUSTRY GROW BETTER CRYSTALS FOR RADIATION DETECTION APPLICATION

The properties of mercuric iodide radiation detectors have been enhanced through the observation and identification of structural changes induced through crystal growth on two different space shuttle flights. The motivation for the initial crystal growth flight stemmed from the recognition that this material is extremely soft at growth temperature. This observation led to the anticipation that a more regular crystal lattice with enhanced properties would be achieved through growth in microgravity.

While the properties of the resulting initial space crystal were enhanced, as anticipated, high-resolution synchrotron x-ray diffraction imaging showed that its lattice was actually less regular in orientation. However, this decrease in orientational uniformity was more than

compensated by greater regularity in chemical composition, indicated by the prevention of impurity inclusions. The property improvement with space growth thus came about more from reduction in convection mixing of the vapor forming the crystal than from removal of gravity loading from the soft growing crystal.

Subsequent terrestrial growth of purified, second-generation material produced an enhancement in properties, but less than those realized in the initial space crystal. Analysis of these terrestrial crystals and similar second-generation crystals grown on a second space flight showed the property enhancement at this stage to be limited by incomplete stoichiometry, resulting in iodine inclusions.

More recently, the use of third-generation material with fuller stoichiometry has led to terrestrial crystals with still more enhanced properties. However, while the crystalline regularity and performance of terrestrial crystals have been improved substantially, work to achieve full parity with the performance of crystals grown in microgravity is under way.

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NIST CONTRIBUTION ADDS 50 % MORE DATA TO CRYSTALLOGRAPHIC INFORMATION FILE

Virtually all materials research is leveraged against understanding how atoms are physically arranged in these substances, information commonly called the "crystal structure." While many crystallographers are working at numerous institutions around the world to determine this structural information, methods used for communication of these results and the data collected for this purpose could be significantly improved.

To address this, the Crystallographic Information File (CIF), a standardized electronic format for the communication of crystallographic data and results, was developed by the International Union for Crystallography (IUCr). The initial development of CIF was targeted for small-molecule crystallographic analysis from single-crystal data, with plans to support other crystallographic methods later. The original deployment of the CIF consisted of a formal syntax and an electronic dictionary with standard representations for over 300 different types of information. The NIST Center for Neutron Research has led the effort to expand the scope of the CIF to include powder diffraction through the creation of a dictionary of approximately 200 additional standard representations needed to describe powder diffraction data and results. The resulting dictionary has been approved by the IUCr Committee for the Maintenance of the CIF Standard. The format also has been endorsed by other organizations such as the International Centre for Diffraction Data. A committee to oversee the maintenance of the powder dictionary is being formed.

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BETA VERSION DEVELOPED OF COMPLIANCE TEST SOFTWARE REQUESTED BY IPC

At the request of the Institute for Interconnecting and Packaging Electronics (IPC), a NIST scientist has developed a beta version Compliance Test Module (CTM) software program to support the GenCAM (Generic Computer Aided Manufacturing) standard under development by the IPC. The IPC is a trade association representing more than 2300 companies in the electronic interconnection industry worldwide; IPC members include printed circuit board designers, fabricators, and assemblers. The GenCAM standard is intended to improve the transfer of design information (for electronic products) from computer-aided design tools, to computer-aided manufacturing tools. Facilitating this transfer will help to decrease the critical time-to-market for electronics manufacturers. GenCAM files could be used to request quotations, to order details that are specifically process-related, or to describe the entire product (printed circuit board and printed circuit assembly) to be manufactured, inspected and tested, and delivered to the customer. GenCam includes the capability to add information to represent multiple images of boards to support panel and subpanel fabrication.

IPC views the CTM as a key element in the industry deployment of the GenCAM standard, recognizing that one of the main problems with predecessors of GenCAM was a lack of strong technical support. This deficiency led to misinterpretations by commercial implementers of earlier standards, which impeded adoption of these standards on the part of industry. An article on GenCAM in the April 1998 issue of *Printed Circuit Design* magazine, stated: "The CTM will be made available so that the misinterpretation evident in past implementation strategies can be avoided." The first official release of the CTM is scheduled for the first quarter of calendar year 1999. The CTM currently verifies the syntax of the GenCAM file, but there are plans to investigate adding checks for a designs "completeness" in the future. As a side benefit, the scientist's CTM development work has brought to light some ambiguity issues

within the GenCAM standard itself that have been addressed by the development committee, thereby making GenCAM a more robust standard.

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NIST SCIENTIST DEVELOPS NEW STANDARD FOR ASSESSING RELIABILITY OF ELECTRICAL INTERCONNECTS IN INTEGRATED CIRCUITS

A new method for calculating the electromigration model parameters for current density and temperature has been developed by a NIST scientist and incorporated in a standard method. Electronic Industries Association/Joint Electron Device Engineering Council Method JESD 63 provides procedures to calculate sample estimates and their confidence intervals for the electromigration model parameters of current density and temperature. The model parameter for current density is the exponent *n* to which the current density is raised in a relation known as Blacks equation. The parameter for temperature is the activation energy for the electromigration failure process.

Engineers need these parameters to assess the reliability of electrical interconnects in integrated circuits when they are extrapolating electromigration failure-time data obtained under accelerated stress conditions to those conditions of current density and temperature expected in operational use. The method requires existing failure-time or median-time-to-failure data from a number of accelerated electromigration stress tests and uses linear regression analyses. Precautions and measurement interferences are provided to assist in the design of experiments to obtain the model parameters. Example calculations to demonstrate the method are provided in an annex.

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NEW LABORATORY MEASURES CRITICAL DATA FOR SEMICONDUCTOR INDUSTRY

A new electron transport laboratory has been designed and put into operation at NIST for measuring critically needed electron transport data for modeling plasma discharges. Such data include electron drift velocities, electron attachment-rate coefficients, and ionization-rate coefficients. Specific data needs are determined on the basis of thorough reviews of available electron interaction data for plasma processing gases. The laboratory apparatus was designed to make measurements for chlorofluorocarbon gases and their mixtures with argon, nitrogen, and oxygen, which are used widely in the semiconductor industry for plasma processing. Tests show that the relative uncertainty for the measured electron drift velocity is 5 % and the uncertainty for the electron attachment and ionization rate coefficients is 10 %. The new apparatus has been designed by taking full advantage of the fast sampling rate and long record length of modern digital oscilloscopes to provide accurate, simultaneous determination of the integrated charges of electrons and ions drifting across a uniform-field gap in separate time scales.

The apparatus was used first to study the effect of temperature on electron attachment to CCl_2F_2, and these data have been submitted for archival publication. Subsequently, the apparatus was used to measure the first electron drift velocities and electron attachment coefficients in pure CHF_3 and its mixtures with argon. These data recently were presented at the Eighth International Symposium on Gaseous Dielectrics. The apparatus recently has been upgraded to handle corrosive gases to allow measurements of the electron drift velocities in chlorine and its mixtures with argon. These will be the first experimental data of this type available for chlorine and will be used to validate gas-phase plasma models of the commonly used etching gas.

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WORKSHOP HELD ON LEGAL METROLOGY FOR THE AMERICAS

A Workshop on Legal Metrology for the Americas was recently held at NIST. It was sponsored by NIST, the National Conference on Weights and Measures (NCWM), the Organization of American States (OAS), InterAmerican Metrology System (SIM), and the International Organization of Legal Metrology. Representatives from 31 of the 34 OAS member nations participated.

Workshop participants acknowledged that legal metrology is an important issue in the globalization of trade, especially with regard to technical barriers to trade. Moreover, since other regions (Europe, Asia-Pacific, and Africa) have developed regional legal metrology organizations, the participants considered whether the Americas should do the same, especially since good metrological cooperation has been growing among the countries of the Americas through SIM.

Based on discussions between NISTs Office of Standards Services and the U.S. National Conference on Weights and Measures, including associate members from industry, the workshop had objectives similar to those of the NIST Standards in Trade Workshops (i.e., familiarizing participants with U.S. technology and practices in metrology, standardization, testing, and

certification and developing professional contacts to strengthen technical ties and enhance trade among participating countries). Representatives of Brazils INMETRO and Measurement Canada, and NCWM members presented informational items to give a broad perspective of weights and measures practices in the Americas.

The workshop achieved its main goals: (1) to better acquaint participants with the weights and measures practices within the Americas and globally; and (2) to solicit views and develop a plan of action toward regional cooperation in the development and implementation of legal metrology procedures and practices within the Americas. The group adopted resolutions to: (1) create a working group on legal metrology in SIM, (2) develop a program structure for that working group, and (3) organize periodic workshops and other forums to identify and address key issues and needs for fostering future cooperation in legal metrology within the Americas.

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NIST MICROTENSILE TEST APPARATUS DUPLICATED AT PRIVATE COMPANY

A NIST scientist worked with a private company's Semiconductor Products Sector/Advanced Interconnect Systems Laboratory to transfer the NIST microtensile test apparatus technology to their laboratory. This was the culmination of a year of collaboration in which the NIST system was used to test films of various metals, prepared by the private company, as part of NIST's ongoing research on mechanical properties of thin films for microelec-tronic applications. The mechanical properties data developed is used in modeling and simulation of chips, packages, and their interconnects using finite-element techniques.

In September 1997, an engineer from the private company, visited NIST to learn the details of thin-film tensile testing using the NIST apparatus. As a result of these interactions, the company decided to establish its own thin-film tensile testing capability using a replica of the NIST apparatus.

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FOURTH JOINT INDUSTRIAL-ACADEMIC-NIST WORKSHOP HELD ON MACHINE TOOL PERFORMANCE MODELS AND DATA REPOSITORY

NIST conducted its fourth National Advanced Manufacturing Testing workshop on the development of machine tool performance models and data repository in June 1998, in Gaithersburg. The purpose of the workshop was to review the progress in the development of the repository and plans for the next years development activities.

Forty people representing 15 companies, seven academic institutions, and NIST attended the workshop. Additionally, three people participated remotely via teleconferencing and PC netmeeting facilities. Participants assessed progress to date, concluding that the basic project goals had been proven feasible, and made specific recommendations with respect to future efforts. NIST, which has an ongoing project in this area, is working with industry and academia to create a virtual manufacturing environment to simulate the complete manufacturing cycle in order to reduce the time for new product introduction.

The first day of the workshop comprised presentations from industrial, academic, and NIST attendees. The presenters described their efforts in developing machine tool performance models and data acquisition, identifying the capabilities of their machine tools, and developing new software tools to model and visualize these capabilities. They also emphasized their efforts in developing computing and communication architectures to enable efficient utilization of machine tool performance data and the repository.

The second day of the workshop was spent receiving feedback from the participants related to NIST progress. While participants appreciated the progress that was demonstrated, due to the fast pace of technology, they recommended modifying the original time schedule that was agreed upon in the last workshop to speed up the development of analytical tools for diagnostics and performance tracking. It also was agreed to increase communications between the collaborators through electronic means as much as possible. An electronic meeting will be scheduled in the next months to review the progress.

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GOVERNMENT/INDUSTRY SUPPORT FOR SYNCHRONIZED MULTIMEDIA INTEGRATION LANGUAGE (SMIL) TO BRING TELEVISION-LIKE CONTENT TO THE WEB

The World Wide Web Consortium (W3C) recently issued a press release citing the Synchronized Multimedia Integration Language (SMIL; pronounced "smile") specification as a W3C Recommendation, representing cross-industry agreement on a wide range of features for putting multimedia presentations on the Web. A W3C Recommendation indicates that a

specification is stable, contributes to web interoperability, and has been reviewed by the W3C membership, who favor its adoption by the industry. NIST is one of 260 participating organizations in W3C.

"Synchronized multimedia is becoming increasingly important on the Web. The SMIL Recommendation will enable much-needed interoperability in this area," explained the W3C director and inventor of the World Wide Web. SMIL enables authors to bring television-like content to the web, avoiding the limitations for traditional television and lowering the bandwidth requirements for transmitting this type of content over the Internet. With SMIL, producing audiovisual content is easy; it does not require learning a programming language and can be done using a simple text editor.

The SMIL 1.0 specification was written and developed by the W3C Synchronized Multimedia (SYMM) Working Group, a unique mix of experts from the four divergent industries (CD-ROM, interactive television, web, and audio/video streaming) interested in bringing synchronized multimedia to the Web. The W3C SYMM Working Group is composed of key industry players as well as research and government organizations such as CWI (Centre for Mathematics and Computer Science, the Netherlands) and NIST.

NIST also hosts the SMIL Feature List and Interop testing Testcase, available at http://smil.nist.gov/Feature.html and http://smil.nist.gov/Testcase.html.

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NIST CONTRIBUTES TO THE SPECIFICATIONS OF THE ISO/IEC MPEG2 PART 10 STANDARD, DSM-CC CONFORMANCE TEST

Through participation in the Moving Picture Experts Group (MPEG) meetings from July 1997 to July 1998, NIST's high speed network technologies group, collaborating with Korean Telecomm, developed and completed the Digital Storage Media Command and Control (DSM-CC) Conformance Test, ISO/IEC 13818-10, FCD (Final Committee Draft, the first stable version of a standard that ISO/IEC member countries vote on toward an international standard). The DSM-CC protocol controls and manages the displaying of MPEG2 streams, the encoded moving pictures and audio bit streams compressed for storage and transporting over networks.

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SEM MONITOR WINS R&D 100

SEM Monitor, co-developed by a NIST scientist, has been awarded one of the 1998 R&D 100 awards given by *R&D Magazine*. The development of SEM Monitor is a collaborative project between NIST and two private companies. The aim of the project was to answer the question: "Can the performance of an automated production line scanning electron microscope (SEM) tasked to control a multimillion dollar semiconductor fabrication line be monitored for data fidelity?"

SEM Monitor is designed to be an objective diagnostic aid for semiconductor scanning electron microscope-based metrology and inspection. It provides a simple quantitative framework for monitoring a SEMs resolution, astigmatism, and image quality both over time for a single instrument or compared to other machines. SEM Monitor also can be used to adjust and align a SEM for optimum performance. SEM Monitor is a revolutionary approach to solving a major problem encountered in the inspection of wafers in the automated SEM metrology environment, namely "is the metrology instrument performing optimally" and thus is it providing correct, believable data.

SEM Monitor is available in either a fully functional stand-alone workstation version ready to be connected to the scanning electron microscope or as software package alone. In either case the package includes the Metrologia modeling package which includes sophisticated modeling for both electron and optical microscopes. Metrologia allows the user to simulate the beam specimen interaction of the microscope and is based on detailed physical models solving Maxwells equations for the optical cases and using Monte Carlo techniques for the electron microscope cases. The combination of SEM Monitor with Metrologia offers process engineers a powerful set of multipurpose utilities for optimizing the accuracy of their metrology.

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SMALLER MANUFACTURERS: SWAT THE "MILLENNIUM BUG" WITH SELF-HELP TOOL

The NIST Manufacturing Extension Partnership's (MEP) nationwide network of centers is offering a computer-based tool to help smaller manufacturers find and assess Year 2000 date problems. Year 2000, or Y2K, refers to the failure of a computer program or system because the "00" year designation is mistaken for "1900."

"Time is running out. Like other businesses, small manufacturers must start paying attention to this potential problem today. If they don't, they risk losing business or even their ability to survive," said Commerce Secretary William Daley.

MEP's tool will help smaller manufacturers conduct an inventory of equipment, identify core business systems and rate their importance to the survival of the business, develop contingency plans, and develop and manage remediation projects.

For assistance with Year 2000 conversion, as well as business and technical projects, smaller manufacturers can call (800) MEP-4MFG (637-4634) to reach the MEP center serving their region. Information also is available on the World Wide Web at http://www.mep.nist.gov and at http://www.nist.gov/y2k.

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STUDY TAKES FIRST STEP TOWARD LESS COSTLY FRESH AIR

Many home builders are moving toward more energy efficient designs, yet concerns about proper ventilation and indoor air quality are fueling an increase in the use of mechanical ventilation systems. Unfortunately, the price of better indoor air quality with these systems may be higher heating and cooling bills.

A recently completed NIST study found that a home where exhaust fans or other mechanical ventilation systems provide additional air flow may have too much ventilation at some times and too little at others. Over-ventilation during winter and summer months typically produces higher utility bills.

The study employed a NIST-developed computer program called CONTAM to evaluate the interplay of energy-efficient design, mechanical ventilation, and power consumption. The two-story fictitious house used in the study is in Spokane, WA, an area that has cool winters and where builders are typically more progressive about energy efficient designs. One-year simulations evaluated four different ventilation approaches. Future simulations will evaluate other housing designs in various climates.

Ultimately, researchers hope to devise an indoor air quality rating scheme that can be used by manufacturers and designers to evaluate the impacts of different means of controlling indoor air quality. Information about the interplay of energy efficiency and optimum ventilation will help builders to evaluate the tradeoffs involved in building designs.

The Electric Power Research Institute sponsored the study under a cooperative research and development agreement.

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NEW STANDARD HELPS COMPUTER MAKERS ASSESS FLAT-PANEL QUALITY

Manufacturers long have needed a comprehensive manual to help them carry out the complex tests needed to accurately specify and measure performance characteristics such as sharpness, brightness, and color quality of the flat-panel displays they use in laptop computers. Until now, they have had to resort to time-consuming performance evaluations before they could decide which displays to order.

Fortunately, that problem has been solved by an international team of researchers led by a physicist at NIST. The group produced the first comprehensive manual for testing flat-panel displays. The resulting Flat Panel Display Measurement Standard has been published by the Video Electronics Standards Association, an international organization representing corporations in the computer industry.

By using the same standard, display producers and laptop manufacturers can speak the same language, ensuring less ambiguity and faster production.

One of the research team's chief triumphs was an improved method for measuring a display's contrast ratio, which dictates the sharpness of an image by virtue of its ratio of whiteness to blackness. The new method works by using a cone-shaped device to screen out the glare of extraneous light that interferes with the measurement.

Copies of the standard can be ordered from VESA in both CD-ROM and hard copy formats. Contact VESA at 2150 N. First St., Suite 440, San Jose, CA 95131-2029, (408) 435-0333, or download an order form (using an Adobe Acrobat 3.0 reader) from the organization's World Wide Web site at http://www.vesa.org.

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FEDERAL/STATE STUDY FINDS 19 % OF MILK CONTAINERS SHORT

In the first national study on the accuracy of milk net contents, conducted by four federal agencies, 44 states and two territories, 19 % of 3355 lots of milk inspected failed due to underfilling. The results of the study are

significantly better than results of a similar, but smaller, study conducted in 1997 in which 45 % of inspected lots failed.

The study was conducted by the staff of the Federal Trade Commission, Food and Nutrition Service at the U.S. Department of Agriculture, and the NIST Office of Weights and Measures, in coordination with the Office of Food Labeling at the Food and Drug Administration. Inspections were conducted by weights and measures officials in 44 states as well as Puerto Rico and the U.S. Virgin Islands using an inspection procedure adopted by the National Conference on Weights and Measures. Inspections were conducted in retail stores, dairies, hospitals, universities, public schools, and other institutions.

More than 6 billion gallons of milk were sold in the United States last year, according to the USDA. According to the report, 83 % of lots inspected at schools this year passed inspection. At hospitals, universities, and other institutions, 72 % passed. Of the 1309 inspections of milk in retail stores, wholesale packaging plants, and dairies, 81 % passed inspection this year.

Copies of the study, "Milk: Does it Measure Up? One Year Later," and a "Facts for Business" brochure are available on the World Wide Web at http://www.ftc.gov. Printed copies can be requested from the FTC's Public Reference Branch, Room 130, 6th Street and Pennsylvania Ave., NW, Washington, DC 20580, (202) 382-4357.

Media Contact: Linda Joy (301) 975-4403; linda.joy@nist.gov.

PORTABLE JOSEPHSON VOLTAGE STANDARD PASSES INITIAL TESTS

A compact, transportable 10 V Josephson calibration system developed at NIST is now circulating among nine NASA laboratories where it is used as a primary standard. A model with an improved microwave oscillator will be tested shortly at several Department of Energy national laboratories.

The portable standard, which weighs only 21 kg, is highly automated and is designed to be operated by technicians without higher level support. It can be transported easily by next-day air shipment in two custom containers and set up in less than 1 hour. It is cooled in a standard 100 L liquid helium transport Dewar that is sufficient to operate the Josephson array for 6 to 8 weeks.

The standard was intercompared with laboratory standards at NIST and Sandia National Laboratories and by members of the National Conference of Standards Laboratories. It tested well within defined uncertainty levels in these intercomparisons.

The standard also was field tested at two NASA laboratories—the White Sands (NM) Test Facility and the Kennedy Space Center in Florida. In addition to the field tests, the standard has been operated at three NASA calibration laboratories resulting in "marked improvement" in the value of the maintained volt for one laboratory and verifying the low uncertainties claimed at the other two laboratories.

For a copy of paper no. 29-98 describing the field tests, contact Sarabeth Harris, MS104, NIST, Boulder, CO 80303-3337, (303) 497-3237, sarabeth@boulder.nist.gov.

Media Contact: Fred McGehan (Boulder), (303) 497-3246; mcgehan@boulder.nist.gov.

NEW CONSORTIUM EXAMINES FLAME RETARDANCY IN PLASTICS

Understanding the fundamental mechanisms of flame retardancy in certain plastics is important because fires started in the synthetic fabrics found in furniture and carpeting frequently cause deaths, serious injuries, and property damage. Several companies have therefore joined a NIST-sponsored research consortium to better examine these characteristics.

The plastics being studied by the consortium are clay-nanocomposites, materials in which clay plate-like particles, 1 nm thick by 1000 nm in diameter, are dispersed throughout the polymers involved. Previous NIST research showed that a commonly used polymer, nylon-6, became much less flammable—by 63 %—if it had a clay content of only 5 %. More recent findings show that the approach of molecularly dispersing clay boosts flame retardancy in many polymers.

The new research consortium will last at least 2 years and will examine a variety of materials to discover if the flame retardancy depends on physical properties, chemical properties or both. Additional companies can join until Sept. 30, 1998.

For more information on the consortium, contact Jeffrey Gilman, B258 Polymer Building, NIST, Gaithersburg, MD 20899-0001, (301) 975-6573; jeffrey.gilman@nist.gov.

Media Contact: Philip Bulman (301) 975-5661; philip.bulman@nist.gov.

UPDATED "ONE-STOP" INDUSTRY *GUIDE TO NIST* AVAILABLE

The new *Guide to NIST*, the third update of the popular "one stop" information resource, is now available. The

184-page volume describes hundreds of different research projects, grants, industry outreach programs, services and facilities.

The guide is divided into sections covering each of the agency's four major programs: the Measurement and Standards Laboratories; the Advanced Technology Program, the Manufacturing Extension Partnership, and the Baldrige National Quality Program. Individual items include contact names, addresses, phone numbers, e-mail addresses and, where present, World Wide Web URLs. A detailed subject index clearly maps all paths.

The complete *Guide to NIST* also is available on the World Wide Web at http://www.nist.gov/public_affairs/guide/index.htm.

For a free copy, send a self-addressed mailing label to Public Inquiries, A903 Administration Building, NIST, Gaithersburg, MD 20899-0001 or fax requests to (301) 926-1630.

Media Contact: Michael E. Newman (301) 975-3025; michael.newman@nist.gov.

15 CANDIDATES FOR ADVANCED ENCRYPTION STANDARD CHOSEN

NIST has announced the acceptance of 15 encoding algorithms as candidates for the new Advanced Encryption Standard (AES). Researchers from 12 different countries worked on developing the formulas unveiled at the First Advanced Encryption Standard Candidate Conference in Ventura, CA, in August 1998.

NIST is inviting the worldwide cryptographic research community to "attack" the formulas in an attempt to break the codes during the first evaluation period, which will end April 15, 1999. Additionally, NIST will evaluate the algorithms for factors such as security and speed.

Five or fewer finalists will be identified by the end of the summer of 1999. NIST eventually will propose that one of these finalists be adopted as the AES. However, detailed analysis is required before this can happen, and the process is structured to build confidence in the AES. Consequently, the process is unlikely to be completed before 2001.

The AES will provide security for encrypted data. It will be a public algorithm designed to protect sensitive government information well into the next century. The AES will replace the Data Encryption Standard currently used by many Federal agencies and businesses. NIST adopted DES in 1977 as a Federal Information Processing Standard for use by Federal agencies to encrypt sensitive information.

NIST has accepted the following algorithms as candidates. The list includes the algorithm name, the submitters' names, and submitters' countries:

- AST-256—Entrust Technologies, Canada;
- RYPTON—Future Systems Inc., South Korea;
- DEAL—Richard Outerbridge and Lars Knudsen, Canada and Norway;
- DFC—Centre National pour la Recherche Scientifique, France;
- E2—Nippon Telegraph and Telephone Corp., Japan;
- FROG—TecApro Internacional S.A., Costa Rica;
- HPC—(Hasty Pudding Cipher) Rich Schroeppel, U.S.A.;
- LOKI97—Lawrie Brown, Josef Pieprzyk and Jennifer Seberry, Australia;
- MAGENTA—Deutsche Telekom AG, Germany;
- MARS—IBM Corp., U.S.A.;
- RC6—RSA Laboratories, U.S.A.;
- Rijndael—Joan Daemen and Vincent Rijmen, Belgium;
- SAFER+ Cylink Corp., U.S.A.;
- SERPENT—Ross Anderson, Eli Biham and Lars Knudsen, U.K., Israel and Norway;
- TWOFISH—Bruce Schneier, John Kelsey, Doug Whiting, David Wagner, Chris Hall and Niels Ferguson, U.S.A.

More information about the AES is available at http://www.nist.gov/aes. A list of press contacts at the organizations that have submitted candidate algorithms can be obtained at http://www.nist.gov/public_affairs/releases/n98-15.htm or by faxing a request to (301) 926-1630.

Media Contact: Philip Bulman (301) 975-5661; philip.bulman@nist.gov.

NEW PRIMER HELPS IMPROVE USE OF ELECTRON-BEAM MOIRÉ TECHNIQUE

Engineers and researchers in the area of electronics packaging will want to get a new publication from NIST that describes procedures for the relatively new electron-beam moir technique which measures submicrometer strains on a local scale in electronic packaging. In particular, it can measure the thermomechanical

displacement caused by thermal expansion mismatches among the various materials used in an electronic package.

Measurements of displacements can be used to validate computer models or otherwise contribute to the assessment of the reliability of the packaging. The new publication describes the background, setup and procedures for the electron-beam moiré technique and is intended to give readers enough information so that they can conduct an experiment in their own laboratories. Such experiments would include a scanning electron microscope, access to electron-beam or other type of lithography process, and computers to run the lithography process and aid in reducing and analyzing the data.

The publication covers specimen preparation, electron-beam lithography, thermal testing, mechanical testing, and analysis of the moiré fields. It also contains, as appendices, nine papers on electron-beam moiré theory and applications by NIST authors. A program disk is included with the publication.

To order a single, free copy of *Procedures for the Electron-Beam Moiré Technique* (NIST Technical Note 1500-2), contact Elizabeth S. Drexler, MC 853.08, NIST, Boulder, CO 80303-3337, (303) 497-5350; drexler@boulder.nist.gov.

Media Contact: Fred McGehan (Boulder), (303) 497-3246; mcgehan@boulder.nist.gov.

BROCHURE DETAILS VALUABLE STANDARDS RESOURCE

Now in its 33rd year of operation, the NIST-managed National Center for Standards and Certification Information serves as a referral service and focal point in the United States for up-to-date information about standards, technical regulations, and conformity assessment programs—domestic, foreign and international. The center's staff respond to inquiries, maintain a reference collection of standards and standards-related documents, and operate two telephone hotlines that provide information on proposed foreign technical regulations issued by the World Trade Organization (301-975-4041) and draft European Union/European Communities standards (301-921-4164).

A new brochure prepared by NIST details the services offered by the NCSCI. The document explains how the center operates, describes the reference collection, and guides potential users on the best ways to access the many resources available.

Copies of the brochure may be obtained by sending a self-addressed mailing label to the NSCSI, Building 820, Room 164, NIST, Gaithersburg, MD 20899-0001. Copies also may be requested by calling (301) 975-4040, faxing (301) 926-1559 or sending electronic mail to ncsci@nist.gov.

Media Contact: Mark Bello (301) 975-3776; mark.bello@nist.gov.

UPGRADED WEBSITE KEEPS THE MILLENNIUM BUG FROM BUGGING

Free software that assesses "millennium bug" problems is only one of many features on the new and improved NIST Year 2000 World Wide Web page located at http://www.nist.gov/y2k. NIST recently redesigned the page, making it easier to navigate and more comprehensive in the services it offers. For example, new documents now are added on a regular basis to ensure timely information. Perhaps most importantly for the weary web traveler, the page includes links to a selective list of outstanding and informative Year 2000 web sites run by industry and government groups.

NIST has developed a variety of programs to help both small and large companies in the Year 2000 conversion process. The projects are part of a larger effort coordinated by the President's Council on the Year 2000 Conversion.

For technical information, contact Gary E. Fisher, Building. 820, Room 562, NIST, Gaithersburg, MD 20899-0001, (301) 975-3275, gfisher@nist.gov.

Media Contact: Philip Bulman (301) 975-5661; philip.bulman@nist.gov.

N-WEST TO HELP SET DIRECTION FOR WIRELESS INDUSTRY

The National Wireless Electronic Systems Testbed, a new measurements and standards resource, recently began its effort to create and carry out tests and measurements, and promote sound operational standards and specifications for the broadband wireless industry. These are considered essential for rapid development of newly allocated wireless spectrum.

N-WEST is oriented toward broadband wireless access, which will offer high-speed two-way data, Internet, telephone, and video services to businesses, schools, libraries, health care providers and eventually, private homes. "Hub" transceivers on towers spaced a few kilometers apart each will serve up to several thousand customers with small rooftop antennas. One of N-WEST's primary concerns is the Local Multipoint Distribution Service, a recently auctioned block of spectrum around 28 GHz to 31 GHz.

N-WEST is a project of NIST and another Commerce Department agency, the National Telecommunications

and Information Administration. N-WEST currently is organizing an industry standardization effort in conjunction with service providers, system integrators, component manufacturers, and others.

For more information, contact Roger B. Marks, MC 813.06, NIST, Boulder, CO 80303-3337, (303) 497-3037, marks@boulder.nist.gov; or visit the N-WEST Website at http://nwest.nist.gov.

Media Contact: Collier Smith (Boulder), (303) 497-3198; smithcn@boulder.nist.gov.

NIST TEST BLOCKS NOW AVAILABLE; ROCKWELL C HARDNESS SCALE REVISED

The hardness of a metal reveals its strength and other properties, which are evaluated for quality control during and after the manufacture of products. Hardness is gauged by using special test equipment to make small indentations in the metal. A hardness value is assigned to the metal based on the depth of the indentation. To ensure that these testing devices are accurate, NIST is now providing U.S. industry with highly precise calibration test blocks.

The test blocks are specifically for the most frequently used hardness standard—the Rockwell C scale (known as HRC)—with which industries gauge the hardness of certain steels. The high quality of the agency's calibration artifacts results from two NIST-developed innovations: a precision "dead-weight standardizing" machine for measuring Rockwell hardness and a sophisticated method for measuring the shapes of the diamond tips used to make test indentations.

An international comparison with other standardizing laboratories showed the NIST data to be nearly identical to those used in Japan and Italy. However, the research also revealed that the commercially accepted U.S. scale for the Rockwell C standard is about 0.2 to 0.8 "hardness points" lower than the NIST scale, depending on the hardness level of the metal. Conforming to the NIST scale will help U.S. industry come in line with the rest of the world.

Because companies use large numbers of hardness blocks to perform tests during production, NIST soon will begin a voluntary accreditation program for test block manufacturers so that they can produce commercial blocks that are traceable to NIST.

NIST eventually will produce test blocks for many of the 30 different Rockwell hardness scales.

For more information, contact Sam Low, B254 Materials Building, NIST, Gaithersburg, MD 20899-0001, (301) 975-5709, samuel.low@nist.gov.

Media Contact: Emil Venere (301) 975-5745; emil.venere@nist.gov.

NEW METHOD MAY LEAD TO BETTER INSULATORS AND FASTER MICROCHIPS

Certain plastics are well-suited for the job of insulating computer chips. But because they sometimes turn rubbery as temperatures rise, the heat of an operating computer may lead to insulation breakdown and, in turn, chip failure.

Therefore, NIST scientists have formulated a new mathematical theory for measuring the viscosity of polymers in thin layers. This allows them to study precisely how extremely thin layers of plastic polymers flow when heated.

To make the measurements necessary for their theory, the NIST team had to design and build an entirely new instrument: the twin-crystal resonator.

The point at which a specific polymer turns rubbery is called its glass transition temperature. To determine precisely at which temperatures and thicknesses this transition takes place, the NIST researchers are studying changes in a polymer's viscosity. With the twin-crystal resonator, viscosity can be analyzed by coating quartz crystal with an ultrathin layer of plastic and then recording changes in the crystal's response to an oscillating electric current.

So far, they have discovered that the changes take place when polymers are produced in layers no thicker than 300 nm. The researchers believe their technique has the potential to measure properties in far thinner films as well.

For more information, contact Christopher White, B320 Polymer Building, NIST, Gaithersburg, MD 20899-0001, (301) 975-6016, christopher.white@nist.gov.

Media Contact: Emil Venere (301) 975-5745; emil.venere@nist.gov.

CENTER HELPS HYDRAULICS COMPANY LIFT ITS EFFICIENCY, SALES

A Reedsburg, WI, manufacturer of filters and valves for hydraulic systems needed help to overcome inefficiencies in its production system. So the call went out to the Wisconsin Manufacturing Extension Partnership (WMEP), an affiliate of the nationwide NIST MEP assisting smaller manufacturers in all 50 states and Puerto Rico.

WMEP first performed a comprehensive assessment of the manufacturer's operations and, based on the data, facilitated a cross-functional team to define and prioritize issues with potential bottom-line impact. Employee teams then were established to work on key priorities for process improvement.

The results? Production lead time decreased 25 %, inventory costs were reduced 35 %, on-time shipping

improved by over 100 % and, best of all, sales increased 55 %.

"WMEP installed the mindset and the skills," says the company chairman. "We are much better today than we were a year ago because of the discipline we learned from WMEP. And we will be a better company next year than we are today. What WMEP started will never end."

Smaller manufacturers can call (800) MEP-4-MFG (637-4634) to reach the MEP center serving their region, or check out the MEP World Wide Web site at http://www.mep.nist.gov.

For more information on WMEP, call (608) 240-1740 or send an e-mail message to wmep@wmep.org.

Media Contact: Jan Kosko (301) 975-2767; janice.kosko@nist.gov.

NEW VERSION OF REFRIGERANT DATABASE RELEASED

A new version of NIST Standard Reference Database 23, Thermodynamic and Transport Properties of Refrigerants and Refrigerant Mixtures (known as REFPROP), has been released. Previous versions of this database have become the de facto standard in the refrigeration industry as well as in research labs for providing the property data needed to evaluate new refrigerants and to optimize the energy efficiency of heat pumps and other refrigeration equipment.

Version 6.0 of this database is a complete revision based on the most accurate pure fluid and mixture models currently available. The models are implemented in a suite of Fortran subroutines that have been rewritten completely from earlier versions of REFPROP. Routines are provided to calculate thermodynamic and transport properties for a wide variety of possible input conditions. A separate graphical user interface, designed for the Windows operating system, provides a convenient means of accessing the models.

Among the database's other features are:

- the ability to calculate tables and/or plots for any of 33 pure fluids listed and for mixtures up to five components;
- the convenience of commercially available refrigerant blends being predefined in the database;
- an online help system for ease in using the program;
- information screens that display fluid constants and documentation for the property models; and
- numerous options to customize the output.

For more information, contact the NIST Standard Reference Data Program at (301) 975-2208, srdata@nist.gov, or go to http://www.nist.gov/srd/nist23.htm on the World Wide Web.

Media Contact: Fred McGehan (Boulder), (303) 497-3246; mcgehan@boulder.nist.gov.

INNOVATIVE MICROSCOPE READY TO MEASURE INDUSTRY SAMPLES

A calibrated atomic force microscope (C-AFM), a device that makes highly accurate, nanometer-scale measurements based on the wavelength of light, currently is testing nano-engineered grids and other references used to ensure the accuracy of dimensional measurements critical to semiconductor processing. If the trial measurements of the industry-supplied references are successful, the C-AFM soon will be the centerpiece of a full-fledged NIST measurement service, and, ultimately, a calibration service.

The planned service will address the measurement needs of the growing number of users of AFMs and other types of scanning probe microscopes. Industrial applications of AFMs, in particular, are multiplying as the scale used to measure the dimensions of integrated-circuit features and other kinds of devices drops from 10^{-6} m to 10^{-10} m. Initial calibration services will focus on tools for pitch (the spacing between lines and spaces or other features on a chip) and step height (the levels on a chip or wafer) measurements. Capabilities for measurements of linewidth (the width of a patterned feature) are under development.

The instrument's measurements in all three dimensions are traceable to the wavelength of light. Over its 50 μm range, the instrument achieves a lateral resolution of better than 1.2 nm and a vertical resolution down to 4 pm.

For measurements of step height, the uncertainty is about 0.4 % of scale. The instrument has been used to evaluate silicon samples with regular, terrace-like features that could serve as references for sub-nanometer measurements of step height. For pitch measurements, an uncertainty of about 0.1 % of scale has been achieved.

Through refinements of the instrument, NIST researchers aim to reduce measurement uncertainty even further and to speed up its performance so that it can accommodate sizable calibration workloads.

During the initial operating period of the C-AFM, suitable samples are being accepted from customers on a limited basis for measurement with the device. Organizations interested in having their samples measured or seeking more technical information may contact Ronald Dixson, A117 Metrology Building, NIST, Gaithersburg, MD 20899-0001, (301) 975-4399, ronald.dixson@nist.gov.

Media Contact: Emil Venere (301) 975-5745; emil.venere@nist.gov.

VIDEO HIGHLIGHTS METROLOGY DONE THE LONG-DISTANCE WAY

Precise and accurate microscopic examination of materials is critical to many aspects of manufacturing. Such metrology is particularly important to semiconductor manufacturers. However, many companies do not have the advanced microscopy and microanalysis instrumentation and expertise needed on site or within easy access.

The telepresence project of NIST's National Advanced Manufacturing Testbed is seeking to address this problem by demonstrating and refining "long-distance" sharing and operation of electron microscopes at NIST's Gaithersburg, MD, site. The links connecting test customers to NIST are via inexpensive teleconferencing hardware/software that utilize World Wide Web-based technology.

A new NIST video, "You Don't Have to Be There ... Telepresence Microscopy," highlights the ongoing project. The 12 1/2 min program shows how telepresence can provide remote, instantaneous, around-the-clock access to critical metrology services, saving customers time and money while helping ensure the quality of manufactured goods.

For a free copy of the video, contact NIST Public Inquiries by fax at (301) 926-1630 or electronic mail at inquiries@nist.gov. For more information on the telepresence microscopy project, contact Michael Postek, A117 Metrology Building, NIST, Gaithersburg, MD 20899-0001, (301) 975-2299, michael.postek@nist.gov.

Media Contact: Michael E. Newman (301) 975-3025; michael.newman@nist.gov.

NIST DEVELOPMENT CONTRIBUTES TO SUCCESS OF DISPLAY "SHOOT-OUT"

NIST scientists chose the INFOCOMM International Exposition to reveal their stray light elimination tube (SLET) as applied to meas-urements of projection displays made during the events Projection Shoot-Out®. The SLET is a device used to aid in making projection display light-output measurements in high ambient light conditions. The SLET was used in the Shoot-Out to monitor the test display source during the normalization process, to evaluate the effects of different display lamp sources on the different light-measuring device (LMD) technologies, and to evaluate the effects of reflections on the LMDs. Reflections, such as light reflected back from the room walls and LMD operators, can corrupt light output measurements. These evaluations helped materially to improve the confidence of the Shoot-Out measurement process.

Every year, the International Communications Industries Association Inc. (ICIA) holds its Projection Shoot-Out® to provide an opportunity for INFOCOMM attendees to judge the quality of individual projection displays in a side-by-side comparison in a darkened room (non-laboratory) environment. This year, a team was assembled to measure the light output of the 107 displays at the Shoot-Out, and NIST was asked to provide technical consultation and support for the measurements. Two different quantities were measured: light output (luminance for self-contained displays and flux for the front-projection systems) and the correlated color temperature. The NIST team coordinated the relative normalization of the various LMDs employed, provided error analysis of the measurements, and offered technical consultation when needed. The results of the measurements are posted at the ICIA web site (http://www.icia.org).

CONTACT: James A. St. Pierre, (301) 975-4124; james.st.pierre@nist.gov.

NIST PROJECT AFFECTS NONLINEAR SYSTEM IDENTIFICATION AND CONTROL

NISTs work on chaotic structural dynamics is having far-reaching effects in nonlinear system identification and control. NIST developed the stochastic Melnikov approach to study transitions from safe to unsafe types of behavior such as snap-through buckling of structures. It is likely to have a significant effect on the stochastic resonance community. The stochastic Melnikov approach also has been adopted in studies of nonlinear control of stochastically exited systems in Belgian and Russian laboratories.

CONTACT: Emil Simiu, (301) 975-6076; emil.simiu@nist.gov.

NEW INTERPRETATION OF THE SI FOR THE UNITED STATES PUBLISHED

A new interpretation of the International System of Units (SI) for use in the United States was published in the July 28, 1998, issue of the *Federal Register* (FR 63 40334-40340). The new interpretation of the modern metric system replaces the interpretation published in December 1990. The Metric Conversion Act of 1975 gives the Secretary of Commerce the authority to interpret or modify the SI for U.S. use, and this authority has been delegated to the NIST Director. Since the publication of the 1990 interpretation, the international bodies responsible for the SI made some significant changes to it, and it became necessary to set forth a new

interpretation. These changes include: (1) the addition of four new SI prefixes to form decimal multiples and submultiples of SI units; (2) the elimination of the class of supplementary units (the radian and steradian) as a separate class in the SI; and (3) changes in the units not part of the SI that can be used with it. The new *Federal Register* notice may be accessed via the NIST Reference on Constants, Units, and Uncertainty, the web site of the Fundamental Constants Data Center at http://physics.nist.gov/cuu.

CONTACT: Barry N. Taylor, (301) 975-4220; barry.taylor@nist.gov

JOINT FREQUENCY-STANDARD DEVELOPMENT PROJECT COMPLETED

A joint project between NIST and Japan's Communications Research Laboratory (CRL) to develop an improved version of NIST-7, the U.S. primary frequency standard, was completed recently. The objectives of this project were to construct an optically pumped standard with an uncertainty comparable to that of NIST-7, to compare this new standard with NIST-7, and to improve a number of subsystems allowing for more rapid, automated evaluation of systematic frequency offsets.

Major improvements made during the project included a more robust diode-laser system for optical state preparation and detection, new servo-control and monitor software using a more flexible object-oriented approach, identification of a number of smaller sources of systematic offset, and improved modeling of several of the larger systematic frequency shifts. Improvements made to the new standard during this development project will be incorporated in NIST-7.

Aside from these improvements, the key benefit of this project was the demonstration of agreement between these independent standards. The final comparisons between the new standard and NIST-7 indicate agreement within the nominal relative uncertainty of each of the standards. It would have been difficult for NIST to justify construction of a second standard for this purpose.

CONTACT: Robert E. Drullinger, (303) 497-3183; robert.drullinger@nist.gov.

NARROWEST LINEWIDTH LASER DEMONSTRATED

NIST researchers recently constructed the narrowest linewidth visible laser ever reported. NIST researchers working with a Brazilian guest researcher developed the laser during research on optical frequency standards. The ultimate goal of this project is to lock a narrow-linewidth laser to a well defined (282 nm, 2 Hz linewidth) transition in $^{199}Hg+$ ions. The resulting optical frequency standard could be used directly in the optical region or frequency divided to the microwave region to serve as a traditional atomic clock.

To demonstrate the performance of the new laser system, the difference frequency (beatnote) between two laser beams, locked to independent reference cavities on independent isolation platforms, was shown to have a linewidth of 0.8 Hz for an averaging time of 40 s. This measurement implies a linewidth for either laser of less than 0.6 Hz, corresponding to a fractional linewidth of about 1.1×10^{-15}. The key to this result is the isolation from seismic and acoustic noise and from pressure and temperature fluctuations of the high-finesse optical cavities used to stabilize the lasers.

The laser performance now exceeds requirements for use as a local oscillator for the optical mercury-ion frequency standard. Since systematic frequency shifts for the optical frequency standard are anticipated to be very small, this new standard should perform better than all previous frequency standards.

CONTACT: James C. Bergquist, (303) 497-5459; james.bergquist@nist.gov.

MODELING THE ALIGNMENT OF PRECISION OPTOELECTRONICS INTERCONNECTS

Scientists at NIST have developed models that help the electronics industry predict the forces controlling the critical alignment of optoelectronic components. Solder is used in optoelectronic assemblies to couple optical fibers to lasers and diode sensors. During the assembly process, the fiber is positioned for maximum optical throughput but may shift out of alignment during the melting and solidification of the solder droplet due to solder surface tension while it is molten, and due to solder shrinkage during solidification and cooling. To make use of higher bandwidth single mode optical fibers in the next generation of optical communications, however, the fibers and devices must remain aligned with micrometer tolerances throughout the lifetime of the interconnect. Consequently, the assembly must be manufactured with submicrometer tolerances.

Models of the assembly process, developed by NIST have provided a new design tool for precision optoelectronics assembly for industry. By calculating the extent of fiber shifting during assembly, including both surface tension and solidification effects, this modeling technology is expected to lead to more robust designs of the interconnect. Without the models, very extensive and expensive experimentation would be required to achieve

the same effect. These results are being applied now to specific problems addressed by NIST and industry.

CONTACT: Adam C. Powell IV, (301) 975-4936; adam.powell@nist.gov.

NEAR INFRARED SPECTROSCOPY TESTED FOR ONLINE MOISTURE MEASUREMENT FOR CERAMIC INDUSTRY

Moisture content and distribution throughout a green ceramic body is critical to controlled processing but cannot be measured quickly. NIST, collaborating with members of the Ceramic Processing Characterization Consortium, successfully completed field tests in a private company's production line. Two, online, complementary near infrared (NIR) spectrometers were used for the field tests: a motion-free spectrometer with acousto-optic tunable filter, and a hand-held NIR. Online NIR intensities were measured for different processing stages for the entire production line (from "dry powder", mixing, pugging, shape-forming, to drying) and moisture contents calculated. For the hand-held unit, in addition to the total moisture content, the variation in moisture content at different locations in the green body, homogeneity, and the effect of the dryer also were measured. For the motion free unit, binder content and moisture also were measured. Based upon the results, the company determined the techniques to be valuable for their quality control and is currently selecting a system to install online.

CONTACT: Pu Sen Wang, (301) 975-6104; pu.wang@nist.gov.

EXPLANATION OF UNEXPECTED CHATTER MAY LIE IN NONLINEAR DYNAMICS

The occurrence of chatter vibrations is a limiting factor in the material removal rates in milling and turning operations. Accurate predictions of the so-called chatter stability boundary for material removal processes long have been desired. While much effort has gone into the development of linear stability analyses targeted at providing this information, these models do not consistently predict the onset of chatter.

Machinists long have been aware that chatter vibrations can appear mysteriously in the middle of an otherwise stable cutting operation, even with no apparent change in the cutting process parameters. Many researchers choose to ignore such behavior, simply chalking it up to inconsistencies in the workpiece material or inaccuracies in the machine tool. Recent observations by NIST researchers indicate that a better explanation might be obtained by considering the nonlinear dynamics of the cutting process.

As part of NIST research into high-speed machining, a NIST scientist has been taking a critical look at the prediction of chatter stability in cutting processes. It turns out that for nonlinear dynamical systems, the stability boundary can be characterized by *jump phenomena*, or the coexistence of multiple dynamic states known as *attractors*. In other words if the process were nonlinear, it might be perfectly reasonable for a cutting process to produce both chatter free and violently chattering tool motions for the same cutting parameters. It may be that what machinists are observing when they see a tool start vibrating for no apparent reason is simply an example of a nonlinear dynamics phenomena known as a subcritical Hopf bifurcation, in which the process "jumps" from one attractor to another.

To test this hypothesis, the NIST scientist undertook a series of carefully performed experiments that led to an experimental bifurcation diagram that suggests that the transition between stable and unstable cutting on a lathe is characterized by jump phenomena. The focus of the current research is to develop a nonlinear dynamics model that will accurately predict the behavior seen in these experiments.

CONTACT: Jon Pratt, (301) 975-5470; jon.pratt@nist.gov.

NIST ANNOUNCES IPsec-WIT (IKE): A WEB-BASED IPsec/IKE (INTERNET KEY EXCHANGE) INTEROPERABILITY TEST SYSTEM

NISTs web-based IPsec test system, IPsec-WIT, (http://ipsec-wit.antd.nist.gov) now supports use of IKE for negotiating Security Associations (SAs), in addition to manual SA establishment. New test suites are available for IKE-based testing. IKE test cases allow users to configure underlying IKE parameters and then conduct interoperability tests from key negotiation through IPsec data transfer. The test system provides output and diagnostics at various levels of detail (high-level script traces to individual packet dumps), either directly through the web interface or out-of-band through e-mail.

For those interested in the IPsec-WIT system but not ready to conduct real tests, the system supports test cases that allow it to negotiate with itself. IPsec-WIT contains an extensive tutorial on the testers operations as well as pointers to documentation for NISTs IKE and IPsec reference implementations, PlutoPlus and Cerberus. Documentation for PlutoPlus and Cerberus is available at http://ipsec-wit.antd.nist.gov/newipsecdoc/pluto.html and http://www.antd.nist.gov/cerberus.

PlutoPlus, the IKE reference implementation (based on the original Pluto), is in an early development state. Currently, it conducts only Phase 1 Main Mode/Phase 2 Quick Mode negotiations authenticated with a pre-shared key. Once PlutoPlus has undergone sufficient testing, the source code will be released to interested parties in the United States and Canada only.

CONTACT: Sheila Frankel, (301) 975-3297; sheila.frankel@nist.gov.

UNRIVALED CAPACITANCE STANDARD EXPERIMENT BASED ON COUNTING ELECTRONS DEBUTS

NIST researchers have carried out a ground-breaking experiment in which they implemented a new type of capacitance standard with a relative uncertainty of less than 10^{-6}. The standard brings together for the first time two technologies developed at NIST. A device known as an electron pump, based on ultrasmall tunnel junctions and operating at temperatures less than 0.1 K, passes and counts individual electrons with a relative uncertainty of 10^{-8}. The electrons flow onto a cryogenic, vacuum-gap capacitor that has exceptionally low leakage and frequency dependence because it does not contain the dielectric materials that make ordinary capacitors imperfect. After placing about 100 million electrons on the capacitor, the resulting voltage across the capacitor is measured, and the capacitance is simply the ratio of pumped charge to measured voltage: $C = Q/V$. Comparing the experimental standard with the best commercial capacitance meter shows agreement well within the 2×10^{-6} relative uncertainty of the commercial instrument. With improvements to room-temperature electronics, a version of the new standard is expected to reach a relative uncertainty of 10^{-7}. Further tests are planned in which the new type of standard will be compared with NISTs calculable capacitor. If in these tests the new standard performs over a range of frequencies with a relative uncertainty on the order of 10^{-7} as expected, it potentially could provide the basis for a significant improvement in NISTs calibration service for capacitance.

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NIST LEADS DEVELOPMENT OF NEW IEC ELECTRIC AND MAGNETIC FIELD INSTRUMENT/MEASUREMENT STANDARD

Under the leadership of a NIST scientist, Working Group 11 of International Electrotechnical Commission Technical Committee (IEC) 85 has developed the now-approved standard IEC 61786, "Low-frequency magnetic and electric fields with regard to human exposure—Special requirements for instruments and guidance for measurements." The standard includes descriptions of instrumentation for characterizing magnetic and electric fields (15 Hz to 9 kHz), terminology, requisite instrument specifications and calibration methods, examples of measurement protocols, and a comprehensive listing of sources of measurement uncertainty. The new standard, also spearheaded by a NIST scientist, has its genesis in a standard of the Institute of Electrical and Electronics Engineers (IEEE), in particular, the AC Fields Working Group in the IEEE Power Engineering Society. This standard, IEEE Std. 1308-1994, Recommended Practice for Instrumentation: Speci-fications for Magnetic Flux Density and Electric Field Strength Meters—10 Hz to 3 kHz, provided the basis when WG 11 began the process leading to the development of the standard in 1995.

The preparation of the IEC standard was prompted in part by the January 1995 publication of a European Committee for Electrotechnical Standardization (CENELEC) Prestandard, ENV 50166-1, "Human exposure to electromagnetic fields, Low-frequency (0 Hz to 10 kHz)." The CENELEC prestandard sets restrictions on human exposure to magnetic and electric fields in the frequency range 0 Hz to 10 kHz and is intended for "provisional application" for 3 years. The usefulness of the new IEC standard also should increase with the recent publication of revised magnetic and electric field exposure guidelines by the International Commission on Non-Ionizing Radiation Protection [Health Physics **74**, 494 (1998)]. The new IEC standard complements these exposure documents without endorsing the appropriateness of their recommendations. Because the text of the draft document will indicate field meter specification requirements, as well as calibration and measurement methods, it is important that conflicts do not develop between the United States (IEEE) and international standards in these areas. As a member of the IEC, the United States is under some obligation to adopt the recommendations of IEC standards, which are voluntary. There also are potential economic implications for U.S. manufacturers of instrumentation that wish to market their products in Europe.

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NIST-LED FIRST INTERNATIONAL STANDARD FOR SUPERCONDUCTORS PUBLISHED BY IEC

The first international standard on superconductivity has been published by International Electrotechnical Commission (IEC) Technical Committee 90 (TC90). The

document is IEC 61788-1 Superconductivity—Part 1: Critical Current measurement—DC critical current of Cu/Nb-Ti composite superconductors. NIST scientists initiated the first draft of this document and subsequently addressed all comments and suggestions received over the last 6 years on nine draft versions. TC90 incorporates eight working groups (WGs), each assigned the task of creating a specific standard. The process of standards development required circulation of each draft for comments and suggestions from the international members of WG2 and the national committees of each participating country. Each national committee has a technical advisor (TA) and a technical advisory group (that provide input and cast votes at various stages of the process.

With this first experience in IEC standards development as a guide, the members of TC90 are proceeding more expeditiously with the development of two companion standards on critical-current measurement for other superconductor materials. In addition, five other standards are in process in TC90.

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INTERNATIONAL COMPARISON OF NOISE-TEMPERATURE MEASUREMENTS COMPLETED

NIST staff have completed their assignment for a pilot laboratory on an international comparison of thermal noise measurements, conducted under the auspices of the International Committee on Weights and Measures/ Consultative Committee on Electricity (now Consultative Committee on Electricity and Magnetism). The comparison is identified as GTRF-92-2. The noise temperatures of two commercial solid-state noise sources having GPC-7 connectors were measured at 2 GHz, 4 GHz, and 12 GHz at the national measurement laboratories in France (Laboratoire Central des Industries Electriques), Germany (Physikalisch-Technische Bundesanstalt), the United Kingdom (National Physical Laboratory), and the United States. Good agreement was found among the results from the different laboratories, with all results agreeing within the relative expanded uncertainties, which ranged from 0.5 % to 2.9 %. The comparison was performed in accordance with the guidelines recently adopted by the Consultative Committee and served as a test vehicle to evaluate these guidelines. A paper reporting the results, authored by representatives from each participating laboratory, was presented at the Conference on Precision Electromagnetic Measurements, held in Washington, D.C., earlier this summer. Accurate knowledge of noise is important, because the presence of noise limits the information capacity of a communication channel.

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NIST UNVEILS NEW WORKING STANDARD FOR LOW HUMIDITY LEVELS

The fabrication of semiconductors requires the use of high purity gases with very low water content. Given its ubiquity, contamination by water vapor is difficult to avoid and can be assessed only by measurement of the water content of the process gases used. Failure to maintain high purity (less than 100 nmol of water vapor per mol of bulk gas) can degrade seriously the overall efficiency of many processes related to semiconductor manufacturing, resulting in decreased yield and increased cost, and limiting ultimate product performance. Consequently, manufacturers install ultra-sensitive hygrometers in an attempt to measure trace amounts of water vapor in their process gases. To ensure that these measurements are reliable, this instrumentation must be periodically calibrated against humidity standards.

Unfortunately, humidity calibration at nmol/mol levels of water vapor is not straightforward. The most common approach is to use humidity generation schemes based on use of “dry” gases, addition of a “known quantity” of water vapor (via a permeation device), and multi-stage dilution. This approach, although widespread, is far from ideal. The dryness of the gas is difficult to ensure, and uncertainties associated with measurement of gas flow rates and water-vapor permeation rates can lead to irreproducibility and significant error.

To address this problem, NIST researchers have developed a high-precision humidity calibration system, based on the physical properties of water. The new device, known as the Low Frost-Point Humidity Generator (LFPG) sidesteps uncertainties associated with the “dry gas” and flow-mixing stages used in conventional systems. Rather than mixing water vapor with dry gas, the LFPG produces accurately known water vapor/gas mixtures by flowing the carrier gas over a surface of pure ice maintained at an accurately known, fixed temperature between –5 °C and –101.6 °C. The resulting water content of the equilibrated gas/water mixture exiting the LFPG is dependent only upon the vapor pressure of ice (a temperature-dependent thermodynamic property) and system pressure. Unlike flow-based systems, the output of the LFPG is independent of the gas flow rate.

Variation of the LFPG temperature over its entire operating range yields humidity levels spanning six

decades in water concentration. By tightly controlling the system temperature to within 0.002 °C, NIST researchers can produce humidity levels with a relative uncertainty of better than 0.04 %. NIST calibration services for trace moisture level hygrometers and humidity generators, using test gas supplied by the LFPG, will commence in early 1999.

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NIST HOLDS WORKSHOP ON DESIGN GUIDELINES FOR FIBER-REINFORCED POLYMER COMPOSITE STRUCTURES

At a workshop hosted by NIST, fiber-reinforced polymer (FRP) composite manufacturers and their raw material suppliers were invited to discuss and make recommendations for an FRP design code for civil engineering applications. In recent years, interest in the use of FRP composites for infrastructural and offshore applications has increased substantially. However, the lack of performance data as well as the absence of design specifications or codes for these materials has hindered greatly their acceptance by civil engineers.

A plan proposing the use of load and resistance factor design (LRFD) principles as a basis for a design code was presented and discussed extensively. NIST researchers presented overviews of NIST's capabilities and potential contributions to an LRFD-based design code. Ongoing efforts in the development of a design code for FRP materials also were reported on by representatives of the American Society of Civil Engineers (ASCE), which has assisted in implementing LRFD-based design codes for both steel and timber construction materials. Issues cited as critical to this effort include long-term durability, fire performance, and industry-wide standardization of FRP components.

A total of 20 participants from a variety of organizations attended the meeting. Plans are currently under way for a follow-up meeting in which plans for establishing a government/industry consortium will be formalized.

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WORKSHOP ON PROPERTIES AND APPLICATIONS OF DENDRITIC POLYMERS

Lack of knowledge about the properties of dendritic polymers at interfaces was identified at a recent NIST workshop as a critical barrier to full exploitation of these unique polymers. Other needs identified by the attendees included direct comparisons of structures of dendritic polymers and characterization of interactions with other polymers. Dendrimers, which are highly branched and precisely constructed polymers, represent new macro-molecular structures that have attracted attention in the scientific community for several years and have recently moved into production and application. The workshop, held in July 1998, sought to define the future research directions that would advance applications of these materials.

Results of the workshop will be used to plan future directions of the research. The 70 participants represented all of the companies manufacturing dendrimers, as well as most of the companies using dendritic polymers in products and the leading academic laboratories in the field. For true dendrimers current products include agents for gene transfection and immunoassays. Promising applications also were described in drug delivery, radiation therapy, imaging enhancement, coatings, and chemical sensors. Other materials applications for dendritic polymers that have demonstrated economic feasibility include production of nanoporous low dielectric materials, additives for coloring polyolefins, and polymer processing or toughening aids. It also was shown at the workshop that some polyolefin polymers synthesized from metallocene catalysis owe their properties to dendritic branching. This information will help NIST direct its research efforts to benefit a wide range of important applications.

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WORKSHOP HELD ON FILLED POLYMERS AND NANOCOMPOSITES

Control of molecular-level interactions and measurement of polymer dynamics at the filler interface were identified by participants at a recent NIST sponsored workshop as the most critical issues in filled polymers and nanocomposites. Although filled polymers already represent a substantial fraction of polymer materials, recent developments in nanocomposites have attracted renewed interest in developing the science and technology base to optimize performance.

The workshop, held in June 1998, focused on identifying the most critical issues hindering improvements in applications of filled polymers and nanocomposites. Of the 75 external participants, 50 were from industry, mostly experts in the area of filled polymer technology. Through lively discussions, the workshop participants highlighted and prioritized a range of future research and measurement needs for filled materials. The discussions also laid the foundation for future research in this

area, and collaborations between NIST, industry and academia. The results of the workshop will be used to plan future directions of NIST work.

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ARTIFACT METROLOGY FOR DEPARTMENT OF ENERGY

Engineers at Los Alamos National Laboratory are pioneering the use of a glass hyper-hemisphere (20° past the Equator) as a reference artifact for the shell measurement machines used throughout the nuclear weapons complex and turned to NIST for assistance in optical measurement of the figure of this artifact. A NIST scientist presented an analysis at Los Alamos of interferometric measurement methods showing that all the relevant features—internal and external radii, wall thickness, wall thickness variation, and "pole height"—can be obtained optically. Optically obtained measurements provide a measurement entirely independent of the mechanical (coordinate measuring machine or special-purpose measuring machine) methods currently used. The first artifact is in production at Los Alamos and measurements are expected to be made on this artifact in 1999.

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Standard Reference Materials

COPLANAR WAVEGUIDE VERIFICATION SETS ARE NOW REFERENCE MATERIALS

Coplanar waveguide verification sets fabricated at NIST have become one of the agency's newest high-frequency reference material sets. Known as NIST RM 8130, the initial set of 25 reference wafers contains NIST-characterized microwave circuitry that can be used to measure the drift of microwave on-wafer probing stations and verify that the instrumentation is capable of repeating NIST measurements. It also makes it possible to test the integrity of the test instrumentation and setup. For example, the test procedure is designed to identify unsound connections and other common instrument problems.

Developed with the help of the NIST Monolithic Microwave Integrated Circuit Consortium, the verif-i cation set costs about $3,600. The 25 reference materials in the initial batch have been tested individually.

For technical information, contact Dylan Williams, MC 813.01, NIST, Boulder, Colo. 80303-3337, (303) 497-3138, dylan@boulder.nist.gov. To order RM 8130, contact the Standard Reference Materials Program, Building 202, Room 204, NIST, Gaithersburg, MD 20899-0001, (301) 975-6776, fax: (301) 948-3730, srminfo@nist.gov.

Media Contact: Collier Smith (Boulder), (303) 497-3198; collier.smith@nist.gov.

NIST SILICON RESISTIVITY STANDARDS IN DEMAND BY INDUSTRY

Semiconductor industry need for new silicon resistivity Standard Reference Materials has been demonstrated through the sales of some 200 units of these standards. They were first put into stock in late 1997 when NIST announced the availability of an improved set of SRMs, superseding the earlier silicon resistivity SRM sets. Resistivity is the most important materials parameter to be specified for silicon starting materials. Nominal resistivity values of the new SRMs range from 0.01 Ω cm to 200 Ω cm; the wafer diameter is 100 mm. In response to industry needs, these SRMs provide improved uniformity and substantially reduced uncertainty of certified values as a result of both material and procedural improvements. In particular, the certification is based on a dual-configuration four-probe measurement procedure in contrast to the single-configuration measurements used in the earlier resistivity SRMs. Extensive testing has shown that the dual-configuration procedure reduces random variation of measurements and probe-to-probe differences. Individual data for each wafer are supplied on the SRM certificate. Technical insights presented by the rigorous certification process are available in NIST Special Publication 260-131, Standard Reference Materials: The certification of 100 mm diameter silicon resistivity SRMs 2541 through 2547 using dual-configuration four-point probe measurements.

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SRM STANDARD BULLETS

The 1998 AFTE (Association of Firearm and Tool Mark Examiners, 98-AFTE) conference was held in Tampa, Fla., July 1998. Approximately 300 people from about 15 countries attended this conference, the 29th AFTE annual meeting since 1969. More than 30 speakers presented talks regarding bullets and casings examinations and crime solving.

In 1997, the Alcohol, Tobacco, and Firearms (ATF) bureau approached NIST about creating a standard bullet and casing that could be used for training new operators and for testing the performance of their machines. NIST agreed to start a new project for Standard Reference Material (SRM) standard bullets and casings. In April 1998, two NIST prototype standard bullets, based on a numerically controlled diamond turning process used for producing the NIST random profile roughness specimens, were delivered to the ATF for testing.

In the 98-AFTE, the NIST prototype standard bullet was measured by a newly developed DRUGFIRE 3-D Rotoscan System for bullets and casings measurements. Measuring results on the new system showed high agreement with that measured at the NIST microform calibration system. Instrument makers and bullet examiners also provided comments and suggestions regarding the improvements on the design, testing, and use of the standard bullets and casings. Based on these comments, a new version of the NIST standard bullets will be put into production and testing. A new proposal will be used for developing some standard bullets with twisted bullet signatures. NIST prototype standard casings also will be developed shortly.

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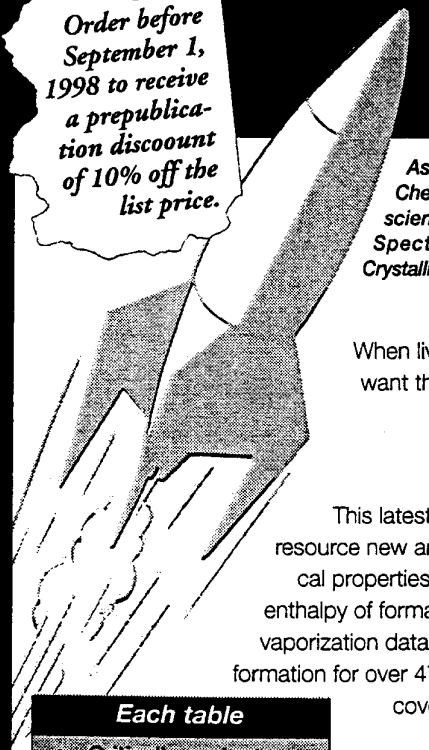

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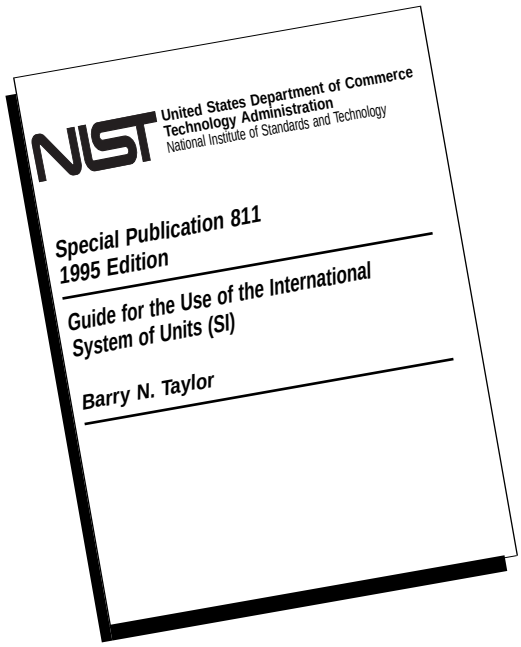

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The 1995 edition of the National Institute of Standards and Technology Special Publication 811, *Guide for the Use of the International System of Units (SI)*, by Barry N. Taylor, is now available.

The 1995 edition of SP 811 corrects a number of misprints in the 1991 edition, incorporates a significant amount of additional material intended to answer frequently asked questions concerning the SI and SI usage, and updates the bibliography. The added material includes a check list for reviewing the consistency of written documents with the SI. Some changes in format have also been made in an attempt to improve the ease of use of SP 811.

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