TCSUH and MCC Establish High T_c Superconductor Consortium

On March 28, 1989, the Texas Center for Superconductivity at the University of Houston (TCSUH) and Microelectronics and Computer Technology Corporation (MCC) announced a cooperative research agreement to develop commercial uses for high temperature superconductor (HTS) materials and transfer HTS technology to U.S. industry. The agreement establishes joint membership in the TCSUH/MCC industrial consortium.

Paul C.W. Chu, director of TCSUH, and Harry Kroger, director of the HTS program at MCC, will manage the partnership and, with advice from consortium members, will recommend the research agenda.

"This collaboration is most significant due to the complementary nature of the two organizations, combining basic and applied superconductivity research with the design and fabrication technology needed for commercial development," Chu said.

MCC, a cooperative research venture owned by a group of U.S. companies, has experience in superconductive device design and fabrication, superconductive circuits, design of unique thin film fabrication equipment, and experience in analyzing electronic applications. MCC's programs are dedicated to long-range research aimed at significant advances in computer and information technology.

As director of MCC's HTS program, Kroger is exploring electronic applications of superconducting materials. Kroger has concentrated on semiconductive and superconductive devices throughout his research career. During his 22 years at Sperry Corporation, he defined and managed research programs, especially in the areas of GaAs and Josephson LSI.

TCSUH and MCC entered this agreement with several industrial participants, including Bellcore, Boeing, Digital Equipment Corporation, DuPont, Motorola, 3M, and Westinghouse. Eventually, the organizations expect to have about 20 members participating from industry, as well as governmental and educational institutions.

To join the consortium, industrial participants make a three-year commitment to pay a $150,000 annual fee to support research at TCSUH and MCC. The TCSUH/MCC consortium, advised by its members, will set a research agenda to address a broad range of HTS material and application projects.

Some of the more important goals to be met by the consortium are to:

- Search for better HTS materials and improve characteristics of existing HTS materials,
- Speed development of commercial applications of HTS materials,
- Develop HTS device concepts and processes optimizing the unique characteristics of HTS,
- Transfer technology to the participants,
- Help provide participants a competitive advantage in applying HTS to their selected markets,
- Provide strategic/technology decision support for the impact of HTS on a participating firm's market, and
- Educate and train scientists and engineers for development and utilization of future HTS technology.

This agreement does not alter the status of the University's existing agreement with E.I. du Pont de Nemours Company, signed August 23, 1988. That agreement assigns exclusive license privileges to Du Pont for superconductivity technology developed by TCSUH's Experimental Materials Research Laboratory. MCC and consortium members may receive sublicenses for this technology under terms of the agreement between the University and Du Pont. *(From TCSUH News, Vol. 1, Issue 3-6, March-June 1989, p. 1.)*

Agreements Signed with National Labs

The TCSUH/MCC consortium recently signed cooperative research agreements with the Pilot Centers for High Temperature Superconductivity at Argonne, Los Alamos, and Oak Ridge national laboratories. The agreements enable researchers from the national laboratories, TCSUH, and MCC to actively exchange information on several levels. The collaboration is expected to open the doors to joint research projects in superconductivity.

"These agreements provide the seven existing and other prospective TCSUH/MMC consortium members additional leverage by providing a window to the annual $30 million HTS-related spending by the national labs," said MCC's Kroger. "Much of the work is directly relevant to TCSUH/MCC-related interests—national lab researchers have already attended our technical reviews and we are identifying exciting areas of collaboration."

Directors of Superconductivity Pilot Centers—Elton Kaufmann of Argonne, Rod Quinn of Los Alamos, and Anthony Schaffhauser of Oak Ridge—said the national laboratories will provide a mutual complement to TCSUH's work on basic and applied superconductive materials and MCC's work on electronic applications. They also stated that the agreements will better enable the national laboratories to understand what research is of maximum relevance to industry, which will help shape the national laboratories' applied programs.

Scientists Work on Recycling Plastics, Developing Biodegradable Forms

Scientists at the Center for Plastic Recycling at Rutgers University, a National Science Foundation (NSF) Industry-University Cooperative Research (IUCR) Center, have developed and are licensing a cost-effective, large-scale recycling system that separates polyethylene terephthalate (PET) soft drink bottles and high-density polyethylene (HDPE) containers for milk and various household products from other plastics. The first commercial plastic bottle recycling plant to use this process will be built in Logan Township, New Jersey.

The IUCR Center at Rutgers also has a demonstration system that extrudes forms made from mixed plastics remaining after removal of PET and HDTE. The system incorporates technology invented by Advanced Recycling Technology of Belgium. The extruded plastic is used in construction to make park benches or parking blocks, with many more applications planned.

In addition to NSF support, the Center receives state funding from the New Jersey Commission on Science and Technology, as well as major support from industry groups including the Plastics Recycling Foundation and the Center for Solid Waste Solutions. Scientists at Rutgers are also examining the potential of degradable plastics that would be broken down into carbon dioxide, water, and soil-fertilizing humic material by microbes in a matter of months.

Using Bacteria to Make Plastics

Douglas Dennis, an NSF-supported researcher at James Madison University, Harrisonburg, Virginia, is studying genetic engineering as a way to efficiently produce plastics from bacteria. When under stress, one bacterium of interest to Dennis, *Alcaligenes eutrophus,* makes significant amounts of a polymer called poly-beta-hydroxybutyrate, or PHB. *A. eutrophus* uses PHB as an energy-storage compound. Humans are considering using PHB-V, a slightly modified form obtained by growing *A. eutrophus* on an altered feedstock, for controlled release of agricultural chemicals, and medically for orthopedic pins and plates.

Marlborough Biopolymers, which is mostly owned by ICI Americas, has bro-

https://doi.org/10.1557/S088376940006142X Published online by Cambridge University Press

https://doi.org/10.1557/S088376940006142X Published online by Cambridge University Press

ken ground on a new plant that will enable the company to increase PHB-V production from 50 tons per year to 500 tons. The company hopes that in a few years, PHB-V might compete as a replacement for polyethylene or polypropylene in specialty packaging or wherever degradable plastics are mandated.

Robert Lenz and R. Clinton Fuller of the University of Massachusetts are also studying PHB, as well as plastics that *A. eutrophus* and other bacteria can make when fed different hydrocarbons. Primarily interested in coaxing bacteria to create new polyesters, Lenz and Fuller are funded by NSF, the NSF IUCR Center for Research on Polymers at the University of Massachusetts, and the Office of Naval Research. They are collaborating with scientists at the New Jersey Institute of Technology to develop fast, quantitative assays for investigating the biodegradability of the new polymers.

Cellulosic Hybrids

Also working with NSF support, Ramani Narayan, Purdue University, has used standard chemical engineering principles to make new, improved hybrids consisting of natural cellulose compounds combined with synthetic plastics.

Cellulosic materials and starches are naturally degraded by microbial enzymes. However, microbes can only digest the long chains of plastic polymers from the end of the chain, one carbon at a time, and only when adequate moisture and oxygen are present. Besides sporting microbe-daunting long chains, the mainstay synthetics repel water, making it difficult for water-borne microbes to get into the plastic in the first place.

Narayan has invented compounds called graft copolymers, which he says improve the mixing of the cellulose compounds with the plastics, making for better adhesion and strength. For a few cents more per pound, biodegradable polyethylene bags can be made with 15 to 30% cellulose. Narayan has made graft copolymers for mixing cellulose acetate with polyethylene, polystyrene, and polypropylene, and Purdue has patented both the copolymers and the process for making them.

Some say the use of degradable plastics may hinder recycling efforts, and that toxic pigments and other additives could leach into groundwater when the plastics break down. Scientists at the Center for Plastic Recycling note that a small percentage of starch in the recycling stream does not hamper the extrusion of mixed plastics. Narayan says starch can be dissolved in one step with acid, leaving synthetic resin. If more laws mandate degradable plastics, companies might pursue further studies to see which of them are recyclable or leave toxic residues.

American Magnetics to Work with Oak Ridge on High T_c Superconducting Wire

American Magnetics, Inc. (AMI) and the High Temperature Superconductivity Pilot Center at Oak Ridge National Laboratory (ORNL) have signed a one-year, $470,000 cost-sharing agreement on research and development, under which AMI will develop technologies to fabricate a flexible high T_c superconducting wire that can ultimately be used to manufacture a demonstration magnet.

The agreement will be carried out in conjunction with the first phase of a proposed three-year project awarded to AMI by the Defense Advanced Research Projects Agency (DARPA), the goal of which is to wind a solenoid magnet with a high T_c superconducting wire. AMI has subcontracted with the Georgia Institute of Technology to provide initial fabrication of sample superconductor materials using a proprietary process. The process is based on the use of chemical vapor deposition to produce thin films of the superconductor on a flexible substrate.

U.K. Company to Produce III-V Wafers by MOVPE

Backed by £9 million from Shell Ventures Ltd., United Kingdom, Mike Scott and Drew Nelson have set up a new company to produce custom III-V wafers by metalorganic vapor phase epitaxy (MOVPE). The company, Epitaxial Products International, will be located in Cardiff, South Wales.

The idea evolved from a Department of Trade and Industry collaborative program to boost U.K. research in indium phosphide and related materials under the auspices of JOERS (Joint Optoelectronic Research Scheme), with two laboratories playing a major role in the plan—Plessey Research and British Telecom Research Laboratories. The expertise being brought to this venture includes MOVPE of a range of III-V device structures, including laser structures, light emitting diodes, and detectors. The aim is to capture a corner of the optoelectronic market by supplying multilayer device structures, fully characterized and designed to customer specifications.

The facility in Cardiff was specially designed for the safe operation of a large MOVPE laboratory. It includes 8,000 square feet of class 100 clean rooms. Plans are to double this within five years to house a total of 12 MOVPE reactors, making it one of the largest of its kind in Europe.

The location in South Wales resulted from efforts by WINtech, the technology arm of the Welsh Development Agency, which is spearheading a high technology economic revival in this area. The company was officially opened on July 11, 1989 by the Rt. Hon. Peter Walker MP, Secretary of State for Wales.

EEC Receives 650 Applications for Materials Research Funding

Following the European Economic Community's call for proposals in materials research earlier this year, the Commission in Brussels received 650 applications for funding within the BRITE/EURAM (Basic Research in Information Technology and Engineering, and European Research on Advanced Materials) combined program. Each application contained, on average, teams of three to four groups from throughout the EEC, with at least two and often three different countries involved.

The proposed 1989 budget of 73 million European Currency Units (1 ECU is approximately US$1.1), would have allowed funding for only about one proposal in 10. However, the Commission decided to combine the proposed budgets for 1989 and 1990, making about 200 million ECUs available at once this year. It will now be possible to fund the top 30% or so of the applications. After scientific judgment of the proposals, some 190 projects are expected to be funded by the end of the year.

The next call for proposals in the BRITE/EURAM area is not expected until mid-1990, with a starting date of January 1991. The budget at this time is expected to be approximately 135 million ECUs.

Japan, Canada Propose 18 Subjects for Joint Research

A Japan-Canada wise men's conference for future joint scientific research recently submitted a proposal of 18 research subjects to Japanese and Canadian prime ministers. Chosen for Japanese-Canadian scientific cooperation were frontier technology, biotechnology, oceanography, space science, frontier manufacture engineering, and environmental control. "Frontier technology" consists of three minor subjects including high T_c superconductor film. Researchers belonging to Japan's Science and Technology Agency and the Ministry of International Trade and Industry assisted in selecting the subjects at the request of the wise men's conference. It is not known at present if the superconductor film topic will start activities.

THE ELEMENTS OF SURPRISE...

Geller MicroAnalytical Laboratory provides expert Auger, SEM, X-ray and metallographic services. The products introduced here reflect our dedication to advancing the state-of-the-art of our industry.

Standards

Set a *New Standard* for calibrating your X-Ray or Surface Analysis Instrumentation by using *Ultra-High Vacuum compatible standards.*

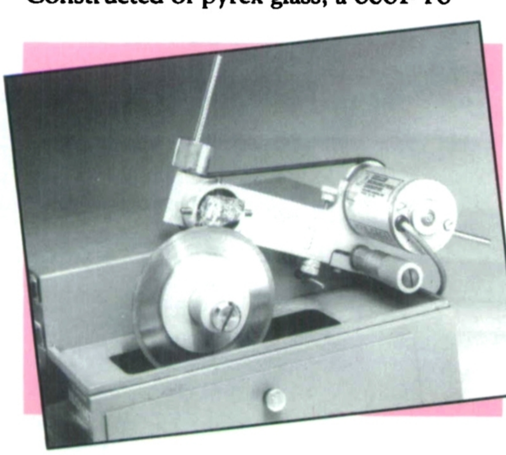
- Each high purity material is individually polished and individually inserted into a SS304 mount (negligible outgassing) fabricated for your instrument.
- Each material (3mm dia.) can be individually removed or replaced with the tools and retainers provided.
- Each standard material is individually analyzed with our in-house Auger/EDS/SEM instrumentation.

And now, *to meet your specific requirements*, SS304 mounts have been designed to accommodate 6, 9, 12, 15, 18 or 37 high purity, reference materials.

Vac-U-Storr

Protect your materials in a stable, controlled environment with the *Vac-U-Storr* dessicator. Designed to reach vacuum levels of 10^{-6} torr, the *Vac-U-Storr* provides a *sure and stable* means for storage of air-sensitive materials either under vacuum or in a specific gaseous environment. Constructed of pyrex glass, a 6061-T6 aluminum lid, a Viton gasket and a shutoff valve, the *Vac-U-Storr* is available in four convenient sizes ranging from 2.0″ O.D. x 2.8″ H to 5.5″ O.D. x 6.0″ H.

Whether you need to maintain calibration standards in a dry vacuum or superconductors in oxygen, *Vac-U-Storrs* provide the ultimate storage environment for your sensitive materials.



Counter-Rota-Cutter

Improve the *performance* of your Buehler ISOMET or of your LECO VC-50 metallographic saw by attaching the precision made, *patent pending, Counter-Rota-Cutter* (CRC-901).

By rotating the workpiece during the cutting process, problems associated with section thickness, large contact area, blade wander, surface deformation or irregular sample shape have been addressed. The revolutionary *Counter-Rota-Cutter* (CRC) provides the capability for producing thinner sections (0.004″ thickness over 1.5″ O.D.) with greatly superior surface finish from larger samples, unattended, with up to a 90% savings of your time.

Whether you need to cut prostheses or open ceramic/metal I.C. packages (without damage or interior contamination), the CRC attachment offers a *New Dimension* for sectioning materials.

GELLER MICROANALYTICAL LABORATORY

One Intercontinental Way
Peabody, Massachusetts 01960
508/535-5595 Fax: 508/535-7653

Buehler ISOMET and LECO VC-50 are Registered Trademarks. Viton is a du Pont Company Registered Trademark.

https://doi.org/10.1557/S088376940006142X Published online by Cambridge University Press

The Japan-Canada scientific cooperation project has the following program:

(1) The governments of the two countries will jointly set up an advisory committee which will consist of industrial and academic scientists and give advice to the joint research activities.

(2) The advisory committee will determine subjects to be carried out from among the 18 minor subjects chosen by the wise men's conference.

(3) The advisory committee will submit the determined subjects to the Japan-Canada joint committee for scientific technology cooperation.

(4) Research will start. One official of the Science and Technology Agency stated that Japan hopes to hold the first meeting of the advisory committee by the end of 1989.

The governments of Japan and Canada reached agreement in January 1988 to strengthen mutual cooperation in scientific technology, and set up a wise men's conference to survey possible subjects for scientific cooperation. The conference is made up of eight scholars, four each from Japan and Canada. The Japanese members are Michio Okamoto, member of the scientific technology conference; Masato Yamano, board chairman of AST; Hiroyuki Yoshikawa, professor of Tokyo University; and Hiroo Kawata, policy committee member of the scientific technology conference. The survey was financed by both governments, each of which contributed $100,000. The Canadian Conference on Sciences took care of managerial work of the survey.

From *Superconductor Week*, **3** (31) Aug. 7, 1989, p. 6.

Acting Director of Penn State's MRL Appointed Murata Professor

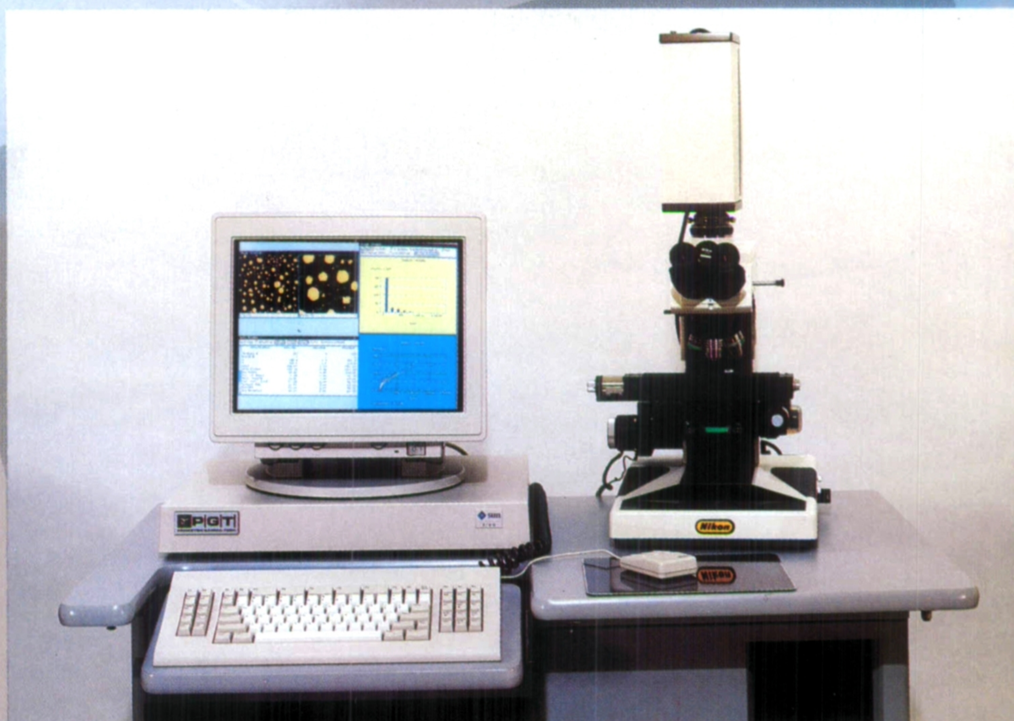
Stewart K. Kurtz, acting director of the Materials Research Laboratory (MRL) and professor of electrical engineering at Pennsylvania State University, has been appointed Murata Professor of Materials Research.

Kurtz will work in advanced materials research on electronic ceramics, with special emphasis on reliability engineering. He is developing experimental methods for rapid and effective screening to determine device performance, and plans to study the complex interrelationship between mechanical and electrical mechanisms as the primary cause of both extrinsic and intrinsic device failures. In his current research, Kurtz is applying and adapting reliability methods developed for semiconductors and opto-electric devices at Bell Laboratories to electronic ceramics

PGT ANNOUNCES

What's New Under The Sun®

IMAGIST® HAS ARRIVED!



The Next Step In Imaging Workstations

Please visit Booth No. 506 at the MRS Show in Boston, November 28-30, 1989.

A TRUE WORKSTATION ENVIRONMENT

To Maximize Productivity and Minimize Cost of Operation

- Sun® Workstation
- Multiuser/Multitasking
- Expanded Computer Power
- 32 Bit Architecture
- Report Writer Capability

A MODERN WINDOWS FORMAT

For Superb Graphics and Unsurpassed Operating Simplicity

- Over 11,000 Simultaneous Colors From a Palette of Over 16,000,000 Combinations
- Resolution of 1152 x 900
- Simultaneous X-Ray/Image display
- Simultaneous Color/Black & White Display
- Menu Driven/Simple Operating Format
- Easy Access to Sophisticated Operations

NETWORKING CAPABILITY

To Facilitate User Efficiency By Linking Facilities and Equipment, Reducing The Need For Multiple Systems

- Ethernet Standard
- Workstation to Personal Computer Communication
- Multiple Console Capability with Remote Access Control and Review
- Electronic Mail Access

UNIX® OPERATING SYSTEM

For Turn On and Run Simplicity With Simple User Customization

- Industry Recognized Standard
- Easy to Learn System Operation
- Readily Available 3rd Party Software
- Compatibility With Most Major Programming Languages

Leader From The Beginning...Committed To Stay In Front!

IMAGIST® is a trademark of PGT

PGT

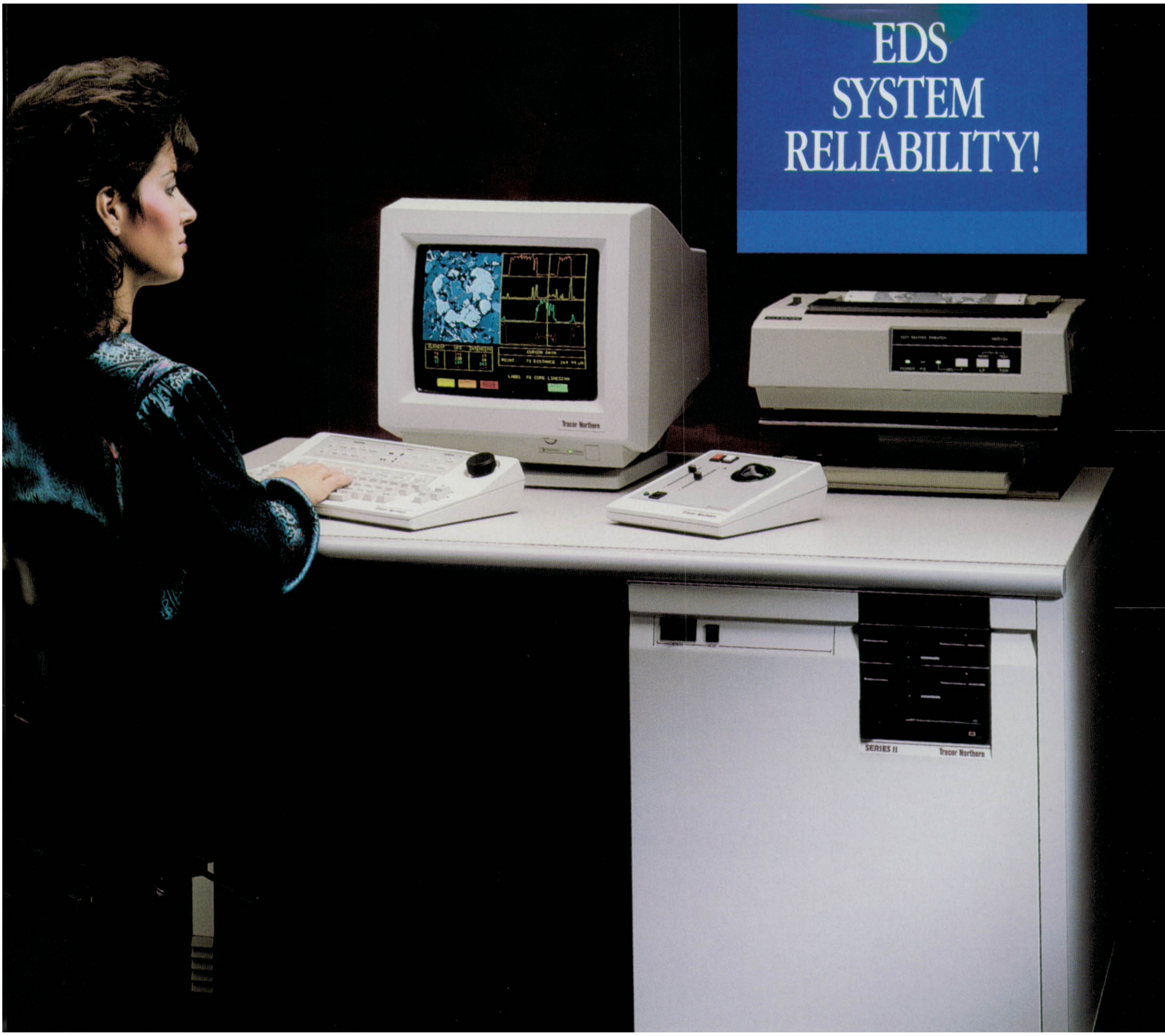
A Member of the ***Outokumpu*** *Group*

Princeton Gamma-Tech, Inc., 1200 State Road, Princeton, NJ 08540, Tel: (609) 924-7310

UNIX® is a registered trademark of AT&T

SUN® is a trademark of Sun Microsystems, Inc.

https://doi.org/10.1557/S088376940006142X Published online by Cambridge University Press



https://doi.org/10.1557/S088376940006142X Published online by Cambridge University Press

and devices such as multilayer capacitors.

Kurtz spent 20 years of his career in industrial research before joining the Materials Research Laboratory at Penn State in the summer of 1987. He teaches a course on semiconductor reliability, which he established in the Electrical Engineering Department at Penn State, and was recently the program chair for the First USA-USSR Seminar on Ferroelectricity, July 9-14, 1989, in Boulder, Colorado.

The Murata Professorship is sponsored by Murata Manufacturing Company of Kyoto, Japan, a producer of electronic ceramics. Murata Erie North America, Inc., a wholly owned subsidiary, has one of the largest surface mount multilayer capacitor manufacturing plants located in State College, Pennsylvania.

Argonne, DuPont in Agreement on High T_c Superconductor Research

DuPont and the Superconductivity Pilot Center at Argonne National Laboratory have signed an agreement for a joint research project to use high temperature superconductors in devices for chemical processing applications. The project is aimed at developing a solenoid based on high Tc superconductors. Each organization will contribute about $250,000 or the equivalent in staff and facilities. DuPont has been involved in superconductivity research for more than 25 years. Argonne has the nation's largest federally funded research program in superconductivity, with some 100 employees working on various aspects of superconductors.

R.M. German Named Hunt Professor at RPI

Randall M. German was named the Robert W. Hunt Professor at Rensselaer Polytechnic Institute (RPI), Troy, New York. The chaired professorship was created in 1938 to honor Robert Hunt and his pioneering accomplishments in metallurgy.

Prof. German has been at Rensselaer since January 1980, after prior industrial research experience. He obtained his PhD degree in materials science from the University of California (Davis) in 1975, his MS degree from Ohio State University, and his BS degree from San Jose State University. At Rensselaer, German has led a research team active in particulate materials processing. He has authored three books and published over 200 articles covering powder metallurgy, ceramics, and physical metallurgy.

India to Create Applications-Oriented National Institute

An advisory group to the Indian government has approved funding that will lead to the creation of a national institute for superconductivity applications in the 1990-1995 timeframe, according to the Chinese News Service *Xinhua*. Approximately $43.75 million is anticipated to be spent during that five-year time. Some $9.38 million is being spent during the current year.

The proposal was accepted in principle by the apex body of the national superconductivity program in a meeting held July 20. The meeting was chaired by Prime Minister Rajiv Gandhi. The body also recommended that short-term superconductivity technology demonstration projects be initiated and completed in the next two years. It also was suggested that a few long-term applications programs leading to industrial products be initiated together with industry.

From *Superconductor Week*, **3** (31) Aug. 7, 1989, p. 3.

"Siberian Snake" Considered for Particle Accelerator Designs

The 19-foot "Siberian Snake," a Soviet-conceived arrangement of magnets wrapped around the main track of a particle accelerator, is likely to be considered worldwide for incorporation into the design of new accelerators following a recent demonstration using the new cooler-ring accelerator at the Indiana University Cyclotron Facility.

The Snake is regarded by many physicists as a potentially useful aid in overcoming one of the technical challenges to cutting-edge experiments in high-energy physics. As subatomic particles increase in energy while they lap an accelerator ring, they periodically encounter disturbances, called depolarizing resonances, caused by powerful accelerator magnets. These disturbances disorient the particles so that they no longer spin in a polarized direction. With the spin direction undefined, a degree of uncertainty is added to experiments, making interpretation of results difficult.

The Snake will overcome depolarizing resonances and allow future high-energy accelerators to provide polarized beams of spinning protons, according to Alan D. Krisch, the University of Michigan physics professor who led the recent experiment—a collaboration between the University of Michigan, Indiana University, and Brookhaven National Laboratory, funded

https://doi.org/10.1557/S088376940006142X Published online by Cambridge University Press

by the National Science Foundation.

The Snake could be an important addition to very-high-energy accelerators such as the planned Superconducting Supercollider (SSC). The Indiana University cooler ring is a medium-energy accelerator with only two depolarizing resonances to contend with, but the SSC will have about 36,000 such resonances. The Snake could overcome these resonances automatically, according to scientists conducting the Indiana experiment.

Martin Marietta Licenses Ceramic Molding Process, Advanced Ceramic Material

A new ceramic molding process and a ceramic composite material are the subject of license agreements between Martin Marietta Energy Systems, Inc., and 12 U.S. companies.

Coors Ceramics Company and Martin Marietta have signed an agreement on a gelcasting process for making complex ceramic shapes. Invented by Mark A. Janney and O.O. Omatete of Oak Ridge National Laboratory's Metals and Ceramics Division, gelcasting has an advantage over current ceramic molding technology in that it minimizes the final machining required after the part has been sintered. In fact, ceramics molded by the gelcasting process can be machined before they are sintered.

The process begins with a suspension of fine ceramic powder in a water solution containing an organic compound. The suspension is poured into a mold at room temperature and polymerized. After the resulting gelatin like material is removed from the mold and allowed to dry, it can be machined if necessary. It is then heated to remove the organic compound, and reheated at higher temperatures to form the finished ceramic.

SiC Whiskers

Eleven companies representing more than 80% of the worldwide market in cutting tools have entered license agreements with Martin Marietta to use a ceramic composite developed by the U.S. Department of Energy's Ceramic Technology for Advanced Heat Engines Project and Energy Conversion and Utilization Technologies Program.

Tools made of the ceramic composite exhibit dramatically higher strength and wear resistance than metal cutting tools because they contain rodlike silicon-carbide reinforcing whiskers, fibers less than 20 millionths of an inch in diameter. Produced from rice husks, the embedded whiskers deflect the growth of cracks, making the composite much less brittle even at temperatures as high as 1,000°C.

The companies licensed to use the ceramic are American Matrix, Advanced Composite Materials, Greenleaf, Sandvik, Dow Chemical, High Velocity Corp., Iscar, Cercom Inc., Hertel, GTE Valenite, and Kennametal Inc. □

https://doi.org/10.1557/S088376940006142X Published online by Cambridge University Press