Scientists Recognized for Transferring Federal Technology to Users

Fifty-six scientists employed by federal laboratories, including three MRS members, received Awards for Excellence in Technology Transfer for their work in transferring federal laboratory results to domestic researchers and engineers in industry and state and local governments. The award is offered annually by the Federal Laboratory Consortium (FLC), formally chartered by the Congressional Federal Technology Transfer Act of 1986. The FLC's mission is to promote the rapid movement of federal laboratory findings into the mainstream of the U.S. economy.

MRS members receiving the FLC awards were James O. Stiegler of Oak Ridge National Laboratory, Richard W. Siegel of Argonne National Laboratory, and Steven J. Visco of Lawrence Berkeley Laboratory. Stiegler was the determining factor in the transfer of technologies from Oak Ridge's metals and ceramics division to the private sector. Siegel made new and improved ceramic/metallic materials via the consolidation of clusters of atoms, the building blocks of nanophase materials. Visco, recognized with Lutgard C. DeJonghe, licensed and transferred new solid-state lithium batteries using a novel solid-state cathode.

The FLC represents about 500 federal laboratories and centers, and its Award for Excellence in Technology Transfer is given annually to no more than 30 research and development teams.

Westinghouse and DOE Speed Development of Solid Oxide Fuel Cells

A $140 million five-year cooperative agreement between Westinghouse Electric Corporation and the U.S. Department of Energy aims to boost the commercial availability of the ceramic-based "solid oxide" fuel cell, a potentially clean, efficient, and versatile power generator. Westinghouse has been working with DOE since the mid-1970s to develop the all solid-state device, but the new contract could bring the fuel cell to the brink of commercial use. Government funding for the project totals $64 million, with Westinghouse sponsoring $76 million.

Westinghouse has assembled 3 kW and 20 kW operational test modules by packing individual cells together. In the new agreement, Westinghouse will test progressively larger single cells and cell bundles, culminating in tests of two 25 kW modules, three to five 100 kW modules, and a 2 mW module at commercial utility and industrial sites.

Research at Westinghouse's Science and Technology Center, Pittsburgh, Pennsylvania, will focus on materials development and cost and performance improvements. Results from developmental generator field tests and research will be used to design, fabricate, and test on-site prototype commercial units.

Solid oxide fuel cells use zirconia ceramics, producing electricity and heat electrochemically from the reaction between oxygen in the air and a hydrogen-rich fuel, such as natural gas. They have several advantages over coal-burning processes:

- Long life. With no liquid or moving parts, the modules are expected to operate reliably for many years.
- Site flexibility. Units could be made small enough to fit in a small room and provide power, for instance, to an apartment complex. Long transmission lines could be avoided.
- Output flexibility. Air and fuel flows could be varied and coordinated with changing electrical needs, providing high efficiency.
- Low-cost manufacture. Solid oxide cells can be made using robotic mass production techniques which have reduced costs in other solid-state manufacturing processes.
- High cell efficiency. The ceramic cell can operate at higher temperatures than other fuel cells, producing more energy per unit of fuel and far less CO_2 than conventional power plants. A commercial solid oxide plant will likely provide 1.5 times the electrical generating efficiency of conventional coal-burning plants.

Potential candidates for solid oxide power generating units are areas with strict environmental requirements such as hospitals, malls, or apartment complexes.

Ceramic Scientist Honored

Arthur H. Heuer, Kyocera Professor of Ceramics at Case Western Reserve University, has been named an external scientific member of the Max-Planck-Institut für

Metallforschung in Stuttgart, Germany. Heuer will collaborate and advise on policy and materials research. The lifetime appointment became effective in January.

Heuer spent nine months doing research at the Institut when he received the Alexander von Humboldt Senior Scientist Award in 1983. He made many subsequent visits to the Max-Planck-Institut, and plans to visit in June to work with scientists there on ceramics research.

Heuer joined Case Western's Department of Materials Science and Engineering in 1967. His research involves high-strength zirconia ceramics, advanced composites, and biological ceramics.

High T_c Superconducting Materials Used in SQUID ICs

Researchers at Conductus, a Sunnyvale, California firm, have demonstrated an integrated circuit containing active devices made from high temperature superconductors, operable with liquid nitrogen cooling. The circuit, a SQUID (superconducting quantum interference device) magnetometer, couples a SQUID sensor and flux transformer on the same chip. Integrating these two components on one chip makes the system more manufacturable and potentially triples the SQUID's sensitivity.

The SQUID sensor exploits a proprietary process for making Josephson junctions by grain boundary engineering. The flux transformer senses magnetic flow or fields with superconducting materials, a technology jointly developed by Conductus, Lawrence Berkeley Laboratory, and the University of California, Berkeley, under sponsorship of the California Competitive Technology Program.

Conductus plans to commercialize the integrated SQUID magnetometer in a variety of applications which might include biomagnetic research, geophysics, magnetic anomaly detection, or nondestructive testing.

R. German Named to Penn State Materials Chair

Randall M. German, formerly the Robert Hunt Professor of Materials Engineering at Rensselaer Polytechnic Institute (RPI), has been named to the Brush Chair in Materials at Pennsylvania State University's College of Engineering. German joined the college in May.

Known for developing high performance materials, German holds six patents for materials and/or ceramic powder processing techniques. He is also technical director of Xform, Inc., an RPI incubator company formed to develop one of his patents. German is an advocate of frequent and dynamic interaction between university researchers and the business and corporate world. "The role of the university researcher is more and more one of technology transfer. We have to translate research discoveries into the distilled knowledge needed to make better products," he said.

A Fellow of ASM International and a member of several societies in his field, German is the author of four books, including a textbook on various aspects of materials science, and the author or coauthor of more than 200 scientific articles.

German holds a BS in materials science from San Jose State University, an MS in metallurgical engineering from Ohio State University, and a PhD in materials science from the University of California at Davis.

Chung Named to Niagara Mohawk Chair

Deborah Chung, professor of mechanical and aerospace engineering and director of the Composite Materials Research Laboratory in the University at Buffalo School of Engineering and Applied Sciences, has been selected as the holder of the Niagara Mohawk Power Corporation endowed chair in materials research. The professorship was established by the New York utility in 1989 to attract and retain a nationally recognized teacher and scholar in the field of energy-related materials.

Chung joined the faculty at the University at Buffalo in 1986 after being associate professor of metallurgical engineering and materials science at Carnegie Mellon University. She received her PhD in materials science in 1977 from Massachusetts Institute of Technology and her BS and MS degrees in engineering science from California Institute of Technology.

Chung is known for her work in carbon fibers, graphite, polymer matrix composites, metal matrix composites, concrete, and electronic packaging. Recently, she was awarded nearly $1 million in research grants. The majority of it, from the Defense Advanced Research Projects Agency, is for work on materials for heat transfer in electronic packages. Other grants are from the New York State Energy Research and Development Authority for carbon research related to battery electrodes and from the Department of Energy for carbon-fiber-reinforced superconductors.

Chung has authored over 80 research articles and holds a number of patents. She has received numerous honors and awards including the Ralph R. Teetor Educational Award from the Society of Automotive Engineers, AIME's Robert Lansing Hardy Gold Medal, and the Ladd Award for being one of the most promising engineering faculty members at Carnegie Mellon University. Chung is serving as chair of the 21st Biennial Conference on Carbon sponsored by the American Carbon Society, to be held at the University of Buffalo in 1993.

Australian National University Opens Department of Electronic Materials Engineering

The Department of Electronic Materials Engineering in the Australian National University's (ANU) Research School of Physical Sciences and Engineering officially opened in May. The new department is specifically chartered to provide an applied and industry-relevant focus to research and facilities already available within the Research School of Physical Sciences and Engineering, and to link the university's research in this area with that of other research organizations.

According to Department Head J.S. Williams, "The prime research thrust of the new department is the growth, processing, and characterization of advanced semiconductor structures....programs already under way are internationally recognized and focused on areas of particular potential for Australian industry."

In addition to Williams, the department has three academic staff members: R.G. Elliman, M.C. Ridgway, and A. Calka.

One major research area involves the growth, subsequent processing, and characterization of precise layers of compound semiconductor materials such as GaAs. ANU is the first institution in Australia to successfully grow this class of materials by metalorganic chemical vapor deposition. ANU recently commissioned a reactor for this method, completing the acquisition of facilities worth $3 million, making the department fully operational.

Other major facilities are an MeV ion implanter for controlled modification of the near-surface optical and electrical properties of semiconductors, and a secondary ion mass spectrometry system for measuring elemental composition profiles in layered semiconducting materials with a sensitivity of around one part per billion. The three facilities are unique in Australia.

The department holds joint appointments and research programs with other ANU departments and schools. It has a formal joint research venture with the Royal Melbourne Institute of Technology, several collaborative research programs and contracts with other Australian Universities, as well as with government agencies and local industry. It also collaborates with research laboratories and industry in several overseas countries.

For more information, contact: J.S. Williams, Department of Electronic Materials Engineering, Australian National University, GPO Box 4, Canberra, ACT 2601, Australia; telephone 61-6-249-0020; fax 61-6-249-0511.

Molecular Engineering Technology Could Aid Development of New Polymer Blends

A new technical approach that could guide chemists in the development of novel polymer blends and copolymers has been developed at Sandia National Laboratories. Using computer codes based on a polymer theory developed at Sandia, polymer chemists can infer the approximate solubility and phase behavior of hypothetical polymer mixtures before going into the laboratory. A San Diego software firm, BIOSYM Technologies, is collaborating with Sandia to develop commercial software based on the polymer theory.

Although alloying of metals has been practiced for centuries, blending polymers to produce engineering materials is relatively new. Because of their chainlike nature, polymers mix in a more complex manner than metals, and researchers are now engaged in understanding the relationship between the polymer blend miscibility and molecular structure.

The polymer theory developed at Sandia differs from previous theories in that it does not assume the polymer molecules are confined to regularly spaced lattice positions. The theory includes the effects of nonrandom packing, chain connectivity, and compressibility. These effects play an important role in accurately predicting the thermodynamics of mixing of polymers. Nonrandom mixing can stabilize the miscible mixture and hinder a polymer's tendency to separate.

The new approach can overcome trial-and-error procedures, potentially identifying promising new alloy systems based on hypothesized polymer structures, reducing the time-consuming, costly synthesis and characterization work of current materials development strategies.

Local chemical details need to be modeled more, and this will be done with industrial partners. BIOSYM has formed a consortium of more than 40 polymer manufacturing companies for the purpose of integrating molecular modeling techniques into their polymer development activities.

Gilbert Y. Chin, retired director of the Passive Components Research Laboratory at AT&T Bell Laboratories in Murray Hill, New Jersey, died of cancer on May 5, 1991. He was 56.

Since joining Bell Laboratories in 1962, his research covered magnetic and mechanical behavior of metals and alloys and how to develop them into commercial alloys. He studied the mechanisms of slip-induced magnetic anisotropy and helped develop magnetic memories for electronic switching systems. He headed a task force that developed Chromindur, a new family of low cobalt Cr-Co-Fe ductile permanent magnetic alloys. AT&T successfully used one of these alloys in telephone receivers, saving several million dollars annually.

Chin made significant contributions to crystal plasticity theory by generalizing and implementing research into linear programming concepts. Computer analysis of this work led to major advances in the understanding of crystal plasticity phenomena such as strength anisotropy, deformation texture development, and formability. His program on crystal plasticity continued over an eight-year period and resulted in over 30 papers. Chin was awarded the Mathewson Gold Medal of TMS-AIME in 1974 for this work.

The Passive Components Research Laboratory was engaged in a broad range of activities in materials and processes of importance to information technologies. These included glasses for optical lightguide technology and materials for optoelectronic packaging and interconnection, new electronic, optical and magnetic materials, and research on the fundamental underpinnings in physics of materials.

Chin received BS and ScD degrees in metallurgy from the Massachusetts Institute of Technology. Besides the Mathewson Medal, his honors include the Achievement Award from the Chinese Institute of Engineers (1980), the Campbell Memorial Lectureship of ASM International (1991), and membership in the national Academy of Engineering (1982). He was also a fellow of TMS and ASM. A graduate fellowship in his name is being funded in MIT's Department of Materials Science and Engineering.

Bernstein is Tufts VP for Arts, Sciences, and Technology

I. Melvin Bernstein, chancellor and senior vice president of the Illinois Institute of Technology (IIT) in Chicago, will assume the position of vice president for arts, sciences, and technology at Tufts University this month. As chief executive officer of Tuft's faculty of arts and sciences, he will be responsible for academic programs, the budget, marketing, admissions, student life, and facilities planning, and will have a wide range of administrative duties.

"...Tufts' academic programs are innovative and progressive," Bernstein said. "At Tufts, I hope to marry the highest goals of the arts, science, and technology." He also plans to continue teaching and pursuing his own research.

While at Carnegie Mellon, Bernstein designed a course titled "The Impact of Materials on Society." "I hope to engage in similar courses at Tufts," said Bernstein, whose most recent interests included chairmanship of the Panel on Education in Materials Science and Engineering for the National Research Council's MS&E study, *Materials Science and Engineering for the 1990s.*

Bernstein earned BS, MS, and PhD degrees in metallurgy at Columbia University, finishing in 1965. He then spent two years as a postdoctoral fellow at the Berkeley Nuclear Laboratory in Gloucestershire, England, and worked as a scientist from 1967 to 1972 at the E.C. Bain Laboratory for Fundamental Research at the U.S. Steel Corporation.

In 1972, he embarked on a teaching career as an assistant professor in the Department of Metallurgical Engineering and Materials Science at Carnegie Mellon University, becoming a full professor in 1975.

From 1979 to 1982, he served as associate dean at the Carnegie Institute of Technology before returning to head the Department of Metallurgical Engineering and Materials Science at Carnegie Mellon in 1987. Afterward, Bernstein accepted the position of provost and academic vice president at IIT until appointed chancellor and senior vice president in 1990.

Argonne, Universities to Explore Heavy Ion Beam Mystery

Argonne National Laboratory and six universities have joined to explore unexpected energy peaks found in the energy spectra of positrons emitted in heavy ion collisions. The sharp lines were first noticed 10 years ago by researchers in Darmstadt, Germany at the Gesellschaft für Schwerionenforschung. Further experiments have repeated the results, but without an explanation of the cause.

Russell Betts, Argonne physicist and coordinator of the research project, said, "In the recent history of physics, there are few examples of such an apparently fundamental discovery which have remained so puzzling over such an extended period." Possible explanations range from the presence of an unknown particle to a new form of vacuum state previously undetected.

Subsequent experiments in other devices have narrowed the possible causes of the peaks, but with no definitive solution. Since similar peaks are found with different beam-target combinations, Betts suggests the cause may be a fundamental process.

One explanation for the peaks may be the existence of an isolated, slow-moving neutral object that decays to positron-electron pairs. Perhaps a new form of positronium (an electron and positron bound together for less than a nanosecond) might exist. Or even a new vacuum state of electromagnetism might exist. No clear evidence favoring any possibility has yet been found.

Argonne's partners in the experiment are Florida State, Michigan State, Princeton, and Yale universities, and the universities of Rochester and Washington. Their spectrometer, scheduled for operation before the end of the year, will allow the study of positrons and electrons produced in heavy ion collisions. The U.S. Department of Energy's Nuclear Physics Division is funding the $2.35 million project, known as ATLAS Positron Experiment, or APEX.

ATLAS, the Argonne Tandem Linear Accelerator System, a superconducting heavy-ion accelerator capable of accelerating ions to 1.9 GeV, will collect data as much as ten times faster than the German device and with greater precision.

Michigan State University has contributed copper coils for the spectrometer. A vacuum chamber is mounted inside the coils where the beam from ATLAS will interact with thin uranium targets, producing the positrons. Princeton University produced the vacuum chamber, and Florida State University constructed the target assembly. The more than 500 positron/electron detectors are being developed at Argonne, Yale University, and the University of Washington. The complex electronics that read signals from the detectors have been designed and tested by researchers at Michigan State and the University of Rochester.