J.D. Jorgensen Promoted to Senior Physicist at Argonne

James D. Jorgensen, group leader of the neutron and x-ray scattering group in Argonne National Laboratory's Materials Science Division and director of the powder diffraction program at Argonne's Intense Pulsed Neutron Source, has been promoted to senior physicist.

Jorgensen, who holds bachelor's and doctoral degrees in physics from Brigham Young University, has received several awards, most recently sharing Argonne's Director's Award for work with superconductors. He is a Fellow of the American Physical Society and a member of the U.S. National Committee for Crystallography, the American Crystallographic Association, and the Materials Research Society. Jorgensen was one of the organizers for the superconductivity symposium held during the 1989 MRS Spring Meeting.

New Method Calculates Molecular Interactions on Metals Surfaces

A method of calculating how atoms and molecules interact when they are attached to metal surfaces has been developed at Sandia National Laboratories. This research is potentially important to the development of "designer catalysts" used in applications ranging from auto exhaust control to petrochemical processing. Molecular interactions on surfaces also have implications for corrosion inhibition and hydrogen uptake by metals, adhesive properties, and the reduction of friction.

The new calculation method, developed by Peter J. Feibelman, differs from previous approaches because it does away with mathematical assumptions, such as assuming that a metal surface acts the same way as a very small cluster of metal atoms. "These were thought to be necessary to obtain numerical results, but in fact are not," said Feibelman. "Since these artifices distort the nature of the results in a way that is difficult to control, the new method represents an important improvement in our ability to predict the behavior of atoms on surfaces," he continued.

Feibelman focused on understanding weak attractive or repulsive interactions between various pairs of atoms attached to metal surfaces, and on how this interaction is affected by disturbances in the positions of the metal's atoms. Specifically, he explained why the energy required to separate a pair of aluminum atoms attached to an aluminum crystal surface is so much smaller than what one would guess based on the energy required to remove an aluminum atom from the crystal itself. Feibelman's calculations showed it to be only one-eighth as much.

The explanation follows from the fact that each aluminum atom has only three valence electrons. Forming a bond between two aluminum atoms requires electrons that would otherwise participate in binding each aluminum atom to the surface. Consequently, as the aluminum-aluminum bond forms, each individual atom's bond to the surface weakens. Conversely, the cost of rupturing the bond between two neighboring aluminum atoms is compensated by the gain associated with the strengthening of each atom's bond to the surface. When an aluminum atom is removed from a crystal the cost of breaking bonds is not compensated.

Feibelman also explained how a pair of atoms attached to a metal crystal can migrate along its surface more quickly than a single atom of the same species would. In contrast to conventional thinking, he also showed that surface impurity atoms need not be attracted to defective regions of a metal crystal. Finally, he discovered, in certain cases, what forces govern how the surface atoms move when an impurity atom is attached in the immediate vicinity.

NKK Develops Ceramic Building Material from Blast Furnace Slag

NKK Corporation's Steel Research Center has developed a ceramic-based building material with hygroscopic properties from blast furnace slag. The material can potentially be used as a replacement for artificial wood-based materials for interior construction work.

In 1984 Japan's Agency of Industrial Science and Technology developed a material for water-treatment by processing slag with alkali. NKK's Steel Research Center took the material and worked to increase the surface area of the slag to develop a hygroscopic material suitable for the construction industry.

Blast furnace slag is powdered and mixed with alkali and water to alter its physical and chemical properties. Other chemicals are added, and the material is molded and dried. The result could be called a "wet ceramic" because it is molded without being sintered. This makes it potentially cheaper to produce than xonotlite, an artificial flame-retardant, hygroscopic building material that requires the use of an autoclave.

The major features of the new "Amenity Ceramics" include the following: a large surface area, giving highly hygroscopic

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properties, which is achieved by using surface-modified slag powder as a main ingredient; a specific gravity of 0.5, comparable to that of wood toughness; good fire resistance; and good workability. The material can be easily cut and ground using ordinary woodworking tools, suffers no shrinking or expansion due to drying or water absorption, and can be easily colored or patterned.

The ceramics are currently being manufactured experimentally in 25 mm thick, 50 cm^2 plates.

Lake Shore President Appointed to CSAC Board

John Swartz, chairman and president of Lake Shore Cryotronics, Westerville, Ohio, was recently appointed to the board of directors for the Council on Superconductivity for American Competitiveness. Headquartered in Washington DC, CSAC provides a national forum for industry, government and academia to share information and discuss emerging government policy on the development and commercialization of superconductivity.

Swartz, co-founder of Lake Shore Cryotronics, has been a significant force in the company's success. In 1969 he received an IR-100 award for the gallium-arsenide temperature sensor used in many measurement and control systems. He has published several papers on thermometry and thermometry calibrations and holds a patent on a fast neutron dosimeter supplied to NATO forces.

Sematech, Sandia to Develop Semiconductor Equipment Technology Center

The Sematech consortium, Austin, Texas, has signed a technical assistance agreement with Sandia National Laboratories, Albuquerque, New Mexico, to develop a national Semiconductor Equipment Technology Center. SETEC's mission will be to strengthen the U.S. equipment and materials infrastructure by developing tool design models and methodologies to enhance future generations of semiconductor manufacturing equipment.

One aspect of the mission will be to extend the reliability of tools identified as critical to the semiconductor manufacturing process. For example, the range of Mean Time Between Failures (MTBF) for semiconductor manufacturing equipment is approximately 10 to 200 hours. According to Sematech President and CEO Robert Noyce, "One of Sematech's goals is to increase the MTBF rates by a factor of 5 to 10."

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Sandia will design data collection techniques for MTBF rates, analyze the specific component that caused the breakdown, and support an equipment improvement plan to extend the component's life cycle.

The program at SETEC falls under the Sematech University and National Laboratory Program, which has identified leading scientists and educators at U.S. institutions to form a network of Centers of Excellence to work under research grants from Sematech. The research programs are coordinated by the Semiconductor Research Corporation. There are currently nine Centers of Excellence in as many states.

Ciba-Geigy Announces Professorship and Research Endowment at MIT

M.S. Wrighton Named First Holder

Ciba-Geigy Limited has established a $3 million endowment to fund both a professorial chair and research in the Department of Chemistry at the Massachusetts Institute of Technology. It is the first time an endowment at MIT will support both a professor's salary and the research in the professor's laboratory.

Mark S. Wrighton, head of MIT's Chemistry Department, was named first holder of the professorship. In making the announcement, MIT President Paul Gray praised Wrighton's accomplishments: "He was made a full professor at the young age of 27, and has been brilliant and energetic in his teaching, his research, and his administration, since 1987, of the Department of Chemistry."

Wrighton, who heads a $1 million a year research program at MIT, gained respect through work that has not only taken the discipline of chemistry into uncharted areas but also covers a broad range spanning photochemistry, molecular electronics, surface chemistry, and transition metal catalysis.

Some of Wrighton's research focuses on developing electrochromic polymers, and he is also trying to convert solar energy directly into electricity or chemical energy by imitating the process of photosynthesis. His laboratory has developed a "molecular switch," which uses molecules of polymers across gold or platinum electrical contacts only one micron apart. While their near-term application is in microsensors for sensing oxygen or pH, the switches are being explored to see if they can be developed into a neural network that might ultimately mimic nerve pathways or brain cells.

Wrighton is active in public and professional affairs, has served on numerous panels, and has received numerous awards. He is a member of the Materials Research Society and a Fellow of the American Academy of Arts and Sciences and the American Association for the Advancement of Science.

"Bridge Builder" award recipients (left to right): J. Tomozawa (accepting the award for J. Furumoto), S. Saito, and M. Tashiro.

Penn State Honors Three Japanese "Bridge-Builders"

Three distinguished Japanese scientists and industrialists were honored by Pennsylvania State University as "Pioneering Bridge-Builders" in a ceremony at the Mitsui Club in Tokyo, Japan, October 26, 1989. Awards were presented to:

Jiro Furumoto, president, Asahi Glass Company, represented by Junjiro Tomozawa, executive vice president. (Asahi recently entered into a joint venture with Corning at Corning's major glass plant in State College, Pennsylvania);

Shinroku Saito, former president, Tokyo Institute of Technology, national leader of ceramic materials research and policy in Japan; and

Megumi Tashiro, one of the leading glass scientists in Japan formerly professor and director of the Institute of Chemical Research, Kyoto University.

Attended by some 80 Penn State alumni and visitors from Japanese companies, the ceremony was preceded by a session of the Japanese Advanced Materials Science and Engineering Society. Rustum Roy, Evan Pugh Professor of the Solid State at Penn State, presented the session's main paper, "Materials Synthesis: Key to Innovation in Materials."

Penn State has hosted over 150 of Japan's leading materials researchers specializing in nonmetallic materials from clays and zeolites to electronic ceramics over the last 35 years. It has also been a pioneer in sending students to work in Japanese industrial and university laboratories.

Los Alamos Researchers Find Laser Deposition Produces Superconducting Thin Films More Quickly

Los Alamos National Laboratory researchers recently announced unexpected results indicating that laser deposition can increase the deposition rate for superconducting thin films to about 150 Å per second while retaining the high quality of the thin films. Typical deposition rates are currently only a few angstroms per second. Researchers Xin Di Wu and Ross Muenchausen presented their team's results at the 1989 MRS Fall Meeting in Boston.

Such a deposition rate would considerably enhance the commercial feasibility of thin films. According to Muenchausen, "They also show that we may be able to make thick films that are highly crystalline," but he cautioned that many engi-

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neering problems have to be solved before thick films can be devised. Los Alamos researchers are continuing work to find out what happens to thin-film crystallinity at higher depositon rates and to learn how and why crystalline properties vary as the deposition rate changes.

Advanced Composites, Fiber Optics Among 10 Greatest Engineering Achievements

Advanced composite materials and fiber-optic communication are on the National Academy of Engineering's list of the 10 greatest engineering achievements of the past 25 years. The list of technological breakthroughs that were first put into practice or commercial use since 1964 and that have dramatically changed society also includes: the Moon landing (July 20, 1969), application satellites, the microprocessor, computer-aided design and manufacturing, CAT scan, jumbo jet, lasers, and genetically engineered products.

Hennessy-Vuitton Offers Award for Application of Matter to a Surface

Moet Hennessy-Louis Vuitton is offering awards for single investigators whose scientific achievements in materials research stimulate the interaction of art, science and industry. Principle areas of interest include:

- Coatings and substrates,
- Engineering technology for surface modification and associated characterization techniques, and
- Modeling and theory.

Two prizes will be awarded—one for the best scientific approach and one for the best technological approach. Each prize includes a 100,000 Fr (approximately US$16,000) award along with all expenses paid for the awardee to attend the ceremonies in Paris in June 1990.

Submissions are due no later than **March 9, 1990.** Industrial as well as academic scientists are encouraged to apply. Nominations are also acceptable.

For information and application forms, call Olivier Goniak at (212) 758-7200; fax (212) 758-2801.

Tektronix to Administer DARPA Funds for Superconductivity Research

Tektronix, Inc., Beaverton, Oregon, was recently named by the Council of Superconductivity for American Competitiveness (CSAC) to administer some $542,000 in special government funding for superconductivity research. The funding was provided by the Defense Advanced Research Projects Agency (DARPA) to develop a set of R&D paths leading to breakthroughs in useful superconducting microelectronic applications for commercial and military purposes.

Bruce Murdock, who heads the superconductor efforts at Tektronix and is also manager of this DARPA program, believes superconductivity "holds the promise for

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very high speed computers and very sensitive and fast measurement tools....because of the unique physical processes which occur in the superconducting state."

As a member of CSAC, Tektronix helped set up SuperChip Inc., to accelerate the use of superconductors in microelectronic-based products. Initially the technology program for SuperChip will be derived from results of the DARPA grant.

University of Houston Receives NASA Grant for Thin Film Research in Space

The Space Vacuum Epitaxy Center (SVEC) at the University of Houston, Texas, has been awarded a $5.5 million grant from NASA to design, develop, and deploy a wake shield facility to conduct research on thin film materials growth in space.

To be deployed from the shuttle payload bay by a remote arm, the wake shield facility is a flat, 10-foot diameter dish that will sweep out an ultra-vacuum region behind it, allowing the generation of the highest quality semiconductor and high temperature superconductor thin film materials.

SVEC has contracted with Space Industries, Inc. to carry out a major portion of the design and construction support for the project which is expected to take 30 months to complete. Other support will come from members of the SVEC consortium, including AT&T Bell Laboratories, Electro Optek Corporation, Instruments S.A. Inc, IONWERKS, Perkin-Elmer, the University of Illinois, Rockwell International, and the U.S. Army Laboratories at Watertown. NASA Johnson Space Center will play a major role in flight tests and the integration of the wake shield. NASA Marshall Space Flight Center will collaborate on the technical aspects of the vacuum wake behind the shield.

The wake shield facility is expected to make four trips into space beginning in the fall of 1991. The first flight will involve the growth of thin film gallium arsenide crystals and characterization of the space ultra-vacuum environment. The second flight will focus on the growth of semiconductor heterostructures; the third, on the growth of semiconducting thin films through the use of organometallic compounds. The fourth flight will undertake the growth of thin film high temperature superconductors and their integration with thin film semiconductors in the space ultra-vacuum environment.

Directed by Alex Ignatiev, the Space Vacuum Epitaxy Center at the University of Houston is one of 16 NASA centers for the commercial development of space. It is funded by both NASA and industry.

Superconductivity Collaboration Yields Prototype Resonators

Researchers from ICI Advanced Materials (Runcorn, United Kingdom) and AT&T Bell Laboratories (Murray Hill, New Jersey) announced that their joint development efforts have produced practical radio frequency and microwave cavity resonators using high temperature superconductivity (HTS). Resonators are key parts of communication and radar systems.

The resonators show significantly improved performance compared to resonators manufactured with conventional technology. The improved performance is attributed to the use of HTS to reduce cavity resistance. ICI's materials processing technology also contributed to producing the strongest HTS materials yet reported.

Du Pont, Hewlett-Packard, and Los Alamos Sign Superconductivity Agreement

Du Pont, Hewlett-Packard, and Los Alamos National signed an agreement to form one of the largest collaborative research and development projects on superconductivity ever concluded between a government laboratory and industry.

The three-year agreement is valued at $11 million and will include a total of 25 or more researchers who will work at their respective laboratories and share equipment and facilities at all three locations.

The first objective of the collaboration is to develop thin-film, high temperature superconductors for electronic components. The effort will focus on both development and commercialization of prototype electronic devices.

Du Pont has also established separate cooperative superconductivity research agreements with the Department of Energy Superconductivity Pilot Centers at Argonne and Oak Ridge National Laboratories. □

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