NSF, States to Create New Cooperative Research Centers

States and industrial sponsors will soon join with the National Science Foundation to create new centers where fundamental research is expected to lead to commercial developments.

Depending on the availability of funds and the commitment of at least one-for-one matching support from both state and industry sources, NSF will spend up to $1 million during the 1991 fiscal year to sponsor from three to five new State-Industry/University Cooperative Research Centers. In a unique arrangement, states will select center candidates before NSF evaluation.

This initiative resulted from discussions between NSF and the National Governors' Association Science and Technology Council of the States aimed at developing mechanisms for greater cooperation and coordination.

The new NSF effort will lead to the creation of "hybrid" university-based centers that combine elements of state centers with those of NSF's Industry/University Cooperative Research Centers (I/UCRCs), first established in 1972.

I/UCRCs emphasize industrially relevant fundamental research and require industry funds. The new State-I/UCRCs are expected to improve coupling across basic and applied research and to promote technological advances, technology transfer, and subsequent commercialization, with benefits to local economies and U.S. competitiveness.

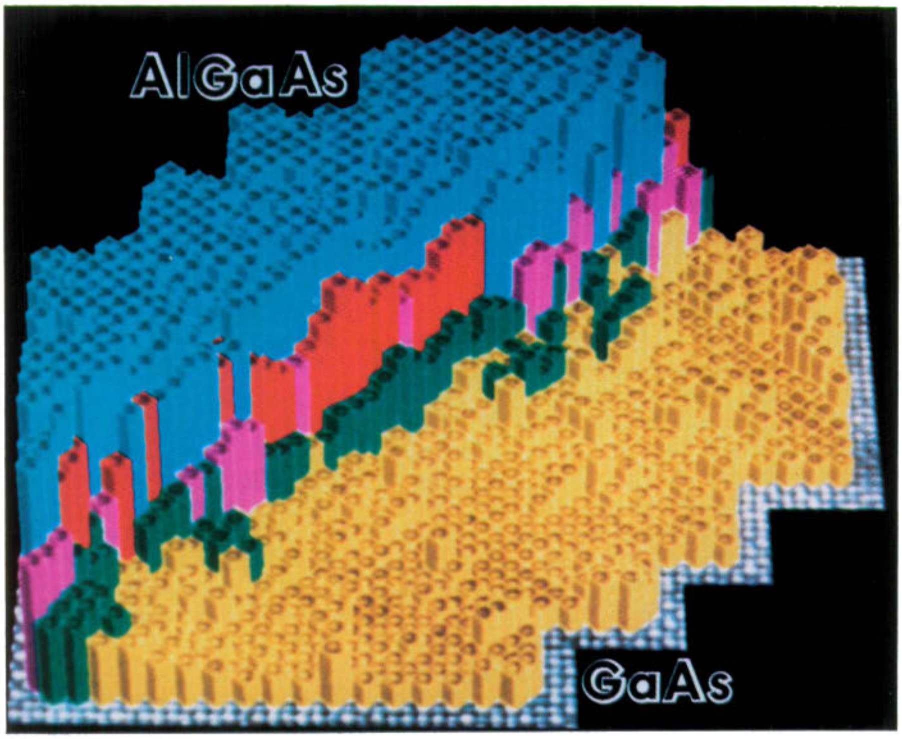
Centers will feature core, generic research that may have applications in numerous industries, processes, or products. This research will be sponsored by NSF, the states, and industry. Member companies may take advantage of nonexclusive, royalty-free patent rights and early use of research results. The core research programs must promote technology transfer through activities such as technical feasibility studies and the establishment of communications networks and training programs.

At the new centers, states and industry, but not NSF, will sponsor projects leading to the development of new products, based on knowledge acquired through the core research programs. This research may be proprietary.

Before receiving consideration through the NSF's merit review process, proposals must first be recommended by, and receive a financial commitment from, the state where the proposing university is located. Each participating state will hone the number of candidates to no more than two.

Depending on the availability of NSF and matching funds for core research, and on the progress of each center, NSF will make four-year awards of up to $250,000 per year. Universities proposing centers also are encouraged to commit support. Centers may be eligible for a four-year renewal upon successfully completing a comprehensive review during the third year, and may therefore receive NSF support for up to eight years.

For more information on the State-I/UCRC initiative, contact Alex Schwarz-



ERRATA

Figure 5 from the article on "Chemical Interfaces: Structure, Properties, and Relaxation" by A. Ourmazd should have been printed in color on p. 61 of the September 1990 issue of the *MRS BULLETIN*. The color figure to the left can be cut from the current issue and pasted over the appropriate area on p. 61 of the September 1990 issue.

This figure is a three-dimensional representation of the analyzed lattice image of $Al_{0.37}Ga_{0.63}As$ grown on GaAs after a 2-min interruption. The unit cells are 2.8 Å squares. The height of a unit cell represents its composition, and the color changes represent statistically significant changes in composition over and above random alloy statistics.

RESEARCH/RESEARCHERS

kopf or other NSF program staff at the Industry/University Cooperative Research Centers Program, Engineering Centers Division, National Science Foundation, Washington, DC 20550; telephone (202) 357-7307.

Chemical Process Removes Strontium-90 from Nuclear Waste

Argonne National Laboratory scientists who have developed a chemical process for removing strontium-90 from liquid nuclear waste say it can reduce the amount of strontium more than 100,000 times.

The SREX (pronounced "si-rex") process, for strontium extraction, uses a combination of chemical extractant and solvent that will extract only strontium-90 from dissolved nuclear waste. The extractant is a form of "crown ether," so-called because its molecular structure resembles a royal crown. The solvent is octanol, a chemical used in the perfume industry.

Strontium-90, which enters the food supply with relative ease, was a major contaminant following the Chernobyl explosion in the Soviet Union. Phillip Horwitz, who headed the team that developed the SREX process, said it was particularly important to remove strontium-90 from nuclear waste before burial because the isotope also generates a great deal of heat as it decays, and this heat buildup complicates the problem for the remaining waste. Presently proposed regulations call for liquid nuclear waste to be mixed with other ingredients and fused into glass for deep burial.

The strontium recovered by the process is chemically pure and can be sold. It has a commercial use in radioisotopic thermal generators (RTGs), which are used as power sources for locations that must go unattended for long periods, such as harbor markers.

New Solar Concentrator Demonstrates High Efficiency

Researchers at Sandia National Laboratories and Solar Kinetics, Inc., a Dallas-based corporation, have developed a parabolic-dish-shaped solar concentrator that differs considerably from other parabolic collectors. The single-facet dish uses a very thin metal membrane in place of the traditional glass mirrors. By alternately applying hydraulic pressure and vacuum during the fabrication process, the membrane is given a curved shape, and then covered with a shiny polymer film to form the reflective surface. Less expensive than glass, the steel membrane also weighs far less. Consequently, it does not need as sturdy a base, a factor that would help keep costs down in a complete system.

Tests of the stretched-membrane parabolic dish show that it is highly efficient and holds promise as a lighter, more economical component of solar thermal systems than other designs. During calorimeter testing, the seven-meter diameter dish achieved peak power of 21.2 kW and peak concentration of 5,400 suns.

The first step in fabricating the stretched-membrane dish involved stretching and fastening a sheet of stainless steel four mils thick on a circular forming ring. A combination of hydraulic pressure and vacuum was used to permanently deform the sheet into a parabolic shape. Measurements were taken after each application of load to determine the next step in the process.

The challenge was to reproduce a parabolic shape as accurately as possible so that sunlight could be concentrated onto a receiver with precision to obtain the maximum possible solar energy, said engineer Tom Mancini of Sandia's Solar Thermal Collector Technology Division. Measurements have shown the dish to have 3.6 milliradians slope error, meaning that its slope is only 0.2 degrees shy of being a perfect parabola.

After the sheet was formed to the required parabolic shape, the membrane and ring were assembled into a complete parabolic dish optical element. Stabilizing spokes radiate from a hub in the center of the dish to the front and back of the ring.

A reinforced polyester membrane similar to that found at the Superdome covers the spokes on the back of the dish to form an enclosed plenum. An aluminized polyester membrane is attached to the front of the dish and adheres to the steel form when a vacuum is created in the plenum.

While the recently fabricated dish is four times the area of earlier models, the goal is to build an even larger one. Solar Kinetics has begun design on an 11-meter dish, which would be used in conjunction with a Stirling Cycle engine to produce 25 kW of electricity at solar-to-electric conversion efficiencies of at least 30%.

Oak Ridge Superconductivity Pilot Center to be Part of Two Joint Research Projects

The High Temperature Superconductivity Pilot Center at Oak Ridge National Laboratory recently initiated two joint cooperative research projects—one with the IBM's T.J. Watson Research Center at Yorktown Heights, New York, and the other with HiT_c Superconco, Inc. of Tullytown, Pennsylvania.

The $920,000 cost-shared, two-year effort with IBM's T.J. Watson Research Center will focus on optimizing the pinning barriers and minimizing the flux dynamics that determine the current-carrying capacity of practical superconductors as well as the effect on ac losses and electronic noise in devices. John E. Clem of the Ames Laboratory in Ames, Iowa, will direct an effort to provide theoretical interpretation of the experimental results.

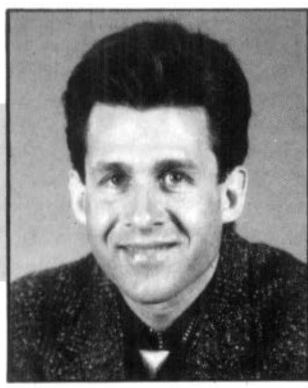
The goal of the joint research project with HiT_c Superconco, Inc. is the development of magnetic bearings using high-temperature superconductors. Researchers participating in the $90,000, cost-shared, six-month effort will try to determine the processing conditions that produce the best superconductor properties for levitated bearings. They will design and evaluate a prototype passive bearing. The Magnetic Bearing Systems Division of Kingsbury, Inc. will provide engineering and design support for this project.

Robert Deluca, chief operating officer of HiT_c Superconco, said the company had received a Small Business Innovation Research Phase I contract from NASA to develop a passive magnetic bearing and apparatus for evaluating bearing performance. "Through this cooperative agreement, ORNL's expertise in materials characterization and testing of superconducting materials will provide extensive support for our SBIR project," he said.

Brinker Named Distinguished Professor

C. Jeffrey Brinker, a member of the technical staff in the Inorganic Materials Chemistry Division at Sandia National Laboratories, was recently named to be a Distinguished UNM/SNL Professor at the University of New Mexico. This is a joint appointment at the UNM/NSF Center for Micro-Engineered Ceramics, Chemistry, and Chemical Engineering Departments.

As distinguished professor, Brinker will teach classes, supervise graduate students, and also direct research programs on sol-gel derived membranes, passivation layers, hermetic seals, and sensors.



Brinker has authored or co-authored more than 70 papers, edited three books, and coauthored the recent book, *Sol-Gel Science*. In addition, he was recently named a Fellow of the American Ceramic Society and in 1988 he received the Zachariasen Award for the best contributions to glass science literature by a young scientist. He is also a member of the Materials Research Society, and has served the Society as a meeting chair (Spring 1990) and symposium organizer for the series on "Better Ceramics through Chemistry."

Along with his work at Sandia and UNM, Brinker is also part of the new UNM/SNL Materials Research and Development Laboratory which will be housed in the new University Research Park on UNM's south campus. This is the first, unclassified free-access facility convenient to both UNM and Sandia where both groups can do research together.

IC Testing Method Transferred to Industry

Sandia National Laboratories is transferring to industry a resting current testing method for integrated circuits which it has been developing for the past two decades.

Instead of using a long series of electrical input test patterns, the resting current testing method identifies defective chips by measuring the level of current through a chip in its resting state when no switching voltage is applied to the gate inputs. In CMOS integrated circuits, this current is extremely low—typically less than 10 nA for all logic states.

While the current is low in all logic states of a good CMOS chip, a defective chip will have a greatly increased resting current in at least one of its logic states. It is this higher current in the appropriate logic state that directly identifies the defective ship, said Jerry Soden, a Sandia electrical engineer.

The resting current testing method is attractive to the microelectronics industry because it is both simple and reliable. Resting current testing usually has a 100% detection rate, but traditional functional testing often misses as much as 50% of the integrated circuits with internal physical defects. The resting current method also requires fewer test vectors and much simpler computer software than the logic response method. Fault simulation for resting current also is much simpler since tests can be done with a single good machine logic simulation rather than the more complex algorithm required for logic response test vectors.

Acid Rain Projects Added to Clean Coal Technology Program

Two new government-industry projects that will use pioneering technologies to combat the air pollutants that cause acid rain have been negotiated under the Department of Energy's Clean Coal Technology Program. The two projects, one from Ohio and one from Tennessee, will demonstrate advanced techniques for controlling nitrogen and sulfur pollutants from coal-fired power plants.

The Ohio project will be a $9.8 million joint government-industry financed project conducted by Babcock & Wilcox Co. of Alliance, Ohio. Babcock & Wilcox will outfit a full-scale (605 MW) coal-burning utility boiler at Dayton Power & Light's Stuart Station in Aberdeen with new burners that can limit the formation of nitrogen oxides (NOx) without the high expense associated with other techniques. The project will focus on reducing NOx emissions from "cell burners," a type of boiler designed during the 1960s to achieve highly efficient combustion at extremely high temperatures—the very conditions that produce high levels of NOx.

In the low-NOx cell burners, developed by Babcock & Wilcox with support from the Electric Power Research Institute, one of the two coal nozzles in the dual-burner "cell" is replaced with an air port, so that coal is injected only through the lower burner. About 70% of the total air needed for complete combustion is supplied through or around the coal feed nozzle, with the remaining air directed to the new upper port.

By limiting the amount of oxygen available at the highest combustion temperatures, the formation of nitrogen oxides is limited to about half of what would have been formed by the original burner design. And, because expensive modifications are not needed, the new burners are only about half as expensive to install as commercial low-NOx burners.

Design work on the 32-month project has already begun. Six weeks of construction are expected to begin in March 1991, followed by 18 months of tests.

The second project, by AirPol, Inc., of Teterboro, New Jersey, will attack sulfur pollutants with an advanced system that is cheaper and simpler to build and operate but just as effective as a conventional "scrubber." The new process, called "gas suspension absorption," will undergo its first trials with U.S. coals at the Tennessee Valley Authority's Shawnee plant in West Paducah, Kentucky.

If successful, the GSA system will combine the benefits of spray dryers with the emission reduction capabilities of conventional scrubbers—at about 40% less cost than wet scrubbers. The system also takes less space than conventional scrubbers, a key consideration when controlling pollution from smaller, older plants. Because the system is relatively simple to operate, it also promises greater reliability.

The GSA system brings coal combustion gases into contact with a suspended mixture of solids, including sulfur-absorbing lime. After the lime absorbs the sulfur pollutants, the solids are separated from the gases in a cyclone device and recirculated back into the system where they capture additional sulfur pollutants. The cleaned flue gases are sent through a final dust collector before being released into the atmosphere.

The key to the system's successful economic performance with high-sulfur coals is the recirculation of solids. Typically, a solid particle will pass through the system about 100 times before leaving the system. Another advantage of the GSA system is that a single spray nozzle is used to inject fresh lime slurry.

Copley Elected Vice President of ASM International

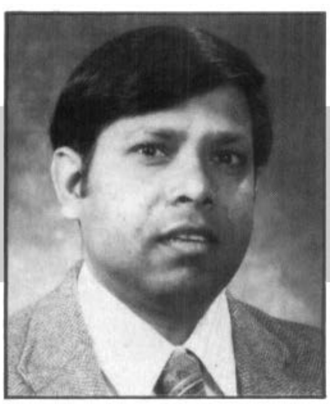
Stephen M. Copley, chairman of the Department of Metallurgical and Materials Engineering and director of the Manufacturing and Materials Process Engineering Center, Armour College of Engineering, Illinois Institute of Technology (IIT), was recently elected president of ASM International.

Copley received his PhD in engineering science from the University of California, Berkeley in 1964. He was first employed by the Advanced Materials Research and Development Laboratory, Pratt & Whitney Aircraft, where he participated in research on alloy and process development for Ni-base superalloys. Before joining ITT, Copley was a professor in the Departments of Materials Science and Mechanical Engineering, and Kenneth T. Norris Professor of Metallurgical Engineering at the University of Southern California (USC). While at USC, Copley also served three terms as chairman of the Materials Science Department. Since organizing the NSF-sponsored workshop on "Needs and Opportunities for Basic Research on Laser-Materials Interactions" in 1976, he has concentrated his research in that area.

Copley is a member of The Minerals, Metals and Materials Society, American Ceramic Society, American Society of Mechanical Engineers, and the Materials Research Society.

NSF Picks Narayan to Head Division of Materials Research

Jagdish Narayan, a distinguished university professor of electronic materials at North Carolina State University, was named director of the Division of Materials Research (DMR) of the National Science Foundation effective October 1, 1990. The position is an Intergovernmental Personnel Act (IPA) assignment from North Carolina State University, where Narayan will continue his research activities.



The DMR, one of the NSF's largest divisions, contains the following program directorates: Electronic Materials, Ceramics, Metallurgy, Materials Theory and Modeling, Condensed Matter Physics, Solid State Chemistry and Polymers, National Facilities and Instrumentation, Materials Research Laboratories, Science and Technology Centers, Materials Research Groups, and cross-directorate programs, including Small Business Innovation Research (SBIR), Presidential Young Investigator Awards, Minority Scientist and Faculty Development Programs.

Narayan joined the N.C. State faculty in 1984 as professor and director of the Microelectronics Center. From 1972-84, he was group leader and senior member of the research staff in the Solid State Division of Oak Ridge National Laboratory. Prior to that, he was a research metallurgist at the Inorganic Materials Research Division at Lawrence Berkeley Laboratory. Narayan received a BS from IIT/Kampur, India, and MS and PhD degrees in materials science and engineering from the University of California.

A member and former councillor of the Materials Research Society and a member of ASM International, The Minerals, Metals and Materials Society, and the American Physical Society, Narayan has published more than 400 scientific papers and has edited six books. In addition, he has received 10 patents in the fields of advanced materials synthesis and processing, defects and interfaces, semiconductor heterostructures, ion implantation, laser deposition of thin films, high-temperature superconductors, diamond thin films, and electron microscopy.

Mellen Awarded SBIR Contract for GaAs Growth Technique

Mellen Company of Webster, New Hampshire, was recently awarded a Phase I contract by the Defense Advanced Research Projects Agency (DARPA) to scale up a new liquid encapsulated vertical zone melting (LEVZM) growth technique developed at the Naval Research Laboratory. The contract is part of the Small Business Innovation Research Program.

LEVZM is used for producing high-quality single-crystal gallium arsenide suitable for fabricating microwave and millimeter wave solid state devices and circuits. LEVZM GaAs crystals produced at the Naval Research Laboratory have exhibited lower etch pit densities and fewer crystalline defects than those produced by other means (e.g., liquid-encapsulated Czochralski growth).

Mellen will design and construct a special version of its patented growth system, which will be able to grow 4-inch diameter GaAs crystals. □