Five-Year Photovoltaics Program Aims to Reduce Manufacturing Costs

A Department of Energy program designed to study and develop ways to reduce production costs of photovoltaic (PV) systems was implemented in January and will provide up to $55 million in federal funding over five years to U.S. PV firms.

The Photovoltaic Manufacturing Technology (PVMaT) Project will initially award contracts up to $50,000 each during the first three months to help individual companies identify areas in manufacturing where research and development will greatly reduce costs.

A second project phase will develop solutions to problems identified in the first phase. Only up to six of the first group of contracted companies will be awarded phase-two contracts. Phase two contracts will last a maximum of three years, and the selected companies will be expected to cost share their work. A second phase two procurement for process-specific research and development projects will be initiated in 1992 for all PV companies possessing manufacturing capabilities at that time.

The PVMaT project has four goals: reducing costs of manufactured PV products, earlier scale-up of U.S. PV production capacities, improving commercial product performance and reliability, and enhancing the U.S. PV competitive posture. Supporting work for the project is being performed by the Solar Energy Research Institute (SERI) and Sandia National Laboratories. All PVMaT project contracts will be issued by the SERI procurement office.

Recipients of the PVMaT Phase 1 contractsinclude : Alpha Solarco, Astropower, Crystal Systems, Energy Conversion Devices, Entech, Glasstech Solar, Global Photovoltaic Specialists, Iowa Thin Films, Kopin Corporation, Photon Energy, Solar Cells, Solar Engineering Applications, Solarex Corporation, Spectrolab, Spire Corporation, Utility Power Group, and Westinghouse Electric Corporation.

Empire State Materials Council Formed

The Empire State Materials Council (ESMC), dedicated to the sharing of information between academia and industry across New York State, was recently formed.

Volker Weiss, professor of engineering and physics at Syracuse University is the organization's director, and James McCauley, dean of the New York State College of Ceramics, and Richard Spriggs, director of the Center for Advanced Ceramic Technology at the New York State College of Ceramics at Alfred University are, along with Weiss, ESMC's founders and charter members. The statewide association has among its members materials scientists and engineers working at educational and research institutions, not-for-profit laboratories, and industries. Their intent is to share their knowledge of the field, with the hope of spurring economic development in New York state.

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IBM Develops Method to Mass-Produce Tiny Semiconductor Lasers

Scientists at IBM's Zurich Research Laboratory have developed a way to build up to 20,000 minuscule lasers on a two-inch semiconductor wafer. The lasers are both mass-producible and testable.

The new method of laser semiconductor fabrication is faster, less expensive, and more efficient than the ones now used in compact disk players, laser printers, computer storage disks and fiber optic networks. The resulting chip holds substantial promise for integration with components that use both light and electric current to carry information.

The process relies on etching to fabricate and test thousands of lasers at once on an uncut wafer. Narrow trenches, 0.5 μm deep, are etched into the wafer to form the laser mirrors, which are subsequently coated with semireflective material. Previously, mirrors were formed by cleaving, a costly and time-consuming technique involving the individual handling of each mirror.

Process characterization, diagnostics, and screening for working lasers can all be done on the wafer. Afterward, the wafer is cut into individual lasers for use. Quality, performance, and working life of the lasers meet that of the lasers produced by the cleaving method.

Called full-wafer technology, the method will allow researchers to etch convex and concave mirrors to bend the path of the laser beams. Researchers will also combine lasers with focusing lenses and reflectors for future electronics applications in optoelectronics.

Glass Researchers Use Laser Technique in Quest for Quality Enhancement

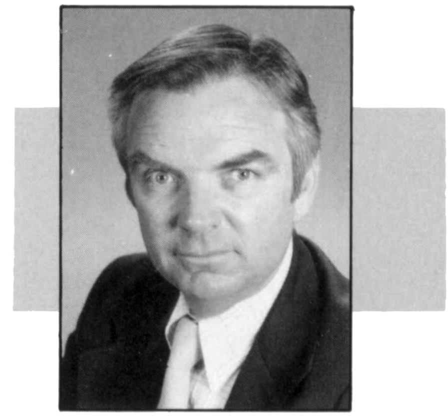
Demands for perfection in glass are more stringent today than ever before. The major hindrance to blemish-free and optimal strength glass is the formation of bubbles in the material during processing and treatment.

Robert Condrate and Sang Won Lee of the Industry-University Center for Glass Research in Alfred, New York, have developed a non-invasive method for determining the nature and concentration of specific gases that form the bubbles, and for identifying crystals that form on bubble surfaces. Condrate, a NYS College of Ceramics professor of spectroscopy, and graduate assistant Lee direct a laser beam into glass bubbles using a Raman spectra microprobe device to look at the backscattered spectra, as reported in *The Glass Researcher,* November 1990, published by Alfred University. Previous methods of bubble study involved controlled fracture of the sample and using mass spectrometry. Traditional Raman spectroscopy has also been used.

Scientists and glassmakers knew that changes in relative concentrations of oxygen and carbon dioxide in silicate glasses can be affected by addition of arsenic oxide, sodium nitrate, and sodium nitrite after heat treatments. But by identifying the specific contents of glass bubbles, glassmakers can better engineer glass to solve specific structural problems and allow them to tailor the amounts of the necessary additives.

With the development of new detectors for Raman spectroscopy, the gas content of the bubbles can be analyzed more quickly. Within three minutes, spectra can be obtained with a multi-photo diode array, as opposed to 30 minutes with traditional Raman spectral capability of a single-photo multiplier system.

Quinn to Take Position with PNL



Rod K. Quinn, director of the Exploratory Research and Development Center of the Los Alamos National Laboratory, Los Alamos, New Mexico, will join Battelle Pacific Northwest Laboratory in early April with the assignment as deputy manger of materials and chemical sciences. He will also have laboratory-wide responsibilities for special programmatic development.

His duties will include responsibility for PNL's materials and chemical sciences activities, including developing and maintaining a strong science and technology base, to a wide range of programs throughout PNL. An initial important duty is to interface with the new Molecular Science and Environmental Science Research Centers.

"My professional interests are in advanced materials, especially those that interface between materials and chemistry," Quinn said. "I also have a keen interest in this nation's technological competitiveness, and have dedicated the last three to four years of my career to this area," he said.

Quinn has been with Los Alamos for five years as program director for all high-temperature superconductivity programs, director of the Superconductivity Pilot Center, and as a leader for new programs in advanced materials and materials synthesis and processing.

He received his BS in chemistry from Southern Methodist University and his PhD in physical-inorganic chemistry from the University of Texas. He has published more than 50 articles in professional journals and presented a similar number of papers at professional meetings.

Quinn was an MRS Meeting Chair in 1986, a Committee Chair in 1986 and 1987, and has served on several other MRS committees.

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Program Formed to Share Techniques and Tools for Microelectronics Analysis

Sandia National Laboratories has announced the formation of the Microelectronic Quality/Reliability Center (MQRC) Affiliates Program allowing American industry to use the Laboratories' facilities and experience to analyze and improve the quality of microelectronic products.

Under this program, access to these facilities will be cheaper for companies than constructing similar facilities themselves. Sandia says MQRC will not compete with private industry because the center will provide access only to equipment and services not available elsewhere.

Available capabilities include nondestructive characterization and failure analysis, physical and statistical modeling, electrical characterization, and process monitoring and control.

Potential MQRC Affiliates include integrated circuit manufacturers, IC reliability test equipment vendors, IC users, and universities. Examples of the type of projects that MQRC could address include investigating the reliability impact of new materials, processes, and equipment; characterizing the statistical distribution of failures; and consulting with Sandia staff on specific reliability problems.

Companies interested in more information on the program can contact Ted Dellin at (505) 844-2044.

13 Nations to Collaborate on Superconductivity Study for Electric Power

Thirteen industrialized nations have funded Argonne National Laboratory to evaluate potential impacts of high T_c superconductivity on the electric power sector. The work is intended to foster an international exchange of ideas for providing cheaper, more efficient electrical service.

Under the three-year, multinational agreement, the U.S. Department of Energy laboratory will review work on superconductivity research worldwide, reporting on its status and identifying areas that need more detailed investigation. Argonne scientists will review issues of common interest to funding nations, making assessments and preparing reports on the potential of developing technologies.

The immediate effort will focus on progress in developing practical superconducting wires and fault current limiters (power grid protective devices).

As the other countries carry out research, they will contribute reports and summaries to Argonne. Also, Argonne plans to contract with the Central Research Institute of the Electric Power Industry of Japan to study and assess superconducting systems.

The multinational technical representatives include Hydro-Quebec and Ontario Hydro, Canada; Elkraft Power Company Limited, Denmark; Ministry of Trade and Industry, Finland; Kernforschungszentrum Karlsruhe GmbH, Germany; Ente Nazionale per l'Energia Elletrica, Italy; New Energy and Industrial Technology Development Organization, Japan; Netherlands Agency for Energy and the Environment, Netherlands; Norwegian Council for Scientific and Industrial Research, Norway; National Energy Administration, Sweden; Office Federal de L'Education et de la Science, Switzerland; Department of Trade and Industry, United Kingdom; the Scientific and Technical Research Council of Turkey, Marmara Scientific and Industrial Research Centre, Turkey; and the U.S, Department of Energy, United States. All are members of the International Energy Agency, which was instrumental in negotiating the international contract.

General Atomics Receives Contract for Fusion Development

The U.S. Department of Energy has awarded a contract for $15.7 million to General Atomics (San Diego) to provide Inertial Confinement Fusion (ICF) target component fabrication and technology development support to DOE for the U.S. laboratories engaged in ICF experimental activities.

According to the contract, General Atomics must provide up to 172,630 direct productive worker-hours over a 21-month period. W.J. Schaffer Associates, Inc., of Chelmsford, Massachusetts, and Polymer Systems, Inc., of Livermore, California, will support General Atomics as principal contractors.

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In addition to the 21-month term of the basic contract, the award also provides for two one-year options that, if exercised by DOE, would increase the level of effort by 107,880 hours for each option year and increase the total cost of the contract to $35.4 million for the full 45 months.

The scope of the work includes:

- fabrication, characterization, and development of ICF target components such as glass and plastic microshells (filled with mixtures of deuterium and tritium or diagnostic trace materials);
- development, evaluation, certification, and application of appropriate methods for characterizing ICF target components;
- development and evaluation of new target components, target support systems, and materials necessary to achieve this; and
- devising and evaluating techniques for the precise, reproducible production of specific types of target components.

Laboratories participating in the ICF program are the Lawrence Livermore National Laboratory, Los Alamos National Laboratory, Sandia National Laboratories (Albuquerque), and the Laboratory for Laser Energetics at the University of Rochester. The program is part of the Research and Advanced Technology Office of DOE's Defense Program organization. ICF technology involves the use of lasers and, potentially, ion beams as drivers to implode microshells in an R&D program to investigate and demonstrate the technologies required to achieve thermonuclear ignition conditions in the laboratory.

Technique Improves Surface Area Measurements of Thin Films

Improving on a decades-old method, scientists at Sandia National Laboratories have patented a highly accurate method to measure the surface area of minute samples of porous, thin films. The technique has implications for the microelectronics, gas separations, optics, and solar cell industries, which use thin films extensively. It can also be used to determine the pore-size distribution of thin films, an aid in the design of highly specific chemical sensors, more effective catalysts, and gas separation membranes.

The technique combines a surface acoustic wave (SAW) device with the BET method—a surface area measurement technique named for its developers, Brunauer, Emmett, and Teller. The BET method, however, cannot discern small weight changes in materials with low total surface area, like most thin films.

Increased sensitivity comes from the solid-state SAW sensor, which uses transducers lithographically patterned on a piezoelectric substrate to launch and detect acoustic waves. These waves interact with solids, liquids, and gases on the SAW device's surface, providing information about the material's characteristics.

The BET technique is based on the premise that a porous material will adsorb nitro-

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gen gas in measurable quantities. The surface area of the sample is calculated using the amount of absorbed nitrogen and the surface area of nitrogen molecules. Traditionally the adsorbed nitrogen was measured by weight change directly. The SAW device measures the speed of acoustic waves traveling along the surface. As nitrogen is absorbed, the mass increases and this slows the acoustic waves. This frequency change is used to determine the amount of nitrogen present.

The SAW device can measure a mass change as small as 20 picograms, while a standard BET system can only measure mass changes on the order of 1 million picograms. The SAW method can also be used to more accurately determine the range and distribution of pore sizes of thin film material.

Kaufmann Assumes New Position at Argonne

Elton N. Kaufmann, who joined Argonne National Laboratory in early 1989 as director of the Superconductivity Pilot Center, a successful and now widely emulated experimental program in technology transfer, has been appointed associate director of Argonne's Strategic Planning Group. The Group, which operates within the office of the laboratory director, is involved in the formulation and implementation of programs that contribute to Argonne's role as one of the Department of Energy's national laboratories and as a national center of excellence in various high-technology fields. Kaufmann will initially concentrate on Laboratory programs in advanced materials and on the Advanced Photon Source (APS), a six-GeV synchrotron facility now under construction on the Argonne site. The $456 million APS research facility will provide the world's brightest x-ray beams for materials research.

When contacted, Kaufmann said, "The Pilot Center experience has been extremely rewarding. To see an innovative technology transfer mechanism coupled to the new and exciting high-temperature superconductor technology, and to encounter rapid and substantial acceptance of this combination by U.S. industry is the best result for which one could have hoped. That formula can serve as a template for use in other technologies and by other federal agencies. I look forward now to applying lessons learned in the Pilot Center to the broader needs of the Laboratory."

Before joining Argonne, Kaufmann held positions at the Lawrence Livermore National Laboratory where he was Materials Division Leader, and AT&T Bell Laboratories.

Kaufmann, author of many research articles on physics and materials science topics as well as co-editor of two books, received his bachelor's degree in physics from the Rensselaer Polytechnic Institute and his doctorate in physics from the California Institute of Technology.

Kaufmann is a former president and current councillor of the Materials Research Society and a Fellow of the American Physical Society.

Experimental Laser Points to Future in Transmissions Systems

Scientists at AT&T Bell Laboratories have generated fast, short, light pulses with a monolithic semiconductor laser that could be a source for ultrahigh-capacity optical fiber transmission systems.

Bell's colliding-pulse mode-locked laser generates 3.5×10^{11} light pulses a second, each one lasting 600 femtoseconds. This is about 140 times faster than the fastest commercial lightwave system in service today. The laser was designed by researchers Young-Kai Chen and Ming C. Wu of the Bell Labs Semiconductor Electronics Research Department.

The accomplishment came from combining three technologies: very high-speed lasers, high-density wavelength division multiplexing, and optical amplifiers for very long distances. David Lang, Director of the Compound Semiconductor Device Research Laboratory, said bit-rate speeds have increased from 45 megabits in 1980 to the research limit of 350 gigabits today, but with these new technology thrusts, it may be possible to extrapolate 1,000 gigabits a second by the year 2000. □

University Materials Council Discusses Focus of Future Research Funding

The University Materials Council (UMC) discussed the prospect for increased materials science support and where those research funds should go at its semi-annual meeting held November 27, 1990 in Boston, coinciding with the Materials Research Society's Fall Meeting. The Council, chaired by Reza Abbaschian, University of Florida, consists of about 105 members who chair materials science departments in U.S. universities.

One focus of the meeting was an update on actions in response to the MS&E report, *Materials Science and Engineering for the 1990s*, published in 1989. Four regional meetings have been held to unify and involve working materials scientists and engineers, and to identify ways to implement the MS&E report's recommendations. The four regions are preparing summary reports. A major theme of the regional reports was synthesis and processing, but instrumentation and modeling were also stressed.

The justification for increased materials science support appears to have shifted from a "global competitiveness" argument to a "quality of life" argument. The final report from the regional meetings will recommend that the federal government fund major initiatives in materials science at the level of hundreds of millions of dollars. The ultimate payoff is expected in the form of a large number of new PhDs trained in processing and a new culture in the universities focused on interdisciplinary research.

In a brief presentation at the meeting, J. Narayan, director of the Division of Materials Research at the National Science Foundation, said that this is a unique time in materials science and engineering. The opportunity exists for this community to speak with one voice and be heard at the highest levels of government, he said, and is an opportunity we cannot afford to miss.

The Council members decided to take the following actions:

1. UMC members will be polled to determine the five most important areas of research funding sought from the government and why. This information will serve as a database for funding justification.

2. UMC members will write letters to relevant federal funding agencies supporting the MS&E initiative. The letters will urge strong support for the "synthesis and processing" initiative, and will stress that the support of individual investigators is crucial and that education in materials science is important. The letters will be general in theme so as to include related fields such as physics and chemistry.

3. UMC members will extend their membership and activities by including department chairs of other fields in the UMC.

Department heads and others interested in the UMC and its activities can contact: Prof. Reza Abbaschian, Department of MS&E, 132 Rhines Hall, Gainesville, FL 32611; phone (904) 392-1454; fax (904) 392-6359.

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