Varian Donates Semiconductor Equipment to University of Texas

The University of Texas Microelectronics Research Center in Austin has received a rapid thermal processor as a gift from Varian's Extrion Division.

The University of Texas faculty and graduate students will use the Model IA-200 rapid thermal processor to experiment with very large-scale integrated (VLSI) circuit processing technologies. Some 20 faculty members affiliated with the center are researching multilayer heterojunctions, compound semiconductor material and processing methods, and VLSI circuitry. Dr. Ben Streetman, director of the two-year-old Microelectronics Research Center, says the university undertakes projects covering a broad range of semiconductor technology.

According to Bob Holzel, general manager of Varian Extrion, the donation of the rapid thermal processor is the beginning of a close relationship between Varian and the university. "We're delighted to be involved in research efforts in one of the country's leading areas of technological development," he says. "This gift to the University of Texas is part of an ongoing Varian program to support high tech research and education throughout the country." Varian has donated similar equipment to institutions in New England and California.

Liquid-Level Sensor Operates in Extreme Environments

An extremely sensitive liquid-level sensor that operates in severe temperature or radiation environments has been developed at Sandia National Laboratories by Michael Field (Advanced Electrical Systems Division) and Bill Sullivan (Passive Components Division).

Developed for a nuclear energy research program, the sensor can be adapted for a wide range of applications in which liquid-level changes from a fraction of an inch to several feet need to be monitored. The basic system includes a coaxial cable probe (partly submerged in a liquid) and associated electronics and equipment. It determines liquid level by comparing features of the electromagnetic signals sent simultaneously through transmission lines in the probe and in a reference line. The sensor's ability to measure very small level fluctuations is controlled by the frequency of an electromagnetic signal during operation: the higher the frequency, the finer the detail provided.

Its inventors say it could be used in nuclear power plants that use water to cool fuel, or in chemical or petroleum processing industries, where high temperatures and corrosive environments are common. The sensor's developers believe there are many applications for the device because it can be used with any liquid that conducts electricity or any liquid that displays a high dielectric constant. Mercury and sodium are conductors, while water and some organic liquids (e.g., alcohols, ketones, and nitriles) have high dielectric constants. A similar device, suggests Sullivan, could even be developed to determine steam quality by measuring the amount of water that is in a gas phase and the amount that remains as droplets.

Martin Marietta Coordinates Waste Management Program

Martin Marietta Energy Systems, Inc. has established a new Waste Management Coordination Office, naming Lance J. Mezga as manager. The new office will coordinate radioactive, hazardous, and mixed waste management activities at the three major Oak Ridge production and research facilities operated by Energy Systems for the U.S. Department of Energy.

The focus of the multi-installation group, consisting of staff members of the Oak Ridge National Laboratory, Oak Ridge Y-12 Plant, and Oak Ridge Gaseous Diffusion Plant, will include on-site storage and disposal, waste generation reduction, disposal operations improvement, and demonstration of available waste management technologies.

Catalytic Hydrogen Igniter Designed to Aid Nuclear Reactor Safety

Several years ago, the U.S. Nuclear Regulatory Commission required certain types of reactors (Mark III boiling water reactors and ice condenser pressurized water reactors) to be equipped with safety systems that would prevent uncontrolled hydrogen buildup and possible detonation during a severe accident. One safety system now being used is electrically activated igniters (diesel engine glow plugs, for example) at various places inside a containment building. They initiate a small, safe hydrogen burn if concentrations of the gas do not exceed 8-10%.

Sandia National Laboratories has conducted detailed studies on the detonation properties of hydrogen-air-steam mixtures that could be expected in reactor containment buildings during a severe accident. These experiments showed that detonations would occur with mixtures containing no more than 13.5% hydrogen. Small-scale tests, conducted about 50 years ago, had concluded that the detonatability limit of hydrogen in air was 18% concentration. Sandia researchers (Livermore, CA) also wanted to investigate a backup system not dependent on electricity.

The result is a self-activating catalytic hydrogen igniter, made of parts costing less than $50 in production quantities. During large-scale tests, the inexpensive device reliably ignited hydrogen when concentrations of the gas in a steel pressure vessel reached 5.5%. Although not under simulated accident conditions, all the tests to date indicate that the device could supplement electrically powered igniters. Future tests would more closely simulate the conditions expected in a containment building during a severe accident and would investigate the effects of gas movement and water sprays on the igniter's performance.

The igniter is made of an aluminum oxide ceramic honeycomb coated with a thin, high-surface-area (100-300 m^2/g) platinum film. As gases pass through the honeycomb, the platinum coating accelerates the chemical recombination of hydrogen and oxygen into water, an exothermic reaction that initially heats the platinum wires to 60-80°C. This thermal boost enhances the catalytic effect of the wires. Heat-producing hydrogen/oxygen water recombination continues until the wires reach about 585°C and ignite the hydrogen.

Experts Identify Interfaces and Thin Films as One of Four Promising Research Areas

Annually since 1982, panels of experts have identified promising research areas in a wide range of disciplines. This year interfaces and thin films has been identified as one of four areas "likely to return the highest scientific dividends as a result of near-term federal investment." Briefings for federal officials by the panels are expected to assist in setting budget priorities for fiscal year 1988. The other three areas identified for 1986 are decision making and problem solving, protein structure and biological function, and prevention and treatment of viral diseases.

The panels are organized by the Committee on Science, Engineering, and Public Policy (COSEPUP) of the National Academy of Sciences, National Academy of Engineering, and Institute of Medicine. The fields are selected by the White House Office of Science and Technology Policy (OSTP) and the National Science Foundation (NSF) in consultation with COSEPUP. Officials of OSTP, NSF, and other federal agencies attend the yearly briefings.

The panel on interfaces and thin films, co-chaired by John A. Armstrong of IBM Corporation and George M. Whitesides of

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Harvard University, noted that the study of this topic can advance basic understanding of the properties of materials in several ways. Because their atomic structure can be manipulated more easily than that of bulk solids or liquids, thin films are useful in studying how a material's atomic structure influences its hardness, conductivity, and other macroscopic properties.

Interfaces and thin films are important in communication technologies and the silicon-based semiconductor industry, in cell biology and the way tissues react to other materials, in the control of corrosion, in the prevention of cracks and fractures in materials under strain, and in energy production.

Increased U.S. investment will yield large returns in improved technology, the panel said, but it cautioned that such an investment should build "strong, two-way interactions between basic science and technology." Programs should encourage interdisciplinary collaboration and exploit the strengths of academic, industrial, and government R&D institutions. The panel indicated that too few students are being trained in polymer-metal, polymer-carbon, and polymer-ceramic interfaces; silicon epitaxial growth; colloid science; and biocompatible surfaces. The panel also recommended organizing research groups in ways that permit sharing equipment.

The complete report of all the panels, *Research Briefings 1986*, is available for $7.50 (prepaid) from National Academy Press, 2101 Constitution Avenue, Washington, DC 20418; telephone (202) 334-2424.

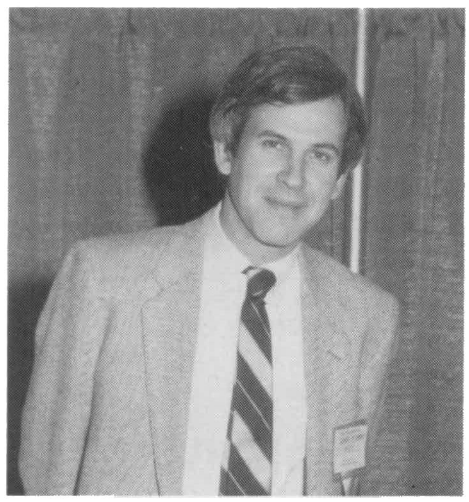
Uranium Fuel Converted to Inert Solid

Oak Ridge National Laboratory (ORNL) has completed a 15-month chemical processing campaign to convert 1,050 kg of reprocessed uranium fuel from a liquid nitrate solution to an inert, solid uranium oxide (U_3O_8) for safer long-term storage. The solidified fuel fills 401 stainless steel canisters, each sealed with a welded lid and placed within a second overpack canister for permanent storage inside a shielded concrete cell.

The Department of Energy-sponsored project, known as the Consolidated Edison Uranium Solidification Program (CEUSP), was carried out in a specially outfitted "hot cell" and support facilities at ORNL's Radiochemical Processing Plant.

Initial equipment design began in 1977; processing of the highly radioactive fuel began in April 1985 and was completed in June 1986, nearly two months ahead of schedule. Another six months to a year will be required for final cleanup of the storage tank and equipment.

The uranium solution resulted from reprocessing by Nuclear Fuel Services, West Valley, NY of a government-owned demonstration fuel core of thorium-oxide/uranium-oxide which had been irradiated in the Consolidated Edison Company's Indian Point Reactor from 1962 to 1965. In addition to two fissionable isotopes of uranium—uranium 235 (76.5 wt.%) and uranium 233 (9.7 wt.%)—the solution contained 140 ppm of uranium 232. Decay of the latter produces a very energetic gamma-ray emission which requires special shielding and handling.



L.W. Hobbs

L.W. Hobbs is EMSA President-Elect

Linn W. Hobbs, professor of ceramics and materials science in the Department of Materials Science and Engineering at the Massachusetts Institute of Technology (MIT), has been elected President-Elect of the Electron Microscopy Society of America (EMSA). Hobbs was Program Chairman of EMSA in 1985 and 1986, and Education Chairman during 1983-1985. He will assume his presidential duties on January 1, 1987.

Hobbs, an acknowledged expert on the deleterious effects of the investigating electron beam of the electron microscope on the specimens being examined, uses the electron microscope in his research on nuclear materials, high-temperature corrosion, and defects in ceramics. He is Facility Director of the X-Ray Diffraction Central Facility in the Center for Materials Science and Engineering.

A member of the Materials Research Society, Hobbs was co-chair of the symposium on Electron Microscopy of Materials at the 1983 MRS Annual Meeting. He was also co-chair of Symposium Q on Problem Solving with the Transmission Electron Microscope and Symposium Y on Frontiers in Materials Education, both at the 1985 MRS Fall Meeting, and co-chair of the 1985 Education Committee. He is chair of the Subcommittee on Student Awards of the Awards Committee, and a Councillor for MRS.

W.O. Baker Receives NAE Bueche Award

William O. Baker, retired chairman of the board of directors of Bell Telephone Laboratories, has received the National Academy of Engineering's Arthur M. Bueche Award for "a lifetime of visionary and dedicated service in the advancement of technology, for inspiring leadership in engineering research and education, and for wisdom and guidance to government and industry." Baker received his award from NAE president Robert M. White and NAE chairman John F. Welch, Jr. on October 1, during an honors program held as part of the NAE's annual meeting.

The Arthur M. Bueche Award was established in 1982 in honor of Bueche, who was senior vice president for corporate technology of the General Electric Co. and a member of the NAE governing Council. The award recognizes "statesmanship in the field of technology," in addition to active involvement in determining science and technology policy, promoting technological development, and contributing to industry-government-university relationships.

In his 41-year career at Bell Laboratories, Baker carried out pioneering work on polymers, particularly those important in electrical insulation in the communication and electronics industries. His early work provided the basis for such discoveries as MICROGEL, a substance used in natural and synthetic rubbers and heavily exploited during the World War II rubber crisis. His later work transformed polyethylene and other synthetic polymers into major classes of materials. Polyethylene subsequently replaced lead as the material used to shield communication cables. Baker's work in materials science also led to the concept used in developing heat shields for missiles and satellites.

In later years, Baker directed the work that extended the use of silicon and other semiconductors into microcircuit forms. He also organized the studies of light-wave properties connected with the discovery of the laser and the application of photonics, or light transmission, to communications.

Baker has worked extensively in the application of science and technology to public policy and government-industry-university cooperation. He served on the President's Science Advisory Committee and the National Science Board of the National Science Foundation, and on various mili-

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COMPONENTS AND SYSTEMS FOR SEMICONDUCTOR AND MATERIALS CHARACTERIZATION...

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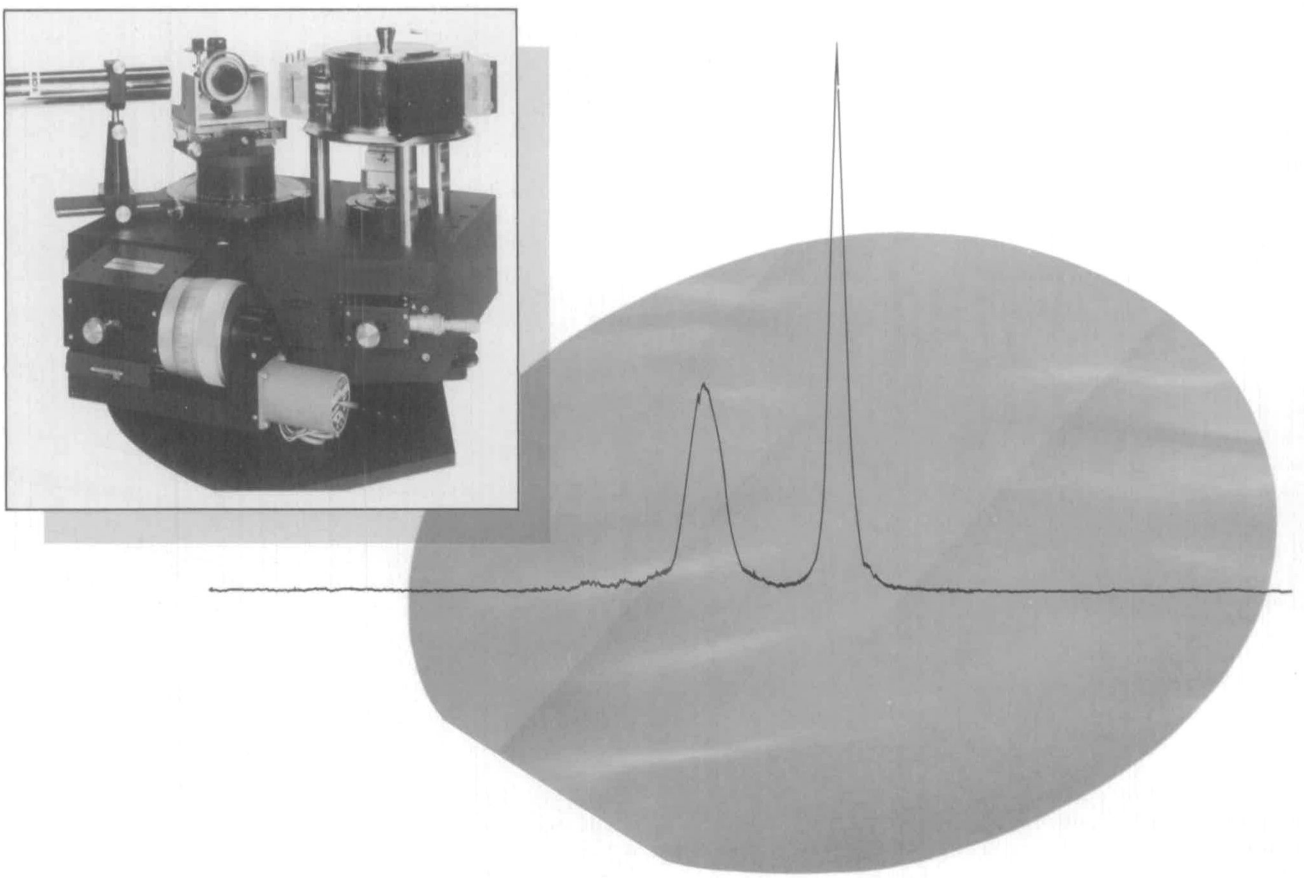

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tary advisory boards that applied civilian science and engineering for military uses. His long-time involvement in education included chairmanship of the boards of trustees of Rockefeller University and Andrew W. Mellon Foundation and trustee of Princeton University, among other institutions. He was a member of the National Commission on Excellence in Education, which in 1983 produced the report "A Nation at Risk," and also served on the Carnegie Forum on Education and the Economy.

Among the many awards Baker has received are the Priestly Medal of the American Chemical Society, the Perkin Medal of the Society of Chemists, and the 1978 Von Hippel Award of the Materials Research Society. He holds honorary degrees from 25 institutions and is a member of the NAE, the National Academy of Sciences, the American Academy of Arts and Sciences, and the Materials Research Society.

Sandia Plasma Materials Test Facility in Operation

The final piece of equipment—a powerful ion-beam source that can rapidly heat large test materials to high temperatures—is now operational at the Plasma Materials Test Facility (PMTF) at Sandia National Laboratories, Albuquerque, NM. The PMTF is a key facility in an international effort to develop magnetic confinement fusion as a source of energy. Sandia's program in magnetic fusion energy, funded by the U.S. Department of Energy's Office of Fusion Energy, includes work with most of the major fusion centers worldwide, including those at Princeton, NJ and in West Germany, Great Britain, France, and Japan.

The PMTF brings together Sandia's expertise in (1) understanding the physics of the interactions of plasma and materials, (2) developing specialized materials for use in magnetic fusion, and (3) designing high-heat-flux components for fusion machines. "Sandia is unique in combining expertise in these three areas," says Wilhelm B. Gauster, supervisor of the Fusion Technology Division. "With the PMTF we are trying to produce some of the conditions that components will see in a real fusion reactor and trying to predict intelligently what their behavior will be in an actual fusion device."

The PMTF contains three apparatuses and their computer control systems: an electron-beam accelerator, a high-velocity plasma spray machine, and the powerful ion-beam source and power supply.

The plasma spray machine makes experimental coatings used to determine which surfaces are most resistant to the heat and other conditions of plasma. It can operate at high deposition rates and produce thick coatings, including a graded mix of composite coatings.

The ion source and power supply can deliver up to 800,000 W of power (40,000 V at 20 A) for several seconds at a time to a large (59 ft^3) test chamber. The chamber can accommodate components of sizes relevant to actual use in a fusion machine, the first time this has been possible.

Advanced Limiter Test II

Sandia also coordinates an international program—the Advanced Limiter Test II (ALT-II)—to build a prototype of limiters for future magnetic confinement fusion reactors. "We expect the ALT-II program to provide definitive answers to many crucial materials and engineering problems for other fusion devices," says Jorman A. Koski, coordinator of the ALT-II project.

The ALT-II limiter, a full toroidal belt pump limiter, will be installed in the TEXTOR tokamak in Jülich, West Germany in early 1987. ALT-II will be required to exhaust 5-10% of the plasma particles and remove about 200 W/cm^2 of heat flux on the limiter face. It must be able to operate through the summation of many 2-second to 10-second tokamak pulses for a variety of plasma conditions, including auxiliary heating by ion cyclotron resonance and neutral beams.

ARCO to Use Whisker-Reinforced Ceramic Composite

Martin Marietta Energy Systems, Inc., has granted ARCO Chemical Co. a nonexclusive license for commercial application of advanced ceramic composite materials with twice the toughness of conventional monolithic ceramics. Martin Marietta Energy Systems, Inc., operating contractor for the U.S. Department of Energy's Oak Ridge National Laboratory (ORNL), said it has licensed ARCO Chemical Co., a division of Atlantic Richfield Co., to produce and market cutting tools and other wear-resistant parts made of the material.

A reinforced composite, the material exhibits dramatically improved strength and wear resistance due to the addition of rodlike silicon carbide "whiskers"—fibers less than 20 millionths of an inch in diameter—to the ceramic matrix. The embedded whiskers, produced by ARCO Chemical from rice husks, deflect the growth of potentially destructive cracks in a normally brittle material, making the composite much less prone to catastrophic failure under mechanical stress. The increased toughness extends to temperatures as high as 1000°C.

Other possible uses of the whisker-reinforced ceramic composite include high-temperature engine components, energy-saving industrial heat recuperators, and pump seals in petrochemical plants.

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