Collaborative European Microelectronics Project Launched

Siemens, Philips, and SGS Thompson, three of Europe's major electronics companies will lead a new collaborative program to develop stronger manufacturing capabilities for advanced VLSI production. The project, to be known as JESSI (Joint European Semiconductor Silicon Initiative) will also benefit from additional collaboration from other smaller companies within Europe.

The four principal aims of the project are to (1) strength basic research into understanding the underlying physics of the devices and technology, (2) develop more advanced materials and production equipment, (3) enhance systems design, and (4) improve the overall cost effectiveness of chip production. Enhancing the links with eventual end-users of the products is also planned in order to strengthen the applications end of the market.

This is the largest joint research project proposed to date, and will be aimed at the routine production of devices with feature sizes down to 0.3 microns (200 times smaller than the width of a human hair) by the mid-1990s. Half of the funding is expected to come from the industries themselves with the other 50% provided by individual governments and the European Economic Community. The project is expected to run for eight years. Details on how the funding will operate and where the major activities will be sited still have to be decided.

I.W.B.

Interuniversity Microelectronics Institute Established in Ireland

The International Fund for Ireland will provide 50% funding for a £3 million interuniversity Institute for advanced Microelectronics involving Queen's University Belfast, the National Microelectronics Research Centre at University College Cork, and Trinity College Dublin.

The Institute is intended to be a "center of excellence" in light of the major growth in the electronics industry both in Northern Ireland and the Republic. By combining the well-established capability and complementary skills of the research groups at the three participating institutions, it hopes to develop a world leadership position in silicon chip fabrication technology and design.

The Institute will intially concentrate its efforts on developing new fabrication techniques for smart power chips and on designing very high performance chips and electronic systems for digital signal processing and control.

Because of its strong industrial bias, the Institute has attracted support from many major electronics companies in Ireland (both North and South). Officials expect the Institute to have a major impact on industrial development by assisting existing companies, encouraging new indigenous industry, and helping to attract multinational electronics companies to Ireland.

I.W.B.

N.Q. Lam Promoted by Argonne

Nghi Q. Lam has been promoted to senior metallurgist at Argonne National Laboratory. Lam, whose work involves theory and study of radiation effects on alloys, was a postdoctoral fellow at Argonne before joining the laboratory staff in 1974. He is adjunct professor at the School of Graduate and Postdoctoral Studies of the Chicago Medical School and has been guest scientist at the Center for Nuclear Studies, Saclay, France.

Lam received the DOE Materials Sciences Research Award in 1984 for sustained outstanding research in metallurgy and ceramics and has written more than 90 articles. A member of the Materials Research Society, he has served on the MRS Publications Committee. Lam is also a member of the American Physical Society and holds a BS degree in materials science from the Universite Laval, Quebec, and a doctorate in materials science from McMaster University, Ontario.

Model Explains Void Defects in 4-Micron Aluminum Lines

A model that successfully explains void defects in integrated circuits with 4-micron aluminum metallization has been developed by three metallurgical researchers at Sandia National Laboratories.

Long after passing acceptance tests and months after storage, a previously acceptable integrated circuit with 4-micron-wide aluminum metallization lines will develop a crack-shaped or wedge-shaped void for no apparent reason. The problem is a seri-

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ous one for the reliability of ICs. It is apparently brought on by the industry-wide trend toward miniaturization. The defect is rarely found in circuits with wider, 6-micron metallizations.

The new quantitative model allows researchers to predict mathematically under what conditions and also at what rates the voids will form.

Electronics engineers have observed that the crack-shaped voids occur mainly in metallizations formed evaporatively; wedge voids occur mainly in those formed by sputtering techniques.

Ruling out traditional causes of defects such as stress corrosion and creep, the Sandia team investigated the stresses that develop after metallizations are made and then covered by and bonded to a deposit of glass (a passivation layer) at 400 to 450°C and finally cooled.

They found that the tightly bonded glass covering resists the tendency of the aluminum grains to move differentially in response to the cooling, a result of the aluminum's much larger coefficient of expansion. A numerical model of the cooling process predicts the development of "incredibly high" stresses, say the researchers.

The nature of these stresses and voids, however, is not consistent with the explanation the researchers initially considered—diffusion creep. Instead, they devised a stress-driven mass transport model that accounts for the formation of both crack-like voids and wedge-like voids. It uses numerical stress analysis to calculate the stress gradients in conductor lines. If these gradients are large enough, sufficient mass can be transported to create voids.

Using the model, the researchers calculated the time-to-failure for various widths of conductor lines subjected to different temperatures. As expected, the time-to-failure decreased as the conductor lines narrowed because higher stresses developed in narrower lines. The calculations, consistent with the experience of the microelectronics community, also show that as temperature increases, void growth quickens—decreasing the time-to-failure. The results suggest at least two categories of solutions—reduce the stresses or decrease the mass transport rates.

The scientists say mass movement and resulting void formation could be reduced by alloying the aluminum with copper—already known to reduce the formation of voids caused by electromigration. There might also be ways to reduce the stress gradients that drive void formation, such as intentionally debonding the interface between the metallization line and the glass covering. Incorporating one or more overlayers, preventing transfer of thermal expansion stress from the passivation layer to the conductor line.

Participating in this effort were Frederick G. Yost, of Sandia's Packaging Technology Division; Alton D. Romig, Jr., Physical Metallurgy Division; and Roy J. Bourcier, Mechanical Metallurgy Division.

M. Cohen Receives National Materials Advancement Award

The National Materials Advancement Award was presented to Morris Cohen, Institute Professor Emeritus at Massachusetts Institute of Technology, by the Federation of Materials Societies at the recent FMS annual meeting in Washington, DC.

The Award recognizes individuals who have demonstrated outstanding abilities in advancing the effective and economic use of materials and the multidisciplinary field of materials science and engineering generally, and who contribute significantly to applying the materials profession to national problems and policy.

Cohen has been a member of the MIT faculty since 1937, specializing in materials science and engineering, materials policy, physical metallurgy, phase transformations, and strengthening mechanisms. He received the SB and ScD degrees from MIT, and numerous honorary degrees from institutions in the United States and abroad.

Recipient of the National Medal of Sci-

Morris Cohen (right) is congratulated on his receipt of the National Materials Advancement Award by FMS president Gilbert M. Ugiansky and executive director Betsy Houston.

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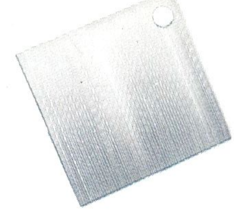

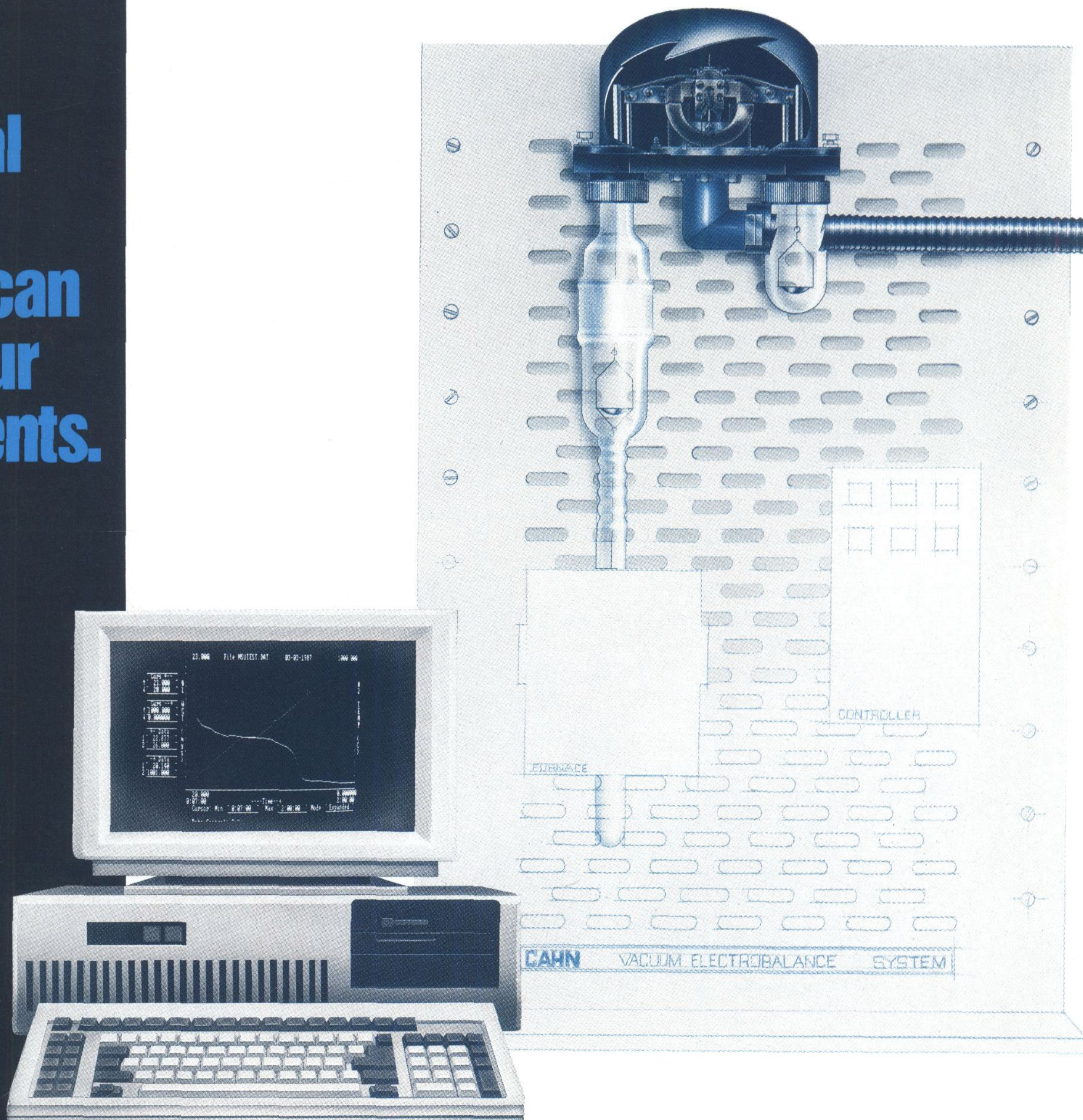

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ence, the Kyoto Prize, and numerous other awards, Cohen is a member of the National Academy of Sciences, the National Academy of Engineering, the American Academy of Arts and Sciences, the Indian National Science Academy, and the Federation of American Scientists.

Powder Diffractometer Uses Neutrons

A new "powder diffractometer" will help Los Alamos National Laboratory researchers use neutrons instead of x-rays to precisely analyze the structure of superconductors and other materials. Neutrons have greater penetrating power than x-rays, and the instrument has the highest resolution of any similar device used in the United States. Located at the Los Alamos Neutron Scattering Center (LANSCE), the instrument took about a year and $400,000 to build and replaces an earlier, less sophisticated version.

The diffractometer uses small amounts of powder or solid fingertip-size samples for analysis. Research will focus on the structure of superconductors, plutonium, and other materials for basic scientific research. The instrument also makes possible study of the microscopic texture of materials and how stresses occur in them.

Joyce Goldstone, who with Robert Von Dreele and Tom Ortiz designed the diffractometer, says plans call for the addition of four more detectors over the next two years to map material structures in even greater detail.

Growth of Japanese R&D Driven Mainly by Industry, NSF Report Concludes

A National Science Foundation report comparing Japanese and U.S. science and technology resources over a 21-year period credits a major part of Japan's growth as a formidable technological competitor to a 9.3% average annual increase in research and development spending, fueled mainly by Japanese industry.

According to the report, "The Science and Technology Resources of Japan: A Comparison with the United States," after correcting for inflation this growth rate was more than one-third higher than Japan's impressive 6.0% average annual increase in gross national product.

In contrast, over the same period, from 1965 through 1985, U.S. R&D spending expanded at a slower pace, by an average of 2.5% each year, while U.S. GNP grew an average of 2.8% yearly.

Japan has a population about half that of the United States, and a GNP about 35% as large. The United States continues to spend more on R&D and to employ more scientists and engineers than Japan, and during the period examined the United States increased expenditures for R&D by a greater amount than did Japan. However, Japan spends a comparable proportion of its national income on R&D, and employs a similar number of scientists and engineers per capita.

In some key aspects the scientific establishments of the economic giants differ, the NSF report shows. Japan trains relatively more engineers, for example, but far fewer natural scientists.

And in contrast to the United States, where half of research funds come from private industry, Japan relies on companies for more than two-thirds of R&D funds. Furthermore, the Japanese government plays a smaller role in the direct funding of industrial R&D than does the U.S. government.

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For copies of the report (NSF 88-318), contact NSF Division of Science Resources Studies, 1800 G Street NW, Washington, DC 20550, or call Elizabeth Michael at (202) 634-4622.

Editor's Note: For more about technological competition see "Maintaining Technological Leadership in a World Economy," the text of economist Lester Thurow's Plenary Address at the 1988 MRS Fall Meeting, in the April *MRS BULLETIN*.

W-K. Chu Named Deputy Director of Texas Center for Superconductivity

Wei-Kan Chu is the new deputy director of the Texas Center for Superconductivity at the University of Houston (TCSUH) as well as a Distinguished University Professor of Physics.

He is the second-ranking administrator at TCSUH and chief scientific advisor to the center's director, Paul Chu. Wei-Kan Chu will be responsible for TCSUH's science and engineering research programs. As principal investigator for TCSUH's Ion Beam Research and Processing Laboratory, Chu will also develop a new laboratory that will allow researchers to study this technology across a wider range of energies than at facilities elsewhere.

Before assuming full-time duties at TCSUH January 15, Chu was a research professor of physics and astronomy at the University of North Carolina, Chapel Hill. He also served as a research fellow at Baylor University and the California Institute of Technology, and as a senior engineer at IBM.

Chu received his BS in physics from Cheng-Kung University, Taiwan, and his PhD in physics from Baylor University. Recipient of a Senior American Scientist Award from the Alexander von Humboldt Foundation of West Germany, he has more than 150 publications, one book, and several patents to his credit. Chu was co-chair for the 1986 MRS Spring Meeting and has been active in several MRS committees.

G.E. Pike Named ACerS Fellow

Gordon E. Pike, a supervisor at Sandia National Laboratories and former president of the Materials Research Society, has been elevated to the grade of Fellow of the American Ceramic Society. The honor will be conferred at a banquet April 25 during the ACerS' annual meeting in Indianapolis, Indiana.

After receiving a BS in physics from Carnegie Mellon University and a PhD in physics from the University of Pittsburgh, Pike joined Sandia and made experimental and theoretical contributions in a variety of fields. These include transport/microstructure relationships in composite materials, electronic properties of semiconductor grain boundaries, superconductivity of CVD films on fibers, dielectric properties of insulators with defects, ceramic ZnO varistors, electrical properties of amorphous metal alloys, and defect microstructures in silicon and SiO2 for VLSI applications. Currently he supervises Sandia's Electronic Properties of Materials Division.

Since organizing the "Grain Boundaries in Semiconductors" symposium at the 1981 MRS meeting, he has served MRS in a variety of capacities. He was a meeting chair for the 1983 Fall Meeting and the first MRS Spring Meeting which was held in Albuquerque in 1984. He was also an organizer for the October 1988 symposium "Advanced Characterization Techniques for Ceramics," which was jointly sponsored by MRS and ACerS. A member or chair of most MRS committees, he was MRS president in 1986.

Johnson Matthey Acquires Cominco Electronic Materials

Johnson Matthey, a London-based firm specializing in advanced materials and precious metals technology, is expected to become a major world supplier of materials for the electronics industry following its recent acquisition of Cominco Electronic Materials, Inc.

As a result of the acquisition, Johnson Matthey now owns Cominco, located in Spokane, Washington, as well as a manufacturing and R&D facility in Trail, British Columbia and Crystar Research Inc. in Victoria, British Columbia.

The company, which has more than 7,000 employees in 24 countries, will establish a world headquarters in Spokane that incorporates the businesses it purchased from Cominco Ltd. with its existing electronic materials operation.

The $32 million transaction establishes Johnson Matthey as one of North America's largest suppliers of gallium arsenide wafers used to manufacture compound semiconductor devices. The company is also positioned as a leading industry supplier of high quality preforms, bonding wire and ribbons, sputtering targets, evaporation materials, and ultrahigh purity materials for applications ranging from research to electronic component manufacturing. □

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