## Japan and U.S. to Study Development of Ferroelectric Semiconductor

The University of Colorado at Colorado Springs (UCCS) and Matsushita Electronics Corp. (MEC) of Japan have signed a three-year joint research agreement to develop a new semiconductor using integrated ferroelectric technology.

The research will combine ferroelectric technology developed at UCCS, with MEC's expertise in semiconductor fabrication technology. MEC plans to use the results on more attractive and effective microelectronics products, and advance the field of semiconductor technology. Ferroelectric technology could be applied in making nonvolatile memories, protecting stored information after a computer's power source is turned off.

This is the first time MEC and a U.S. university have agreed to conduct component research together. The agreement supports nine U.S. researchers and one MEC engineer working in Colorado, while three MEC scientists will conduct design, testing, and analysis experiments in Japan.

UCCS Chancellor Dwayne Nuzum said, "Projects of this kind benefit both nations. The U.S. can only realize full use of its brain trust if ideas become commercial realities. Joint development at the laboratory level ensures that joint ownership of the technology also benefits the U.S. economy directly."

## Sandia Engineers Launch Campaign to Commercialize Solar Energy

A new generation of solar electric power plants has potential for use in the commercial sector, according to engineers at Sandia National Laboratories. The engineers are contacting utilities, regulatory agencies, and environmental groups in order to promote the possibility of building a molten salt central receiver power plant of commercially competitive size. Such a plant would be the first utility-scale facility of its kind in the country.

Molten salt is attractive for heat transfer and energy storage because of its lower cost, safety, and high heat-transfer capabilities compared to previous steam/solar energy plants. For instance, the hot nitrate salt can be stored at atmospheric pressure and used later. Steam-driven facilities produce electricity directly by passing the steam to a turbine because of the difficulty of storing energy in the form of high pressure steam.

Sandia's analysis showed that a 200 MW power plant could produce electricity at a cost competitive with power from a fossil fuel facility, or one to two cents per kilowatt-hour higher than a coal plant of similar size. Studies have also estimated





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the environmental costs of burning coal, such as acid rain damage and adverse health effects, to be several cents per kilowatt-hour of electricity used. Several states are considering adding these costs to the price of producing electricity, making solar central receivers cheaper than coal.

Since the initial investment for a 200 MW plant is several hundred million dollars, Sandia has developed the option of building a 10 to 50 MW plant to demonstrate the technology's benefits.

## MRS Members Elected to National Academy of Engineering

The National Academy of Engineering has announced its selections for new membership, and among them are six MRS members. Election to the Academy is among the highest professional distinctions accorded an engineer. Academy membership honors those who have made important contributions to engineering theory and practice, including significant contributions to the literature of engineering theory and practice, or those who have demonstrated unusual accomplishment in new and developing fields of technology. Among the 84 newly elected members to the Academy are the following MRS members:

**Robert A. Brown,** professor and head, chemical engineering, Massachusetts Institute of Technology, for application of computing techniques to fundamental and practical problems in fluid mechanics, rheology, and crystal growth;

**Howard R. Hart Jr.,** physicist, GE Research and Development Center, for successful and original application of high-field magnetic resonance scanners to medical technology;

**Frank E. Karasz,** distinguished university professor of polymer science and engineering, University of Massachusetts, for innovative contributions in polymer alloys and composites, miscibility theory, and electrically conducting polymers, including processing technology;

**Robert S. Stein,** director, Polymer Research Institute, and professor of chemistry, University of Massachusetts, for pioneering investigations of the relationships between structure and properties of semicrystalline polymers and polymer blends;

**Donald O. Thompson,** director, Center for Non-Destructive Evaluation, Iowa State University, for major contributions to placing quantitative nondestructive evaluation on a basis of interdisciplinary science and engineering; and

**Rao R. Tummala,** fellow and director, advanced packaging technology, IBM T.J. Watson Research Center, for pioneering contributions in developing glass, ceramic/copper multilevel packages for computers.

## Coatings Offer a New Route to Biocompatibility

Beacon Research, a nonprofit research institute in suburban Philadelphia, wholly





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owned by Beaver College, has developed a rugged permanent coating for artificial implants that can render existing materials biologically compatible. The coating, made from readily available biocompatible chemicals such as heparin or hyaluronic acid, bonds to a large variety of materials such as plastics, rubbers, glasses, metals, and new lightweight, high-strength composites.

The permanent nature of the biocompatible coating opens a whole new range of possibilities for the implant designer, who can now work with an unprecedented choice of existing materials.

The coating has a bilaminar design. One layer binds to the substrate and can be modified to adhere to a particular material. The portion of the bilaminar exposed to the body's immune system is a naturally occurring mucopolysaccharide. The two layers are covalently bonded to each other, making the coating permanent.

The coating surface is highly slippery when wet, showing a contact angle of zero when fully hydrated, thereby reducing tissue irritation. The coating is only microns thick and so will not significantly change the shape of the substance coated, yet it is highly durable. No changes in clarity, adhesion, lubricity, or any other observable property resulted when coated samples were immersed for five years in distilled water or saline solutions. Other samples were held in water at 37°C or 100°C or subjected to industry standard abrasion tests with no changes.

Food and Drug Administration toxicological tests have begun, showing promise for future applications, but final marketing approval by the FDA is still years down the road.

Initial applications could come in the form of urethral catheters and a new generation of contact lenses. Other possible uses are artificial blood vessels, heart valves, transparent and moisture-retentive bandages, orthopedic devices, implants with sustained drug release, and hybrid kidneys, pancreases, livers, etc., made from polymers, living tissues, and the coating.

## Sandia, Los Alamos, Nuclear Metals to Develop Commercial High $T_c$ Superconducting Wire

Sandia National Laboratories, Los Alamos National Laboratory, and Nuclear Metals Inc. have agreed to be partners in developing and producing a commercially usable high temperature superconducting wire from a ceramic powder composed of yttrium, barium, and copper oxide. The two national laboratories are providing materials and expertise, and Nuclear Metals (Concord, Massachusetts) the production capability. All share equally in financing the $800,000, three-year project.

The powder, manufactured by a Sandia-patented co-precipation process, will be encapsulated in a billet designed by Sandia and Nuclear Metals. Nuclear Metals will produce large-scale samples of the experimental wire under high pressure and high temperature on its extrusion presses. Los Alamos will test the composition and properties of the components and the wire, and may also provide bismuth and thallium compounds.

As a small business under a cooperative research and development program, Nuclear Metals will receive patent rights to the resulting superconducting wire.

## EUPOCO Targets Polymer and Composites Education

European Postgraduate Education in Polymer and Composites Engineering (EUPOCO) will provide advanced, long-term education geared to the needs of the European polymer and composite supplier/user industry for trained engineers and scientists. The program, which begins in October 1991, is intended for postgraduate students and professionals from industry. EUPOCO is the first program in Europe to lead to a "European Advanced Academic Degree" in polymer and composites engineering.

The program is being jointly organized by six leading European Universities; Katholieke Universiteit Leuven, Université Catholique de Louvain, Rheinisch-Westfälische Technische Hochschule Aachen, Technische Universiteit Delft, Ecole des Mines Paris, and Imperial College London.

These universities have already been cooperating through the ERASMUS program for the past two years. The ERASMUS program is supported by the European Trade Association of Advanced Composite Suppliers, representing some 35 companies.

The EUPOCO program consists of mod-





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ular courses so that participants can either obtain an advanced academic degree or simply attend lectures on topics of their choice. Those opting for the advanced degree can complete it as full-time students in one year or as part-time students (while working in industry) in two or three years. Advanced degree students will also carry out research projects based at one of the six organizing universities.

For the first academic year, six independent two-week modules, taught by lecturers from all participating universities, will be held at Katholieke Universiteit Leuven. The modules will address the following topics:

1. Basic concepts for polymer and composites engineering (polymer chemistry and physics, continuum mechanics, conservation and constitutive laws).

2. Fundamentals of polymer science and engineering (polymer chemistry, microstructure, characterization, physics).

3. Fundamentals of composites science and engineering (fibers and reinforcements for composites, micromechanics and elementary macromechanics of composites, testing and mechanical behavior of composites).

4. Manufacturing with advanced polymers (rheology, manufacturing processes, process modeling).

5. Manufacturing with advanced composites (manufacturing processes for thermosets and thermoplastic matrix composites, NDI and quality control).

6. Design and manufacturing of polymer and composite parts and structures (design and optimization, maintenance, repair, recycling, economic aspects).

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**William Pence Slichter,** retired executive director of materials science and engineering research at AT&T Bell Laboratories, and inspiring influence in his discipline, died of cancer at age 69 at his home in Chatham, New Jersey on October 25, 1990.

Soon after he joined Bell Labs in the early 1950s as part of a new initiative in polymer research headed by William O. Baker, Slichter was considered a key contributor. He helped to research findings which became the building blocks of modern semiconductors and solid state processing, and he initiated long-term polymer studies with nuclear magnetic resonance which later had wide applications. He received the American Physical Society Prize in High Polymer Physics in 1970 for his contribution to the understanding of engineering properties of polymeric materials.

Slichter also demonstrated organizational and administrative abilities that led him to manage engineering and research activities at Bell Labs. Besides forming research teams in many areas including organic and theoretical chemistry; polymer physics, chemistry and engineering; and specific applications groups concerned with extruded products, molded products, adhesives, and other materials classes, Slichter was skilled at producing clear, persuasive papers. He was highly regarded for his ability to interpret advanced results in terms plain to co-workers. He assumed responsibility for the entire range of Bell Lab's materials activities in 1973, when he became executive director of materials science and engineering research.

Slichter inspired teams to perform innovative tasks, and his technical and managerial skills were widely recognized. He was frequently asked to consult with and advise organizations in government and academia as well as professional associations. In 1988 he received the Earle B. Barnes Award for Leadership in Chemical Research Management from the American Chemical Society, and the Application to Practice Award of The Minerals, Metals and Materials Society.

Memorable for his humanity, Slichter also took an active interest in education. He served on the American Chemical Society's Committee on Professional Training, and was an active member of the Committee on Human Rights of the National Academy of Sciences and the Committee on Public Affairs, also of the American Chemical Society.

Slichter graduated from Harvard University in 1943, returning there to receive his PhD in chemical physics in 1950. MRS was fortunate to enjoy Slichter's service as an inaugural member of the *Journal of Materials Research* Advisory Review Board. He was also instrumental in the issuance of the National Research Council's MS&E Study report, *Materials Science and Engineering for the 1990s: Maintaining Competitiveness in the Age of Materials,* as a member of the Steering Committee for Materials Science and Engineering, who oversaw its execution.

## CLARIFICATION

MRS was recently called upon to handle rapid publication of the report titled *A National Agenda in Materials Science and Engineering* for release in conjunction with the Forum of the Solid State Sciences Committee of the National Research Council on February 27, 1991. The preface to the report clearly attributes its content to summaries assembled by organizers of a regional meeting process which involved hundreds of participants from many disciplines and institutions, and who were undoubtedly affiliated with many materials-related professional societies. Nevertheless, some reports have erroneously referred to this publication as an "MRS report" or "MRS study." The Materials Research Society is pleased to have been able to expedite publication for the materials science and engineering community and regrets that from such service, an exaggerated impression of the MRS role may have been inferred.