CSAC Sponsors Tech Transfer Conference on Superconductivity

On June 23, 1989 the Council on Superconductivity for American Competitiveness (CSAC) sponsored the First Annual Superconductivity Technology Transfer Conference in Washington, DC. The one-day conference, which attracted more than 120 industry, government, and academic superconductivity experts, focused primarily on technology transfer issues and the partnership opportunities available at Argonne, Los Alamos, and Oak Ridge National Laboratories' High-Temperature Superconductivity Pilot Centers. The meeting also included discussions of superconductivity policy initiatives at the federal level, including the five-year National Action Plan and the National Commission on Superconductivity. Participants were also briefed on recent application developments in specific areas such as microelectronics and energy storage.

George A. Keyworth II, chairman of the board of CSAC, opened the meeting with a review of President Reagan's 1987 initiative to encourage industry and government cooperation in superconductivity research and development. He set the theme of the conference by describing the commercialization of superconductor technology as "the principal test of America's ability to compete in the international marketplace."

The keynote address was given by Robert L. San Martin, deputy assistant secretary for renewable energy at the U.S. Department of Energy. San Martin, whose office has management responsibility for the High Temperature Superconductivity Pilot Centers, reiterated DOE Secetary Watkins' position that the national laboratories, particularly the pilot centers, can serve as unique vehicles for "full cycle collaboration" from basic research in the laboratory to commercial products in the marketplace. He announced that the DOE, which has stewardship of about one-quarter of federally funded R&D, has also, for the first time, issued a "class waiver" of patent rights in superconductivity.

Other conference highlights included several panel discussions and a luncheon address by Denise Greenlaw Ramonas, legislative director and general counsel to Senator Pete Domenici (Republican, New Mexico). Ramonas outlined the Senator's bill, S. 550, a legislative effort to strengthen the national laboratory program. The bill provides formal authority for the cooperative agreement concept and directs the Secretary of Energy to form a council of industry, government, and universities to set goals and strategies for superconductivity research. The bill also clarifies how ownership of patents and intellectual property rights arising from work at the national laboratories would be transferred.

Pilot Center and Industry Panel

CSAC Executive Director Kevin Ott moderated a panel consisting of the directors of the three High Temperature Superconductivity Pilot Centers (Rod Quinn of Los Alamos, and Anthony Schaffhauser of Oak Ridge, and Elton Kaufmann of Argonne) and two industry representatives (Edward Mead, manager of business development at Du Pont, and Gregory Yurek, president and chief operating officer of American Superconductor).

Quinn explained the concept of the pilot centers, emphasizing the nature of the pilot centers' work. Concentrating on the relationship with industry, Schaffhauser pointed out that industry needs certainty, speed, and simplicity. Kaufmann described the technical activities that spread across the three pilot centers and noted that the number of collaborative agreements with industry has grown rapidly because industry is drawn to the excellent

Participating in the pilot center and industry panel at the CSAC conference are (left to right): Rod Quinn (Los Alamos), Anthony Schaffhauser (Oak Ridge), Elton Kaufmann (Argonne), Gregory Yurek (American Superconductor) and Edward Mead (Du Pont).

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research facilities available at the national laboratories.

Mead and Yurek both commented on recent collaborative agreements reached with the national laboratories. Yurek expressed reservations about the nature of cooperative R&D as defined in the model agreement.

In the question-and-answer period, attention turned to the expeced lag time before superconducting applications become a reality. All five panelists were confident that new applications would be developed, particularly in electronics, in perhaps just three years.

National Commission Panel

Alan Schreisheim, director of Argonne National Laboratory and a member of the National Commission on Superconductivity, moderated a panel whose purpose was to examine ways the federal government can "spend smart" in superconductivity R&D. Panelists included Praveen Chaudhari, vice president, IBM Corporation; David W. McCall, director, AT&T Bell Laboratories' Chemical Research Laboratory; and Paul C. Maxwell, staff science consultant to the U.S. House Science, Space, and Technology Committee.

Chaudhari, secretary to the Committee to Advise the President on High Temperature Superconductivity, summarized the "Wise Men's" report. Principally, he said, they tried to stay alert to the differences between American and Japanese management and corporate attitudes. The major conclusions were to substantially increase research grants to principal investigators, and to form consortia of university, industry, and national laboratories with a term of at least 10 years.

McCall, chairman of the National Commission on Superconductivity, described the scope of the Commission's work, acknowledging its slow pace. The Commissions will review 10 areas: the current status of U.S. competitiveness in superconductivity; methods to improve and coordinate data collection, funding, and the development of commercial applications; the need to provide increased federal funding; foreign government activities and the impact on U.S. national security; and antitrust exemptions, tax incentives, and patent protection.

Maxwell discussed the status of the Five-Year National Action Plan on Advanced Superconductivity R&D, which aims to: specify R&D goals and priorities by individual departments of the federal government; assign responsibilities of individual departments; recommend levels of funding for five years for each department; and list proposals for industry participation in the plans implementation.

Additional presentations came from Kenneth W. Klein, director of the Office of Energy Storage and Distribution, DOE, and from Wei-Kan Chu, deputy director of the Texas Center for Superconductivity at the University of Houston (TCSUH). Klein reviewed the Superconductivity Technology for Electric Power Systems program, a collaborative research program to develop high T_c coils and cables for large power equipment. Chu explained the goals and philosophy of the TCSUH. He also described the recent TCSUH development of a new thin film device known as a high temperature superconducting magnetic field-effect transistor (HTS-MET). (See the July *MRS BULLETIN*, p. 7.)

The wrap-up discussions were lead by George Keyworth, who saw considerable change in the federal government's attitudes about R&D, especially the government's recognition that research leadership in areas like high temperature superconductivity should come from industry rather than government. The discussion then turned to the question of weak capital formation and the low savings rate in the United States, to the problems of "bottom line" management philosophy, and to concerns that the incentives for change may come too late. Cited as positive trends in the U.S. effort to develop commercial applications of superconductivity were the recent change in government policy to use the national laboratories' capabilities to give industry the leverage to develop new technology, increased funding, strategy planning, and the steady growth of superconductivity consortia.

Silicon-Based Polymer has Potential for Optical Devices

AT&T scientists have created a fundamentally new class of plastics with unusual properties that may have novel uses in electronics and optics. The key ingredient of the new material is silicon, rather than

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carbon. Called polysilynes, the new material consists of silicon atoms linked together in irregular networks of fused rings. These networks give the plastics their special properties.

"Their unique combination of optical properties and chemical sensitivity to light make polysilynes more than laboratory curiosities," said Tim Weidman, the AT&T chemist who synthesized the materials.

The plastics are being used to explore a new technology for making optical waveguide connections. Polysilynes are expected to speed research into new types of waveguides because they can be prepared in minutes instead of days.

To prepare the new materials, researchers use ultrasonic waves to coerce silicon atoms into forming disorganized networks. A special characteristic of these networks is that each silicon atom bonds to three other silicon atoms and one organic group to make the networks soluble and useful as coatings.

It was discovered that UV light causes atmospheric oxygen to join the network, causing considerable change in the materials' optical behavior. By carefully exposing polysilyne films through an optical mask, the reaction involving the polysilynes, oxygen and UV light can be used to generate thousands of optical interconnections in a single step.

For further information, contact: Russ Glover, Bell AT&T Laboratories, telephone (201) 564-4097.

From *Electronic Materials Technology News* **3** (8) July 1989, p. 4.

U.S. Group Looks at Superconductivity Research in Japan

The leader of a U.S. committee that is looking at superconductivity research in Japan says the Japanese are placing much more emphasis on basic materials research than the United States.

Mildred Dresselhaus, a professor of physics and electrical engineering and computer science at the Massachusetts Institute of Technology, says the emphasis on basic research will pay off for the Japanese in the long run.

Dresselhaus, a member of the Materials Research Society and a principal editor for *Journal of Materials Research*, is chairman of the Japanese Technology Evaluation Committee's High-Temperature Superconductivity Study. The seven-member study group recently visited laboratories, universities and industrial facilities in Japan. Later, Dresselhaus commented on the study during a visit to Los Alamos Na-

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tional Laboratory, where she was briefed on a number of research programs. Although national laboratories have been pushing materials research in the United States to some degree, Dresselhaus said they must take more of a leading role in the future.

The committee, whose sponsors include the National Science Foundation and Department of Energy, is designed to assess various aspects of Japanese technology to help balance the exchange of technical information between the two countries.

Dresselhaus said she hopes the group's forthcoming report will provide an impetus to improve U.S. research in superconductivity and other programs in materials science.

Researchers Report Transforming Hydrogen into Metal-Like Solid

Ho-Kwang Mao and Russell J. Hemley of the Geophysical Laboratory, Carnegie Institution of Washington, reported to the U.S. National Science Foundation that they compressed hydrogen under such extreme pressures that it became a solid with properties of a metal. Using the flat surfaces of two precision-cut gem diamonds, Mao and Hemley compressed hydrogen to pressures above 2.5 Mbar, reporting that they first transformed hydrogen from a gas into a transparent insulating solid, then into a semiconductor, and finally into a metal-like solid.

"We found evidence for transitions that are consistent with what recent theoretical calculations have predicted about behavior of hydrogen at high pressure," said Hemley. "Instead of transforming abruptly to a fully metallic state at a critical pessure, the hydrogen changes gradually over a wide pressure range. It becomes brown and finally black. At the highest pressures the electrons in the material appear to undergo electronic transitions expected for a metal," he continued.

During the diamond anvil experiments, Mao and Hemley detected a gradual increase in hydrogen absorption of visible light over a pressure range from about 2.0 Mbar to the limits of the experiment. Above 1.8 Mbar, the researchers observed changes in the way the hydrogen scattered laser light, evidence for changes in molecular vibrations resulting from electronic transitions. The scattered light spectrum, though changed, persisted to pressures well above 2.0 Mbar, indicating that although the hydrogen was beginning to exhibit metallic characteristics, it was still in molecular form.

At higher pressures, 2.5 to 3.0 Mbar, this signal disappeared, suggesting that the molecules in the solid may have dissociated, converting the material into an atomic metal, said Mao and Hemley. However, they added that at these pressures, high background readings, and also additional signals from the compressed diamonds, make the evidence for atomic hydrogen inconclusive at present.

The team could not measure conductivity on the small samples they produced. The volume of solid hydrogen compressed in their most recent experiments was several cubic microns. They believe they can compress larger samples that will enable them to make electrical measurements at high pressures.

The solid hydrogen produced by Mao and Hemley at high pressure and low temperature (-321°F) evaporates on returning to atmospheric pressure.

The research, described in the June 23, 1989 issue of the journal *Science*, was funded by the National Science Foundation, NASA, and the Carnegie Institution of Wasington.

Mao, Hemley, and colleagues are also studying other materials at high pressures. Using ruby and tungsten, much stronger sample materials than hydrogen, they have sustained stable pressures as high as 5 Mbar for weeks between diamond anvils. They are devising various spectroscopic, diffraction, and electrical techniques they hope will reveal the possibly novel properties of hydrogen and other materials at these very high pressures.

CSI Introduces GaAs Wafers Based on Vertical-Bridgman Crystal-Growth Process

Crystal Specialties International (CSI) has developed a promising new crystal growth process called vertical Bridgman (VB) to produce GaAs wafers. Initial applications for the wafers are optoelectronic devices such as light-emitting diodes (LEDs), solid-state lasers, and photovoltaics. Future applications include digital, analog, and optoelectronic integrated circuits (OEICs).

CSI is the first company to develop a technology like VB for commercial production of GaAs. Compared to competing growth techniques, VB is capable of larger diameter material that is substantially higher in quality and uniformity. A benefit of the process is the production of very low-defect, 3-inch diameter wafers.

CSI's new VB technology combines the advantages of the existing GaAs growth techniques horizontal Bridgman (HB), and liquid-encapsulated Czochralski (LEC). HB uses precise temperature control to produce uniform wafers with few defects, but the growth "boat" is not round, which makes large wafers more challenging after the required shaping. The LEC technique produces round GaAs wafers, but thermal stress in the process results in wafers with a high density of crystalline imperfections.

Another advantage of VB is its use of a non-quartz growth apparatus. Quartz present during growth dopes GaAs with silicon, causing it to become conductive. Although such semi-conducting wafers are ideal for optoelectronic and solar devices, they have limited use for analog and digital ICs, which require "undoped" semi-insulating GaAs wafers.

For more information, contact CSI, 2853 Janitell Road, Colorado Springs, Colorado 80906; telephone (719) 540-0990; fax (719) 540-0994.

J.A. Switzer Receives Mitsubishi Kasei Faculty Development Award

Jay A. Switzer, associate professor of Materials Science and Engineering at the University of Pittsburgh, has been awarded the Mitsubishi Kasei Faculty Development Award from Mitsubishi Kasei Corporation, Yokohama, Japan.

The $35,000 award will support Switzer's research in the processing of thin-film optoelectronic ceramics and high-temperature ceramic superconductors.

A member of the Materials Research Society, Switzer was a senior research scientist at Unocal Corporation prior to joining the University of Pittsburgh faculty in 1987. At Unocal, his research in solar energy conversion, semiconductor electrochemistry, and low-temperature processing of ceramics led to at least 13 patents. His current research interests include conducting and superconducting metal oxides, electroceramic/semiconductor interfaces, and electrochemical deposition of ceramic thin films.

Electrophoresis Contributing to Sandia Projects

The technology for electrophoretically applying very thin coatings to materials appears to have applications in the manufacture of high-performance electrical motors and more efficient transformers, according to researchers at Sandia National Laboratories. Electrophoresis is also being applied in solar photovoltaic work at Sandia and is being studied for applications in medicine, weapons, communications, and other fields.

In the case of the switching devices now being studied, an amorphous metal foil (Metglas) is wound to form inductors using a thin Mylar plastic insulating film. [For a related story see "Allied-Signal Starts Metglas Alloy Plant" in the June 1989 *MRS BULLETIN*, p. 8.] The switches are being designed to provide trillions of watts of power for tens of nanoseconds in future particle beam accelerators. The Metglas foil was deemed desirable because its lack of crystalline structure results in lower losses than can be achieved with other high-saturation, flux-density magnetic materials. During operation, voltages approaching 1000 V may appear between each of the many turns of this material.

Metal microspikes on the foil present problems. Metglas foil must be tightly wound to effectively make use of its magnetic properties, ruling out thick insulation between foil layers. The spikes penetrate or damage the 12m Mylar film, used as insulation. This results in electrical shorts across foil layers before saturation—sometimes even before high voltages are applied to the system.

Donald Sharp, of Sandia's Interfacial Chemistry and Coatings Research Division and a member of MRS, and Thomas G. McDonald found they could apply thin, uniform EP coatings on the microspikes—preventing them from tearing the insulating Mylar. The resulting inductors demonstrated breakdown voltages of about 6000 V—a 240% improvement compared to the uncoated foil.

To perfect the EP coating procedure, McDonald conducted laboratory tests with a styrene-acrylate commercial polymer mix. Next a continuous processing machine was constructed for coating 2-inch wide strips of foil several hundred feet long. H.C. Harjes and G.A. Mann, of Sandia's Pulsed Power Research and Engineering Division, helped in the design of the research machine, making use of information developed by McDonald and Sharp.

Results to date indicate that coating thicknesses of up to 25 m are possible with appropriate currents and baking temperatures for the polymers. The EP coating procedure has also worked very well on irregularly shaped objects. Corner areas, which typically aren't well coated in spray processes, tend to be well coated in electrophoresis because the electrical charges are strong in these areas.

Plans have been made, pending future funding, to design a larger process machine for coating the lengths of Metglas foil required to make the large switching inductors. Several miles of the 2-in. wide material will be needed for this purpose.

Sharp and his colleagues issue several general cautions about EP coatings:

- Coatings may be soft and poorly adherent on surfaces until they've been cured or sintered;
- If there's a large mismatch between the thermal expansion of the coating and material being coated, cracking or peeling may occur;
- There are upper limits on thickness—about 40μm—since running or dripping may begin to occur. Thickening agents may extend these limits in some cases; and
- Deposition surfaces must be electrically conductive.

Despite these limitations, Sandia research has shown a number of cases where the EP coating process is of value. In addition to the styrene, a number of powders have been deposited. These include: glasses, mica, silicon and titanium dioxide, aluminum and zirconium oxide and titanium diboride.

Private Japanese Agency in $20 Million Agreement with DOE on Safe Nuclear Reactor

The Japanese electrical industry will provide $20 million for research on America's inherently safe nuclear reactor concept—the Integral Fast Reactor (IFR)—under terms of an agreement between DOE and CRIEPI, the private research arm of the Japanese electrical utility industry.

The funds will be provided over a five-year period in return for information about the pyrometallurgical fuel reprocessing technology being developed by DOE's Argonne National Laboratory. The Japanese plan to use the information to assess the applicability of the process—which is hoped will lead to the development of reactors that are environmentally benign and inherently safe against severe nuclear accidents—to their own nuclear-power program.

Pyrometallurgical fuel reprocessing would separate radioactive elements from used fuel for recasting into new fuel. Fuel recycling would then allow an IFR-type reactor to burn its own long-lived nuclear

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wastes as it produced electricity, thereby reducing the time needed to store high-level radioactive wastes from millions of years to a few hundred years.

Pyroprocessing could also minimize risk of unauthorized diversion of nuclear fuel materials for two reasons. First, it can be carried out in a facility on the reactor grounds, thereby avoiding the need to transport fuels off site. Second, fuel materials would remain so radioactive during and after reprocessing that they could only be handled safely with sophisticated, remotely controlled equipment.

The IFR ideally would shut down without human intervention or action by automated backup systems in case of severe accidents, such as loss of coolant flow to the core. The concept comprises two key elements in addition to pyroprocessing.

First, it's a pool-type, sodium-cooled reactor. The reactor core and other major components are submerged in a pool of thousands of gallons of molten sodium, which gives the reactor passive protection against overheating in case of an accident.

Second, the IFR would use a new metallic fuel that cools readily, has a long operating lifetime, and possesses properties that contribute to the inherent safety of the IFR concept. The use of metallic fuel also simplifies the process of recasting recycled fuel products into new fuel pins.

Kay Rhyne Adams Goes to Lockheed

Kay Rhyne Adams, program manager for the Defense Advanced Research Project Agency's high temperature superconductivity program, has left that position for a job with Lockheed, the agency has confirmed. Her last day was July 15. Adams is being replaced by Francis Patten, who worked with her in the same program at DARPA, according to a Pentagon spokeswoman.

Several sources suggested that Adams left DARPA because ethics legislation now coming into effect prohibits federal officials leaving the government from doing business with it for a period of two years. Adams left prior to the regulation's taking effect.

Adams was considered an eloquent spokeswoman for high temperature superconductivity at DARPA and oversaw an aggressive program whose intention is to speed the manufacture of high temperature superconductivity components to both the defense and commercial sectors. She also was instrumental in organizing early high temperature superconductivity standards efforts and was at the forefront of budget struggles for the program, at times exposing illogic in the federal process.

Adams is one of a number of DARPA officials who left the agency because of the ethics law. Others also believed to have left due to the law are former DARPA director Ray Colladay, DARPA's Richard Reynolds, and Robert Costello, the former Undersecretary of Defense for Acquisitions.

From *Superconductor Week* 3 (30) July 31, 1989, p. 1.

CPS and GM Join in Advanced Product Development Program

Ceramics Process Systems Corporation (CPS), Milford, Massachusetts, has begun a major product development program with funding from General Motors Corporation.

Under the program, CPS will develop components for a high-temperature gas turbine engine developed by GM's Allison Gas Turbine Division, Indianapolis, Indiana, under the sponsorship of DOE's Automotive Gas Turbine Program. The components will all utilize CPS's binderless injection molding technology, especially suited for processing high-performance ceramics materials.

Although experts for some time have predicted that this use of ceramics would become a major market, CPS and GM officials say it will still be several years before these materials are widely used in automobile engines.

Argonne Conference to Focus on NDE Technologies

A conference for senior managers of manufacturing firms on new developments in materials evaluation and inspection will be held Sept. 25-26 at Argonne National Laboratory, Argonne, Illinois.

"Materials Evaluation and Inspection: New Methods, Materials and Dimensions" will focus on uses of new nondestructive-evaluation technologies to maintain and improve product quality and competitiveness in small and medium-sized manufacturing firms. It's the second annual Argonne conference for senior manufacturing executives.

Topics and speakers include:

- Interfacing new nondestructive testing techniques with process control—Emmanuel P. Papadakis, Iowa State University;
- Real-time application of x-ray and magnetic-resonance techniques—William A. Ellingson, Argonne National Laboratory;
- Locating material defects with ultrasonic visualization and microscopy—Lawrence W. Kessler, Sonoscan Inc.;
- Application of NDE techniques to new materials—Harold Berger, Industrial Quality Inc.;
- Application of neutron-diffraction techniques for NDE—David S. Kupperman, Argonne National Laboratory;
- Technical and social issues in use of sensor systems on the factory floor—Leonard H. Bieman, Industrial Technology Institute;
- Real-time monitoring of manufacturing processes using infrared signature analysis—Edmund R. Bangs, IIT Research Institute; and
- Combining know-how, sensors and analysis in materials processing—Donald E. Yuhas, Allied Signal Corp.

Conference sponsors, in addition to Argonne, include the University of Chicago, DOE, the Illinois Manufacturers' Association, the Tooling and Manufacturing Association, the Chicago High Tech Association, the Management Association of Illinois, and the Industrial Technology Institute.

Ford Foundation Fellowships Benefit 102 Minority Scholars

Fellowships have been awarded to 102 minority scholars under two Ford Foundation programs. Fifty-five predoctoral students and 21 doctoral dissertation candidates received awards in the fourth year of the Ford Foundation Predoctoral and Dissertation Fellowships for Minorities Program. Fellowships were also awarded to 26 doctoral degree recipients in the tenth year of the Ford Foundation Postdoctoral Fellowships for Minorities Program.

Administered by the National Research Council, the fellowships provide funds for research costs, stipends, and tuition to help increase the presence of underrepresented minorities on U.S. college and university faculties.

Plans for the 1990 fellowship competitions are under way. Further information and application materials are available after September 1, 1989 from the Fellowship Office, National Research Council, 2101 Constitution Avenue NW, Washington, DC 20418; telephone (292) 334-2000.

Nine from Argonne Receive Awards

Nine employees of Argonne National Laboratory were honored recently for exceptional performance. The University of Chicago Award for Distinguished Perform-

ance was given to five individuals in recognition of outstanding contributions to Argonne's research and development programs. The award consists of a medal, a certificate and $2,500. Four others received the Argonne Board of Governors Outstanding Service Award for exceptional effort in positions supporting research. The award consists of an engraved plaque and $1,500.

Distinguished Performance recipients:

- Patricia Dehmer and Joseph Dehmer shared an award for independent work in vacuum ultraviolet photophysics during their first decade at Argonne. They were also honored for joint research, over the last nine years, investigating the physical and chemical properties of excited molecules. Through laser techniques, they achieved much greater control over the microscopic processes being studied.
- David Hinks, an MRS member, was honored for outstanding contributions over the past decade to the development and analysis of superconductors. Hinks isolated the first material to achieve superconductivity above the temperature of liquid nitrogen and is studying the underlying principles of these materials.
- Michael Wasielewski was honored for producing the first conclusive study of photoinduced electron transfer rates. Wasielewski produced the world's best compounds that mimic photosynthesis and allow study of photoinduced electron transfer. He also revealed much about converting light into chemical energy through his laboratory duplications of the process.
- Alan Smith was recognized for leadership as an internationally known nuclear physicist. Because of Smith's work, Argonne operates the only single-energy neutron facility in the world dedicated to applied neutron and nuclear data measurements. He is currently chairman of the Nuclear Energy Agency's Nuclear Data Committee.

Outstanding Service recipients:

- Ronald Breyne was recognized for outstanding administration of Argonne's Chemical Technology Division and for exceptional work in labor negotiation, hiring policies and staff evaluation.
- Antoinette Engelkemeir was honored for more than 20 years of providing high quality analytical gas mass spectrometry data to researchers.
- Joseph Haumann contributed to the success of the Intense Pulsed Neutron Source (IPNS), the nation's leading source of neutrons for studies of the atomic and molecular structure of solids and liquids. He was honored for work in analog and digital electronics, and data acquisition.
- Judith Johnson, recognized for many years of exceptional service to the physical research divisions, provided executive assistance during several management transitions and helped establish the Associate Director's Office for the Advanced Photon Source. □

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Advance Announcement

INTERNATIONAL CONFERENCE ON ELECTRONIC MATERIALS–1990

September 17-19, Newark, New Jersey, USA

The second International Conference on Electronic Materials (ICEM) will be held September 17-19, 1990 in Newark, New Jersey adjacent to the Newark International Airport. This biennial conference provides the opportunity for investigators in the field of advanced electronic materials to discuss recent progress and future trends. Following the successful format of the first conference, there will be no parallel sessions, and the technical sessions will consist of oral and poster sessions.

ICEM-90 is sponsored jointly by the Materials Research Society, the European Materials Research Society, and the Japan Society of Applied Physics.

Conference topics will include:

- SUPERCONDUCTING DEVICE MATERIALS
- MATERIALS FOR OPTOELECTRONICS
- ADVANCED THIN FILM TECHNOLOGY
- DIAMOND FOR ELECTRONIC AND OPTICAL APPLICATIONS

The Program Committee will be pleased to consider abstracts on the topics listed above. To receive further ICEM-90 announcements, Call for Papers and program information regarding ICEM-90, contact Jane Stokes at MRS Headquarters:

ICEM-90
Materials Research Society
9800 McKnight Road
Pittsburgh, PA 15237
Telephone (412) 367-3003
FAX (412) 367-4373

CONFERENCE DETAILS

LOCATION: The conference will be held adjacent to the Newark, New Jersey International Airport. Complimentary shuttle service will be available from the airport to the conference hotel.

PROCEEDINGS: A proceedings will be published; camera ready manuscripts will be due the first day of the conference and refeered at the meeting. Instructions and templates for the preparation of the manuscripts will be sent with notices of acceptance of papers.

RELATED CONFERENCES

September 9-14, 1990: The 7th International Conference on Ion Beam Modification of Materials (IBMM) will be held September 9-14, 1990 in Knoxville, Tennessee immediately prior to ICEM-90. This biennial conference will bring together investigators in the field of materials modification of ion beams to discuss recent progress and future trends. For further information, contact IBMM-90, P.O. Box 2008, MS 6033, Oak Ridge, TN 37831-6033, USA; FAX (615) 574-4143.

September 23-27, 1990: The 2nd International Conference on New Diamond Sciences and Technology (2nd ICNDST) will be held in Crystal City, Virginia (near Washington D.C.) following ICEM-90. For further information, contact Russell Messier, Professor of Engineering Science & Mechanics at Pennsylvania State University, 265 Materials Research Laboratory, University Park, PA 16802, (814) 865-3704, FAX (814) 865-2326.

ABSTRACT DEADLINE: MAY 1, 1990

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