Sōmiya Receives Chemical Society of Japan Award

Shigeyuki Sōmiya received the Chemical Society of Japan Award for 1987 during that society's spring meeting, April 2 in Tokyo. The honor recognizes his studies of hydrothermal reactions and their applications for the synthesis of inorganic materials. Sōmiya is professor and director of the Laboratory for Advanced Ceramics at the Tokyo Institute of Technology. A graduate of the Institute, he received a BS in engineering in 1952 and a DrSci in engineering in 1962. He spent two years at Pennsylvania State University under the Fulbright exchange program prior to joining the Institute faculty in 1959.

Sōmiya is a Fellow of the American Ceramic Society and a member of the Materials Research Society. He is a meeting chair for the MRS International Meeting on Advanced Materials, May 30–June 3 in Tokyo, Japan.

Fradin Named Associate Lab Director at Argonne

Frank Y. Fradin has been named associate laboratory director for physical research at Argonne National Laboratory and assigned responsibility for all research and development on high temperature superconductivity. Fradin, formerly director of the Laboratory's Materials Science Division, is widely known for his work in materials science, physics, and superconductivity.

Fradin is a Fellow of the American Physical Society, a member of the Basic Energy Science Advisory Committee of the U.S. Department of Energy, and a member of the International Advisory Board to the 1988 Conference on High Temperature Superconductors. He is divisional associate editor of *Physical Review Letters*. A member of the Materials Research Society, Fradin also serves on the MRS BULLETIN editorial board.

Materials Research Corporation to Begin Commercialization of ECR

Materials Research Corporation (Orangeburg, NJ) has signed a technology transfer agreement covering electron cyclotron resonance (ECR) with NTT Technology (Japan). MRC's joint venture partner, Mitsubishi Corporation, was instrumental in the acquisition agreement reached with NTT.

ECR has gained attention in Japan as the latest plasma technology for the production of leading-edge circuitry. ECR is differentiated from other technologies by the use of magnets to produce high levels of plasma excitation. The combination of microwaves plus magnets central to this plasma-making method provides the advantages of low radiation damage, low operating temperatures, and low contamination.

Scientists Report New Evidence for a Fifth Force

In the September 28 issue of *Physical Review Letters*, scientists at the University of Washington in Seattle report new evidence for the existence of a "fifth force." The force would effectively act over distances between 10 and 1,000 meters with a strength much weaker than gravity and depend on the composition of the matter experiencing the force. Its existence would augment the traditionally identified four basic forces of nature—gravity, electromagnetism, the strong nuclear force, and the weak nuclear force.

The results were reported by Paul E. Boynton and Anthony Szumilo of the University of Washington at Seattle and David Crosby and Philip Ekstron at Northwest Marine Technology in Shaw Island, Washington.

Their experiment, the most sensitive to date, consisted of a ring of material suspended from a wire and set up at the base of a granite cliff. The ring was made of two halves with identical mass but different compositions—beryllium and aluminum. If the gravitational interaction between the cliff and the ring contained a composition-dependent component (the fifth force), the ring would twist slightly. The team reports observing such an effect.

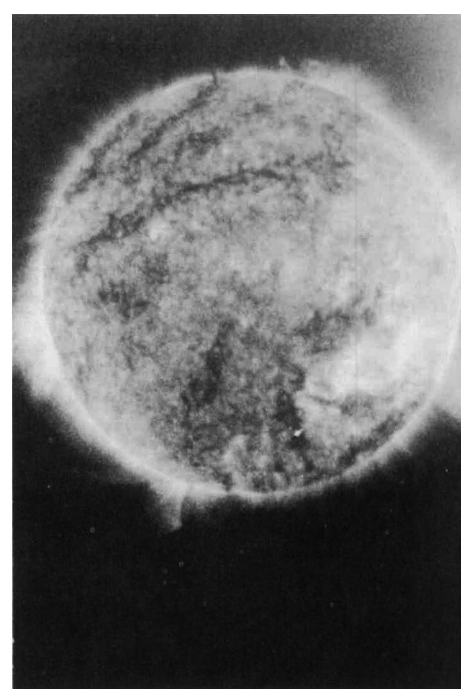
Boynton and his colleagues cast their data in a form permitting direct comparison with the results of previous fifth-force experiments. They report that all these results, taken together, form a consistent picture if the candidate interaction were related to the isospin of the atomic nuclei in the sample materials. Isospin is defined as the number of neutrons (N) in a nucleus minus the number of protons (Z). Previous hypotheses about a fifth force mainly assumed a dependency related to the baryon number (N+Z) of each sample.

Copies of the article can be obtained from the Public Information Office, American Institute of Physics, 335 East 45th Street, New York, NY 10017; telephone (212) 661-9404.

X-Ray Image of Solar Corona Obtained with Multilayer Optics

The accompanying image shows the solar corona as photographed on October 23, 1987 in the light (x-rays) of the ions Fe*IX* and Fe*X* in the band pass 17.1 to 17.6 nm. It was obtained with a normal incidence Cassegrain multilayer telescope from the Stanford/Marshall Space Flight Center rocket spectroheliograph launched on a Nike/Black Brandt rocket at 12:05 p.m. MDT from White Sands Missile Range, New Mexico. This is the first high resolution wide field x-ray image of an astronomical source to be obtained with multilayer optics. Multilayers, a class of artificially structured materials, can now be fabricated with enough precision for such applications.

The x-ray optics for the image used 25 layer pairs of Mo/Si with period d $\approx$9.45 nm with Mo comprising 40% of the thickness. Each of the two optical elements show 45% reflection efficiency at 17.2 nm, yielding ~20% overall efficiency. The emission of Fe*IX* and Fe*X* is excited from material in the temperature range from 1.0 to 1.3×10^6 K. Absorption channels due to overlaying cool prominences in the northern hemisphere are clearly visible, as are small coronal holes at both poles. Note the sharp limb brightening and the fine loops and loop arcades on the limb. The resolu-



First high resolution wide field x-ray image of the solar corona obtained with multilayer optics.

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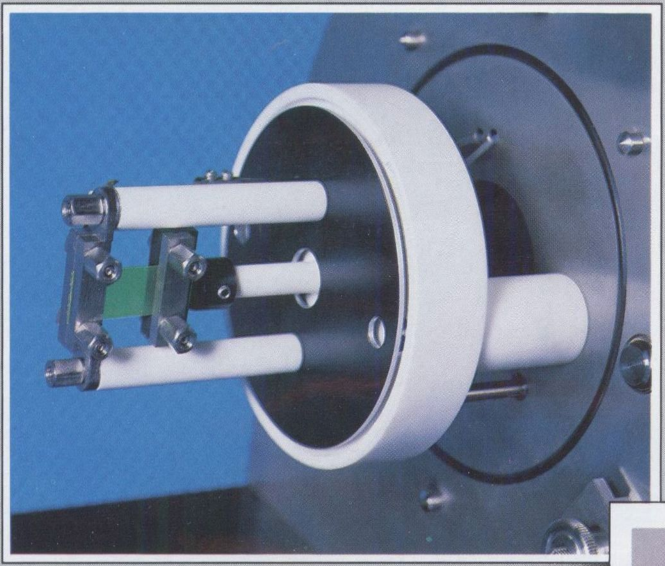
TENSILE HEAD

Dynamic Mechanical Thermal Analyser

The Tensile Head allows measurement of the dynamic mechanical properties of thin films and fibers in elongational deformation in the presence of a static force up to 4 Newtons (400 gm wt). The static stress on the sample is maintained constant throughout the experiment by an advanced feed back control.



1 STATIC LOAD

The tensile head vibrator is wound with two separate coils. One is used for the dynamic experiment, the other is used for static stress.

The static stress is applied under the control of an on-board microprocessor. Current to the static stress coil is increased and at the same time the stepper motor moves the whole vibrator in such a way as to keep the instrument transducer working at its normal gap. During the dynamic run the stepper motor moves the whole vibrator to keep the stress in the sample constant and the transducer gap constant. It is this transducer gap which is feeding information back to the stepper motor.

The whole mechanism is very sensitive and the example traces enclosed show that the static stress corrections do not interfere with the dynamic measurements and that a single fiber (finer than a human hair) can be measured.

2 ADJUSTMENT OF PRE-LOAD

The pre-load is adjusted by a thumb wheel switch on the Tension Control Unit. Range 0 - 4 N. It is maintained constant throughout the experiment.

3 HOW IS THE POWER KEPT CONSTANT WHEN THE SAMPLE CHANGES?

The average load on the sample is monitored and kept constant by moving one of the clamps and the whole vibrator using a stepper motor. The motor is controlled automatically by the Tension Control Unit.

4 SAMPLE LENGTH

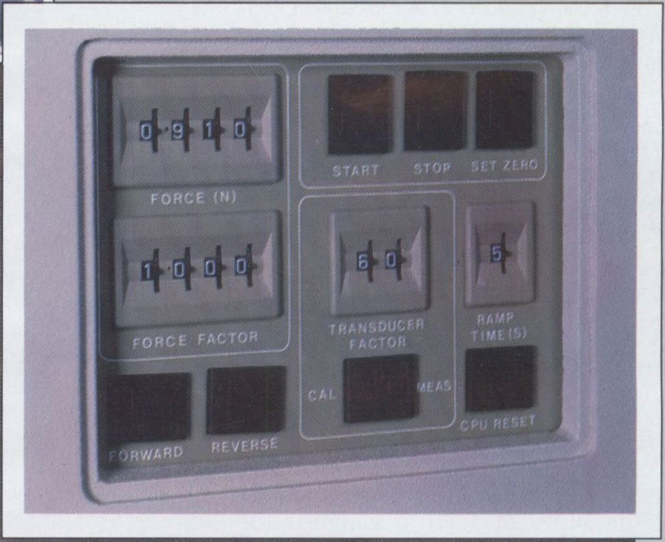
This is read to 1 micron accuracy by the control pulses to the stepper drive. It is available as 0–10 V signal and read to the computer.

5 HARDWARE REQUIRED

Hardware comprises standard DMTA units plus Tension Control Unit (box same size as DMTA Analyser unit) plus Tensile Head (complete replacement head for tension only).

6 CLAMPING INFORMATION

The clamps are flat bar units approximately 20mm x 6mm x 4mm. Each clamp is held in place by a screw at each end. There are no springs in the clamp, and it is completely rigid.



7 DMTA MEASUREMENT

The dynamic measurements are performed independently of the static force. The required dynamic amplitude and frequencies are selected and these remain constant throughout the experiment. It is recommended that frequencies be kept to the range 0.1 Hz to 50 Hz for best results with most tensile samples.

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tion of the image is 1–2 arc seconds, and the exposure time was 64 seconds. The image was recorded in Kodak T-grain 100 film.

The experiment was a collaboration of Joakim F. Lindblom and Arthur B.C. Walker Jr. of the Applied Physics Department at Stanford University, Richard B. Hoover of the Space Science Laboratory of the Marshall Space Flight Center, and Troy W. Barbee Jr. of Lawrence Livermore National Laboratory.

DOE Invites SBIR Proposals

The U.S. Department of Energy is inviting small business firms to submit proposals under its sixth annual solicitation for the Small Business Innovation Research (SBIR) program. The object of the SBIR program is to strengthen the role of small, innovative firms (500 employees or less) in areas of research and development that are federally funded. Proposals will be reviewed competitively, and approximately 100 winners will receive contracts of up to $50,000 to explore the feasibility of their ideas. Up to $500,000 is available in a second phase for ideas with the highest potential to meet SBIR program objectives.

Firms with strong research capabilities in science and engineering in any of 29 technical topics are encouraged to participate. The closing date for receipt of proposals is *January 22, 1988*. For a copy of the solicitation, contact: SBIR Program Manager, U.S. Department of Energy, Washington, DC 20545; telephone (301) 353-5707.

Small Business Innovation Research Program Proposal Topics

Geothermal instrumentation
Advanced industrial sensors and control systems
Advanced building envelope materials technologies
Indoor radon
Human genome
Environmental biotechnology and analyses
Botanical research techniques and instrumentation
Chemical sciences research
Materials sciences
High temperature superconducting materials—processing and devices
Two-phase flow instrumentation
Plasma diagnostics
Plasma confinement systems technology
Fusion energy systems
Technology for the superconducting super collider
High energy physics technology and research
High energy physics data processing and detector instrumentation
Accelerator technology for high energy physics
Accelerator technology for nuclear physics
Nuclear physics instrumentation and techniques
Coal utilization and conversion
Fossil energy instrumentation
Fossil energy material
Enhanced oil and gas recovery and tar sands
Biotechnology for fossil energy
Advanced robotic systems and concepts for nuclear facilities
Sensors and monitoring for advanced nuclear reactors
Computer applications to nuclear power plants
Fuel cycle processes

Four Countries Complete Test of Large Superconducting Magnets for Fusion Power

The United States, West Germany (acting for EURATOM), Japan, and Switzerland sucessfully completed a collaborative program to determine the operating limits of large superconducting magnets for fusion reactors. The $180 million Large Coil Task experiment, organized through the International Energy Agency, produced valuable data that will help the participants design and build magnets twice as large for fusion machines designed to produce electricity. The four-nation team is jointly comparing the performance, reliability, and economics of different magnet designs and manufacturing processes.

Six experimental magnet coils were tested over an 18-month period at an Oak Ridge National Laboratory (ORNL) facility. In the final test, September 3, 1987, all six coils showed they could operate well beyond their original design goal of 8 teslas. The six D-shaped coils, each 20 feet tall and weighing about 40 tons, reached peak magnetic fields of 9 teslas. The force on each coil in the final test exceeded 5,000 tons.

With ORNL as the lead laboratory, the U.S. Department of Energy supported development of the three U.S. coils. They were designed and constructed primarily by General Dynamics Convair Division, General Electric Company, and Westinghouse Electric Corporation. The EURATOM coil was designed and built by Siemens (West Germany) under the leadership of the Nuclear Research Center at Karksruhe. Hitachi, under the guidance of the Tokai Laboratory, designed and built the coil for the Japan Atomic Energy Research Institute. Brown Boveri Company designed and built the Swiss coil in cooperation with the Swiss Institute of Nuclear Research.

Five of the magnets tested at ORNL have superconducting filaments made of niobium-titanium. The Westinghouse magnet uses niobium-tin and also differs in its support structure, using bolted aluminum plates rather than a stainless steel external case.

Liquid helium was used to cool the conducting materials by two different methods. For three coils, helium at 15 times atmospheric pressure was forced through channels in the conductors. For the other three coils, conductors were immersed in a bath of helium that filled the structural shell.

Preliminary analysis of the LCT test results shows that:

- Both methods of cooling (forced flow or bath) are practical for large coils, but each has advantages that can now be evaluated.
- Niobium-tin conductors could perform at full potential by eliminating manufacturing flows that limited the performance of this material.

A joint technical report comparing performance and reliability of different designs and manufacturing procedures is expected in the Spring of 1988.

Competition Opens for NSF Science and Technology Research Centers

The National Science Foundation is soliciting proposals for its new Science and Technology Research Centers (STC) program. Establishment of the program reflects the fact that many important research problems can no longer be studied by scientists working alone—because of the need for large facilities, research support teams, or the need to bring together individuals with diverse expertise. It is intended to complement, but not substitute for, regular individual research project funding. STCs will be based in academic institutions and involve students and research scientists from academia, industry, and federal laboratories. The STC competition, intended to complement other NSF programs that support research group and center activities, is open to all fields of science and technology typically supported by the NSF.

The NSF anticipates making between 10 and 20 center awards in fiscal 1988, each in the range of $500,000 to $5 million per year. Initial awards will be for five years, but successful centers will be eligible for support for up to 11 years. Two kinds of awards will be made for fiscal 1988: Research Center Awards and Planning Grants to assist institutions to develop

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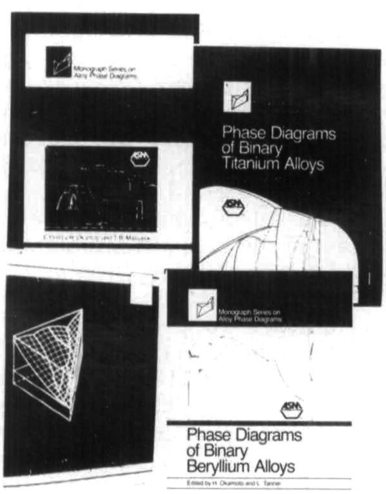

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Research Center proposals that will be competitive for federal or other support in subsequent years.

The deadline for Research Center proposals is *January 15, 1988*. The deadline for Planning Grant proposals is *February 1, 1988*. Contact Office of Science and Technology Centers Development, National Science Foundation, Washington, DC 20550; telephone (202) 357-9808.

Two-Billionth Pulse Accelerated at Argonne's Intense Pulsed Neutron Source

The two-billionth pulse of protons was accelerated in September at the Intense Pulsed Neutron Source (IPNS), one of the largest and most productive centers in the United States for the study of the atomic and molecular structure of solids and liquids. IPNS began operations in November 1981 at the U.S. Department of Energy's Argonne National Laboratory. It is used to study such materials as high temperature superconductors, the myelin sheath that insulates living nerve cells, the structure of catalysts used to promote key reactions in oil refining, and a wide range of materials for advanced energy technologies. Last year more than 200 experiments were performed at IPNS by more than 150 scientists from throughout the world.

Army Researchers Develop Process for Nitrogen-Enriched Glass Fibers

Donald Messier and other researchers in the Ceramic Research Division of the U.S. Army Materials Technology Laboratory (Watertown, MA) have developed a process for making nitrogen-enriched glass fibers. Although it has been known for years that nitrogen-enriched glasses hold several advantages over oxygen-based glasses, Messier was the first to demonstrate that such glasses could be made into fibers that would retain all the benefits—increased hardness, stiffness, strength, and resistance to corrosion.

Much improved since the patent application was first filed, the process can now produce continuous strands of the fiber, which is flexible and nearly as fine as human hair. All the potential applications of the oxy-nitride glass fibers are not yet known. Messier said there is a possibility of using the fibers in aircraft and missile radomes, the protective shields for sensitive radar equipment. He cited a joint venture between the Materials Technology Laboratory and private industry an another option for developing the process.

Photoinjector Increases Performance, Reduces Size of Free-Electron Lasers

A photoinjector, or electron gun, developed at Los Alamos National Laboratory will significantly increase the performance of radio-frequency, linac-driven, free-electron lasers. The device will also reduce their physical size.

Principal investigator Richard Sheffield, with the Free Electron Laser Accelerator Technology Group, says, "The new gun is a very bright source of electrons, meaning the electrons are all moving in a forward direction with very little straying or sideways motion. This, in turn, produces a more concentrated beam, which increases laser efficiency."

The preliminary stage in a typical accelerator can occupy as much as ten feet and includes a large amount of associated electronics and other components. In the new system, the electron gun is part of the first cell of the accelerator, eliminating much of the hardware. Because of the improved characteristics of the new source, reduction in complexity, and other new ideas, free electron lasers can become more compact and cheaper, making them more practical for hospital and industrial use.

The research is being supported by the Strategic Defense Commant, Huntsville, Alabama, as part of the ground-based Free Electron Laser Program.

Panel Outlines National Research Strategy for High T_c Superconducting Materials

Capitalizing on the "enormous scientific opportunity" and the important commercial potential presented by the recently discovered high temperature superconductors—in the face of stiff international competition—will require a coordinated U.S. national research program stretching over "a decade or more." This was the conclusion of the Research Briefing Panel on High Temperature Superconductivity.

The panel conducted its study under the aegis of the Committee on Science, Engineering, and Public Policy (COSEPUP), a joint unit of the National Academy of Sciences, National Academy of Engineering, and Institute of Medicine. The study is one of five requested by the White House Office of Science and Technology Policy and the National Science Foundation as part of an annual COSEPUP program to assist the federal government in setting budget priorities.

The panel recommended that the federal government proceed with current plans to provide about $100 million in fiscal 1988 for high temperature superconductivity research and development. The panel also identified major scientific and technical objectives for such a program. The group of scientific and technical experts urged the federal government to help U.S. industry meet the challenge of foreign competition through enhanced university/industry interaction, cost sharing on proof-of-concept projects, and improved programs for transferring new technologies from national laboratories to industry.

While the panel found the United States "in a good competitive position in the science of this field," it observed that several other countries, including Japan, Western European nations, and the USSR, have launched substantial scientific and technical efforts in high temperature superconductivity. The panel did advise the United States to "maintain an open and cooperative international posture."

The success of U.S. efforts to commercialize superconductivity technologies, the panel continued, "will depend not only upon technological factors, but also upon company business strategies and upon a range of government policies." It suggested that these policies include monitoring the need for increases in scientific and technical manpower, coordinating planning for superconductivity programs among the federal agencies, and reviewing progress in the field after 12 months as a guide for future funding.

The Research Briefing Panel on High Temperature Superconductivity was chaired by John K. Hulm, director, Corporate Research and R&D Planning, Westinghouse R&D Center, Pittsburgh, Pennsylvania. Allan R. Hoffman, executive director of COSEPUP, served as the study director. Copies of the panel's report are available from COSEPUP, 2101 Constitution Avenue, Washington, DC 20418; telephone (202) 334-2424.

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