NSF Program Will Reward Creative Engineering Students

A National Science Foundation program will give undergraduate engineering students and recent graduates grants based on creative ideas submitted in a research plan and not solely on academic achievement. The Awards for Creative Engineering program is designed to make graduate study more attractive and to improve the quality of engineering education by encouraging creative activities.

Approximately 30 grants per year will be awarded competitively, whether students are still undergraduates or have graduated in the last three years and have not done graduate work. Grants will be for up to $30,000 a year for up to three years and could be used to produce a graduate thesis.

The awarding process will be like that for a research grant. The student will submit a proposal letter incorporating an idea for research or an invention, and the application will be evaluated by a review panel.

For further information, write: Office of Engineering Infrastructure Development, National Science Foundation, Washington, DC 20550; telephone (202) 357-9834.

J.B. Wachtman Receives Materials Advancement Award

The Federation of Materials Societies (FMS) has presented the National Materials Advancement Award to John B. Wachtman, Jr. The award recognizes individuals for outstanding capabilities in advancing the effective and economic use of materials and the field of materials science and engineering generally, and for contributions to the application of the materials profession to national problems and policy.

Wachtman is director of the Center for Ceramics Research at Rutgers University. Prior to joining Rutgers, he was director of the Center for Materials Science at the National Bureau of Standards. He holds BS and MS degrees from Carnegie Mellon University and a PhD from the University of Maryland. A Distinguished Life Member, Fellow, and past president of the American Ceramic Society, he holds membership in the Basic Science and Engineering Ceramics Divisions and NICE. Dr. Wachtman is a past president of FMS and a member of the Materials Research Society.

D.M. Roy Receives ACerS Copeland Award

Della M. Roy was selected to receive the Llewellyn E. Copeland Award of the American Ceramic Society's Cement Division. The award recognizes individuals for "outstanding contributions to the development and understanding of the science and technology of cements."

Roy is professor of materials science at the Materials Research Lab and Department of Materials Science and Engineering at Pennsylvania State University. Her research interests include cementitious materials and chemically bonded ceramics, materials characterization and preparation, and high performance materials with applications in nuclear waste and under extreme conditions. The author of more than 240 technical papers and patents, she initiated and serves as editor-in-chief of *Cement and Concrete Research*.

A Fellow of the ACerS, she is affiliated with the Cements, Nuclear, and Basic Science Divisions. She was presented the Society's John Jeppson Medal and Award in 1982. Roy is a member of the Materials Research Society.

NSF Establishes Two New Engineering Research Centers

The University of California at Los Angeles (UCLA) and the University of Colorado at Boulder will receive up to $32.5 million over the next five years to establish and operate Engineering Research Centers. The two new facilities will bring to 13 the number of such Centers established by the National Science Foundation since 1985 to develop fundamental knowledge that will enhance the international competitiveness of U.S. industry. The two universities were selected from 68 proposals submitted by 48 institutions.

NSF director Erich Bloch said "The new Centers, like those already established, are promoting cooperation among universities, industry, and state governments.... The Centers are also excellent conduits for the transfer of knowledge from the universities to industry."

In addition to adding to basic engineering knowledge, the Centers will improve engineering education by involving graduate and undergraduate students in solving complex engineering problems. The Centers are also expected to receive significant industrial support.

UCLA will receive up to $18 million over the five-year period. An initial award of $2 million in fiscal 1987 will be used to establish an Engineering Research Center for Hazardous Substance Control. The Center's goal will be to develop and apply an interdisciplinary engineering systems approach to the cost-effective improvement of hazardous substances control. The Center will be directed by Sheldon K. Friedlander, professor of chemical engineering.

The University of Colorado at Boulder will be awarded $14.5 million during the five years. Funding for fiscal 1987 will be $2 million for the establishment, in cooperation with Colorado State University, of an Engineering Research Center for Optoelectronic Computing Systems. The Center's goal will be to create optoelectronic devices and systems or computing, signal processing, and artificial intelligence. Thomas Cathey, professor of electrical engineering, will direct the Center.

D.E. Moncton Selected Interim Director for Argonne's 7 GeV Photon Source

David E. Moncton has been selected interim associate laboratory director at the Department of Energy's Argonne National

Continued

Engineering Research Centers

Brigham Young University	Center for Advanced Combustion
Carnegie Mellon University	Center for Engineering Design
Columbia University	Center for Telecommunications
Lehigh University	Center on Advanced Technology for Large Structural Systems
Massachusetts Institute of Technology	Center on Biotechnology Process Engineering
Ohio State University	Center for Net Shape Manufacturing
Purdue University	Center for Intelligent Manufacturing Systems
University of California-Los Angeles	Center for Hazardous Substance Control
University of California-Santa Barbara	Center for Robotic Systems in Microelectronics
University of Colorado-Boulder	Center for Optoelectronic Computing Systems
University of Delaware	Center for Composites Manufacturing Science and Engineering
University of Illinois	Center for Compound Semiconductor Microelectronics

https://doi.org/10.1557/S0883769400067695 Published online by Cambridge University Press

Laboratory, responsible for administration of the 7 GeV Advanced Photon Source. Moncton, senior research associate of Exxon Research and Engineering Co., will direct the research and development of the $400 million facility planned for construction at Argonne. The new accelerator will provide a 10,000-fold increase in x-ray beam brilliance over current sources to study increasingly complex structures of scientific and technological importance.

Moncton has been responsible for management of Exxon's synchrotron facilities at Brookhaven National Laboratory and at the Stanford Synchrotron Radiation Laboratory. In 1983 he served on DOE's Advanced National Synchrotron Facilities Planning Committee, the first group of synchrotron users to endorse the construction of the 7 GeV photon source. He currently serves as chairman of the Advanced Photon Source Steering Committee. Moncton is also a member of DOE's Basic Energy Science Advisory Committee and participates in user-related activities at various national facilities.

Moncton will serve as interim associate laboratory director at Argonne for the balance of 1987. A search for a permanent associate laboratory director for the project is continuing, according to Alan Schriesheim, director of Argonne.

NAE Re-elects R.M. White, Three Councillors

The National Academy of Engineering has re-elected Robert M. White to a second four-year term as its president. White, an internationally recognized expert in meteorology and oceanography, has served as president of the 1,300-member engineering academy since 1983.

Re-elected to three-year terms were three members of the NAE governing Council: H. Norman Abramson, executive vice president, Southwest Research Institute, San Antonio, TX; Gerald P. Dinneen, vice president, science and technology, Honeywell Inc., Minneapolis, MN; and Paul E. Gray, president, Massachusetts Institute of Technology, Cambridge, MA. Terms for White and the three re-elected councillors begin July 1, 1987.

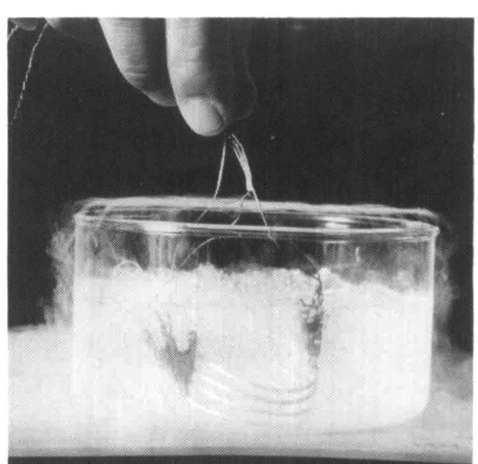
Elected to the NAE in 1968, White has long been active in both the Academy and the National Research Council. He served as administrator of the Research Council and executive officer of the National Academy of Sciences from 1979 to 1980, and he served as cochair of the Research Council's Commission on Physical Sciences, Mathematics, and Resources from 1980 to 1983. Before his election as NAE president, White was president of the University Corporation for Atmospheric Research, a consortium of 50 universities with research programs in atmospheric sciences and technology. White holds a BA degree in geology from Harvard University and MS and ScD degrees in meteorology from the Massachusetts Institute of Technology.

AT&T Coils Its Prototype Superwire

A team of scientists at AT&T Bell Laboratories, Murray Hill, NJ has developed superconducting wire that can easily be formed into coils. When cooled to 91 K (-296°F), the wire conducts electricity without resistance. The wire is made of a barium-yttrium-copper-oxide compound. The ability to draw the material into fine wire and to wind the wire into coils and other forms is the key for many superconductor applications now being considered throughout the scientific and engineering community.

The Bell Labs researchers overcame the difficulty of drawing wires from the brittle and fragile ceramic superconductor compound by using unique processing methods. The wire is clad in a metal coating for electrical, thermal, mechanical, and environmental protection. While many engineering details still need to be worked out, this prototype wire brings application of the new superconductor technology a step closer to reality.

"Fabrication of 91 K Superconducting Coils" was presented by AT&T researchers during the symposium on High Temperature Superconductors at the 1987 MRS Spring Meeting in Anaheim. A seven-hour videotape and an Extended Abstracts volume of the symposium are available from the MRS Publications Department. See also the 1987 Spring Meeting Report in this issue.



AT&T's coiled superconducting wire is made by filling hollow metal wire (such as silver) with Y-Ba-Cu-O powder and drawing out the wire to the desired diameter.

Women's Gains in Science, Engineering May Be Slowing

Extraordinary gains made by women in science and engineering, an encouraging phenomenon of the past 15 years, may be slowing, and some advances of the past decade may not last, according to an expert on personnel in those fields.

The comments were made by Betty M. Vetter in an article for the spring issue of *Mosaic*, a magazine published by the National Science Foundation. Vetter is executive director of the Washington-based Commission on Professionals in Science and Technology, formerly called the Scientific Manpower Commission. The Commission is a private nonprofit organization formed in 1953 by major scientific societies to focus on problems in scientific manpower.

The number of women graduates in mathematics and computer sciences could drop from a high of about 22,400 women in 1986 to 9,600 in 1989, Vetter said. Between 1960 and 1985 women earned almost 57,000 doctorates in science and 1,000 doctorates in engineering. The number of women graduating in engineering will peak in 1986 or 1987.

Vetter cited various reasons for these changes. Opportunities in the marketplace, though somewhat improved for women, continue to lag behind those for men, she said. Several programs to recruit women into science and engineering have been dropped, she added. "In general," she said, "the professional community of scientists and engineers has made little effort to welcome women into their fraternity, particularly in those fields where few women worked before 1970."

Three MRS Members Elected to NAS

Three MRS members were among the 61 new members and 15 foreign associates elected to the National Academy of Sciences in recognition of their distinguished and continuing achievements in original research:

- Morton B. Panish, member, technical staff, AT&T Bell Laboratories, Murray Hill, NJ;
- Daniel Tsui, professor of electrical engineering and computer science, Princeton University, Princeton, NJ; and
- Benoit B. Mandelbrot, IBM Fellow, IBM T.J. Watson Research Center, Yorktown Heights, NY (France).

Election to membership in the Academy is considered one of the highest honors that can be accorded an American scientist or engineer. Those elected bring the total number of current members to 1,523. The

Continued

https://doi.org/10.1557/S0883769400067695 Published online by Cambridge University Press

total number of foreign associates stands at 249.

The National Academy of Sciences is a private organization of scientists and engineers dedicated to the furtherance of science and its use for the general welfare. The Academy was established in 1863 by a Congressional Act of Incorporation, signed by Abraham Lincoln, that calls upon the Academy to act as an official advisor to the federal government, upon request, in any matter of science or technology.

Gas Gun Enhances Study of High-Tech Materials

A new gas-powered laboratory gun has given researchers at Sandia National Laboratories the capability to study high 3technology materials and processes faster and more thoroughly than before. The heavily instrumented stationary gun is designed to help expand knowledge about high-impact physics, shock chemistry, and the dynamics of explosions. Capable of hurling projectiles into materials at speeds approaching Mach 5 (about 3,600 miles per hour), the gun is being used as a research tool in several scientific and engineering disciplines.

In one project, the gun is being used to test casings for solid-fuel rocket boosters to determine the best type of metal and the optimum thickness for protecting the fuel and rocket cargo without adding unnecessary weight. Another project is looking at ways a precisely timed light beam, initiated by a high-speed impact, may be used as a reliable timer for advanced weapon systems. Yet another project is using the gun to study microscopic chemical and physical dynamics that take place during the first 100 billionths of a second during the detonation of explosive materials. The ultimate goal is to develop information that will lead to new types of explosives that are less sensitive and less susceptible to accidental detonation.

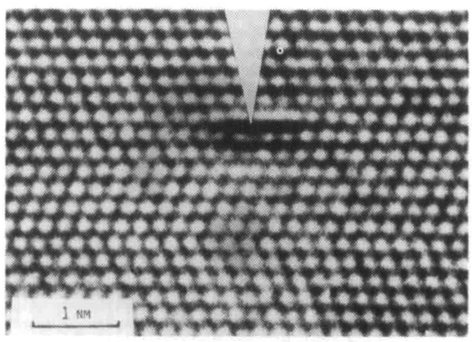
Sandia has used similar gas guns for about 25 years, but the new gun has features that make it easier to control and operate and that provide for noncontact measurement of projectile velocity. These features, which allow one-person operation and quick turnaround between firings, include a quick-acting, quick-change breech; a remote target manipulating system; and a laser-based, projectile velocity measurement system.

The projectile velocity measurement system uses bar-code markings. Placed on the projectile are the bar codes, illuminated by laser light channeled through a fiber-optic probe and onto the fired projectile just after it clears the end of the barrel. The reflected light is directed to a system that automatically records the time for each of the 30 variable-width bars to pass the probe.

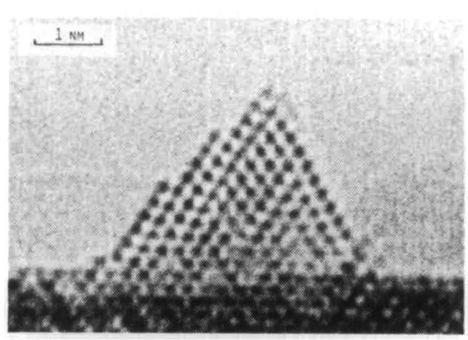
Besides easily calculating projectile velocity, the system can measure a projectile's rate of acceleration. Other measurement techniques can be used in the large target chamber as the projectile approaches and strikes the target, including electromagnetic gauging, Raman spectroscopy, time-resolved infrared spectral photography, and electronic streak and framing camera photography.

Atomic Resolution Electron Microscopy at Oxford

A new 400 kV high resolution electron microscope at Oxford University's Department of Metallurgy and Science of Materials is finding a wide range of applications in materials research. A new JEOL 4000EX electron microscope was equipped with a high sensitivity TV imaging and recording system capable of displaying an image magnified up to 50 million times directly on a TV monitor. Images can also be recorded at the same time on photographic film, at magnifications up to 2 million times.



Microtwin lamella in Cu/5%Al alloy, projected along <110>. Atomic columns are imaged as white circles, and the structure of the twin boundaries, as well as the partial dislocation at a step along the upper boundary, are clearly revealed.



A (100) "surface profile" image of a spinel, $ZnCrFeO_4$, which is catalytically active. Electron irradiation with 400 kV electrons induced the growth of an "island" of oxide (probably $Fe_{1-x}O$ in the Wüstite phase). Early stages of crystal growth processes can thus be studied, giving insights into surface reactivity and other phenomena.

The instrument has been shown to have a resolving power better than 1.6 Å (0.16 nm) and this capability is currently being exploited in studies of a wide range of materials, including semiconductors, catalyst particles, metals, and minerals. Two micrographs recorded by Dr. John Hutchison, research fellow in the Department of Metallurgy and Science of Materials at Oxford University, illustrate the capability of the new high resolution electron microscope.

Beryllium Detector Speeds Materials Analysis

A new instrument, using a laser spark to break down material to its basic elements, can reduce some laboratory analyses from a day to a couple of minutes. The "rapid beryllium detector," developed at Los Alamos National Laboratory, could significantly change the way some materials are analyzed. The detector includes a laser, spectrometer, and computer.

"What we did is take a technique called laser-induced breakdown spectroscopy and adapt it to fit a need for fast analysis of certain materials," said David Cremers, the Los Alamos physicist who heads the detector project. The team's efforts focused on designing and building an instrument that would quickly detect particles of airborne beryllium, a metallic element used extensively in the aerospace, electronic, and nuclear power industries. Beryllium can cause acute respiratory disease if inhaled in large quantities.

Chemical analysis of the contents of beryllium filters, which includes dissolving them in an acid solution, can take up to eight hours. The rapid beryllium detector analyzes the same filters (thin, one-inch diameter disks of cellulose acetate) in about two-and-a-half minutes. A laser shoots small sparks (24,000°C) at the filters, vaporizing whatever is on the target and breaking down the materials to their elemental contents. A spectrometer reads the energy levels given off by the contents. Detectors then feed that information into a microcomputer, which furnishes a digital printout of the amount of beryllium present on the filter. The monitor can detect traces of beryllium down to ten-billionths of a gram, and it can be operated by nearly anyone.

Because the detector can analyze anything placed on the laser target, the possibility of using it for mineral prospecting is being explored. "We're actively seeking companies to take over the technology and

Continued

https://doi.org/10.1557/S0883769400067695 Published online by Cambridge University Press

commercially build more detectors for the marketplace," said Cremers. A patent for the laser-spark analysis method used in the prototype instrument was issued last year to the Department of Energy, naming Cremers and L. Radziemski as co-inventors. Other applications of laser-induced breakdown spectroscopy are being developed by Tom Loree of the Laboratory's Tunable Lasers and Applications Group.

New Highly Selective Etching Technique Demonstrated

A new dry photochemical etching technique that allows selective dry chemical etching of compound semiconductors, such as gallium arsenide phosphide, could be a boon to future solid state device design and fabrication. Developed at Sandia National Laboratories, the technique exploits electronic differences as a means of discriminating between chemically similar semiconductor materials. Conventional dry chemical etching techniques are of limited use with compound semiconductor technology, in which it is frequently necessary to etch one material while leaving an adjacent chemically similar material intact.

The new dry photochemical etching technique—successfully demonstrated in a series of laboratory experiments that involved etching gallium arsenide phosphide and gallium arsenide materials—received two U.S. patents. They were issued to the U.S. Department of Energy (DOE) in the names of Carol Ashby and James Dishman, both of Sandia's Laser and Atomic Physics Division. The work earned Dr. Ashby the DOE's Basic Energy Sciences 1986 award for "significant implication for DOE-related technologies" in materials science research.

The technique operates by using a light source, such as a laser, to bombard the semiconductor with photons. The photons carry a precisely determined amount of energy, sufficient to create free electrons and holes in the material that is to be etched, but not in adjacent or underlying material with different electronic properties.

One variation of the technique etches only materials with bandgaps of a certain maximum energy level. Another variation can selectively etch any semiconductors whose chemically similar regions are electronically different because of different doping levels.

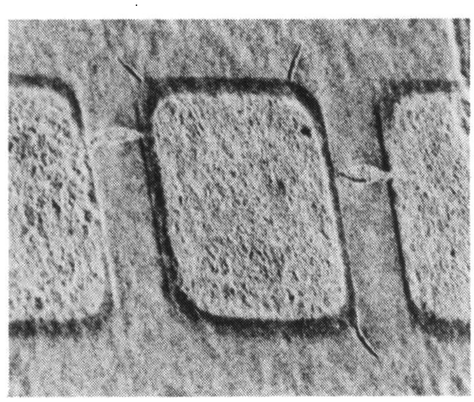
There already is evidence of the commercial potential for this bandgap selective etching technique. United Technologies, (East Hartford, CT) used principles of it to wet-etch gallium arsenide from an aluminum gallium arsenide substrate.

Ashby believes the new etching technique could be used to cut special features, such as windows, into a specific layer or substrate of a semiconductor device during fabrication. Or, designers may call for process engineers to strip off most of a film layer in order to expose a large area of an underlying material.

Ashby also successfully demonstrated how to selectively suppress etching in chemically similar/electronically dissimilar semiconductor materials. She applied a negative voltage to the material, creating a barrier that prevented the migration of current carriers (holes in this case) to the surface. Without these carriers present at the surface, the chemical etching could not begin.

IBM Makes Superconducting SQUIDs

Researchers at the IBM Thomas J. Watson Research Center (Yorktown Heights, NY) have made the first thin-film superconducting devices that operate at temperatures high enough to be of practical use. This major advance builds on the breakthrough discovery last year by J. Georg Bednorz and K. Alex Mueller of the IBM Zurich Research Laboratory that a class of copper-oxide materials is superconducting at unprecedented high temperatures.



IBM's SQUID, shown magnified more than 500 times, can be used for extremely sensitive magnetic measurements—even of the tiny magnetic fields caused by electrical currents in the human brain. Surface irregularities are in a layer of gold deposited on top of the superconductor.

The new devices, called SQUIDs (Superconducting Quantum Interference Devices), are the most sensitive magnetic detectors known to science. Composed of two thin-film Josephson devices each, the SQUIDs are only one-hundredth the thickness of a human hair and are superconducting at up to 68 K (-337°F). SQUIDs have been used by scientists in studying brain waves, in geological exploration, and in fundamental physics research. Previous applications, however, have been limited by the need to cool the SQUIDs to 4 K, the temperature of liquid helium.

Making the SQUIDs required innovative adaptation of the technical processing steps used in fabricating semiconductor computer chips. These included electron-beam vapor deposition, sputtering, lithography, ion milling, etching, and ion implantation. Before fashioning the new SQUIDs, the IBM T.J. Watson Research Center scientists first made thin films of the superconducting material. Colleagues at the IBM Almaden Research Center (San Jose, CA) provided the structural and compositional information for making the films. The new thin-film SQUIDs which become fully superconducting at 87 K, can operate at temperatures as high as 68 K by using liquid nitrogen under reduced pressure.

IBM's ability to make such thin-film devices with revolutionary new superconductive materials opens the door to producing instruments and complex microcircuits using superconductivity technology.

The announcement of high-temperature SQUIDs was made during the symposium on High Temperature Superconductors at the 1987 MRS Spring Meeting in Anaheim. A seven-hour videotape and an Extended Abstracts volume of the symposium are available from the MRS Publications Department. See also the 1987 Spring Meeting Report in this issue.

Instrument Measures Magnetic Fields Over Microscopic Depths

A new instrument that could lead to improved devices to record stereo sound and computer data and that could add to the knowledge of superconductivity, has been developed by Argonne National Laboratory scientists. The device, called the polarized neutron reflectometer, measures magnetic fields over microscopic depths at the surfaces of materials.

"The instrument has already been used to measure the response of new recording materials to magnetic fields," said Gian Felcher of Argonne. The instrument has also been used to map the current flow close to the surface of superconducting metal.

"It is powerful enough that IBM is collaborating with us to study advanced magnetic materials and plans to work with us to explore the instrument's use. Three European laboratories plan major efforts using a copy or adaptation of our instrument," said Felcher.

The instrument uses neutrons as tiny compasses that penetrate the material and react to magnetic fields along their path.

Continued

https://doi.org/10.1557/S0883769400067695 Published online by Cambridge University Press

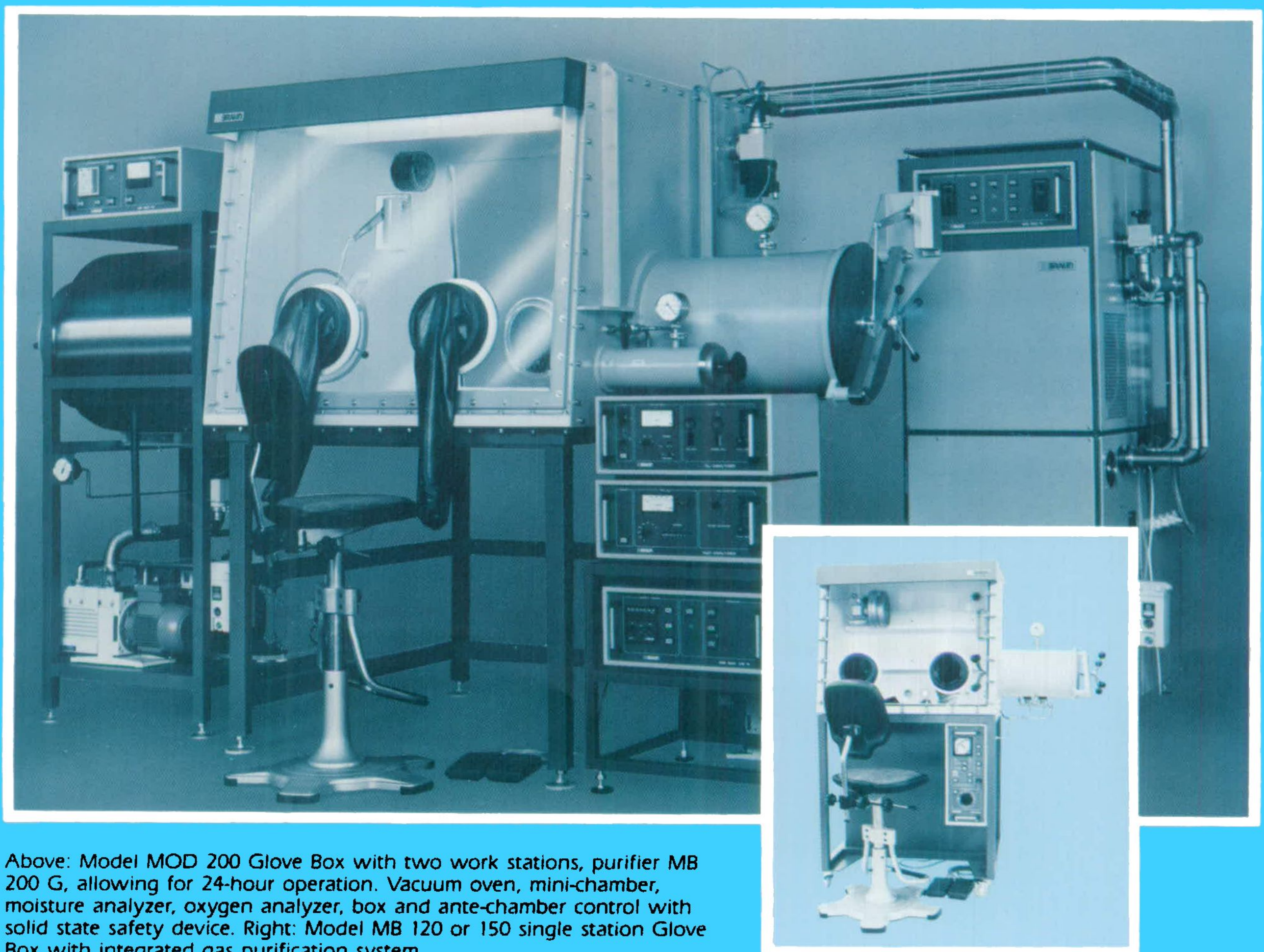
COMPARE . . .

the MBRAUN Glove Box to any other and you'll see — there is no comparison!

Our systems are completely packaged and ready to run. Systems capable of removing H_20 and 0_2 to one ppm in an inert gas atmosphere. All stainless steel modular construction. Vacuum pumps with automatic gas ballast and exhaust traps. All valves are electropneumatic, controlled by convenient front panel pushbuttons and floor pedal. Built-in solid state pressure measurement and regulation device with integrated high/low safety trip points.

Other standard features include: automatic regeneration control; 11 Kg of copper catalyst and molecular sieve material in purifier column. Copper tubing throughout with stainless KF connectors; safety hydraulic ante-chamber door device.

Dollar for dollar — our Braun Glove Box is the best value on the market, nothing else even comes close!



Above: Model MOD 200 Glove Box with two work stations, purifier MB 200 G, allowing for 24-hour operation. Vacuum oven, mini-chamber, moisture analyzer, oxygen analyzer, box and ante-chamber control with solid state safety device. Right: Model MB 120 or 150 single station Glove Box with integrated gas purification system.

it innovative technology, inc.

205 WILLOW STREET • SOUTH HAMILTON, MASSACHUSETTS 01982 • (617) 468-3543

https://doi.org/10.1557/S0883769400067695 Published online by Cambridge University Press

"The trick," Felcher said, "was to make this probe as sensitive as possible to magnetic fields at the surface. This was accomplished by sending the neutrons nearly parallel to the surface, so they graze it."

The instrument is sensitive enough, he said, to measure magnetic fields within one five-thousandth of an inch of the surface without harming the material. It can detect magnetic field changes over distances as small as one ten-billionth of an inch.

Panel Urges Army to Use More Advanced Materials

The Army could better exploit the "cutting edge" of materials technology by greater cooperation with industry and academia rather than relying too heavily on in-house research and development, says a new report by a committee of the National Research Council. During a two-year study sponsored by the U.S. Army, the committee found that Army researchers may be overlooking major developments in materials research that could prove vital to U.S. technological superiority in weapons systems.

Emerging materials technologies that the Army needs to monitor more carefully include powder metallurgy for producing lightweight aluminum alloys that resist high temperatures; fiber-reinforced ceramic composites for advanced engine parts, gun tubes, and armored combat vehicles; gallium arsenide semiconductors for high speed transistors and integrated circuits; and organic polymers for use in surveillance and communication.

The report also recommends that Army research protocols focus on entire weapons systems rather than on individual components and single characteristics. For example, the initial tread life of M1 tank tracks was significantly reduced because the suitability of materials for that use was not considered during the system design phase. The committee noted that the Army selected a tread material because it was lightweight, without also considering its other characteristics. The new tread showed poor wear in field trials and had to be replaced late in the development process.

In addition to improving Army interaction with non-Army scientists, the committee advised that a greater portion of the Army's budget for materials research—nearly $100 million in 1986—be allocated for research at non-Army facilities. Reducing security restrictions to an "essential minimum" would be a first step toward greater participation by outside materials experts as advisors and researchers, the report says.

Comprised of experts on materials technology and military weapons systems, the committee was chaired by Arden L. Bement Jr., vice president for technical resources at TRW Inc., Cleveland, Ohio.

The report, *Achieving Leadership in Materials Technology For The Army Of The Future*, is available from the Board on Army Science and Technology, National Research Council Commission on Engineering and Technical Systems, 2101 Constitution Avenue NW, Washington, DC 20418; telephone (202) 334-2000.

NSF Graduate Fellowships Offered to 505 Students

National Science Foundation fellowships for graduate study in the natural and social sciences, mathematics, and engineering have been offered to 505 outstanding college students. Nearly 4,730 students submitted applications in the nationwide competition for the NSF Graduate Fellowships, which are awarded on the basis of merit.

Panels of scientists, assembled by the National Research Council of the National Academy of Sciences, evaluated applications; final selections were made by NSF. In addition to the fellowships, NSF awarded Honorable Mention to 1,212 applicants in recognition of their potential for scientific and engineering careers.

The new fellowships provide a stipend of $12,300 per year for full-time graduate study at any appropriate nonprofit U.S. or foreign institution of higher education. Each fellowship is awarded for three years of graduate study but may be used over a five-year period to permit students to incorporate teaching or research assistantships into their education.

The new fellows come from 48 states, the District of Columbia, and Puerto Rico. Of the 505 award offers, 178 were made to women. By scientific discipline, the distribution of awards was as follows: 109 in engineering; 22 in mathematics; 15 in applications of mathematics; 34 in computer science; 37 in physics and astronomy; 37 in chemistry; 17 in earth sciences; 136 in biological sciences, including biochemistry; and 98 in the social sciences and psychology.

Superconducting Wire Shows Higher Current Density

A 30-fold improvement has been measured in the current-carrying ability of high temperature superconducting wire developed by the U.S. Department of Energy's Argonne National Laboratory. The new ceramic wire contains an oxide of yttrium, barium, and copper first discovered by C.W. Chu and coworkers at the University of Houston and now under study at laboratories throughout the world.

On April 28, 1987 Argonne scientists announced a current density of 191 A/cm^2, an improvement over a previously reported high of 6 A/cm^2. The previous current density was announced on April 1, when Argonne scientists were the first to run current through a thin, relatively flexible wire of the material. The higher current density was measured in a 0.007-inch-thick wire cooled to liquid nitrogen temperature of 65 K (-342°F). Nitrogen remains liquid to 65 K in a sealed, pumped system of the type likely to be used in practical applications.

A current density of 564 A/cm^2, said Roger B. Poeppel of Argonne, was measured at an even lower temperature of 54 K (-362 F). This temperature is lower than can be achieved with liquid-nitrogen cooling, but shows that the wire can carry substantially larger currents. "The wire is still a long way from being useful," Poeppel said, "but this is progress. It is a strong indication that the material can be made into practical wire."

National Science Board Meeting Hosts Speakers on Superconductivity

The May 22 meeting of the National Science Board, governing body of the National Science Foundation, featured three speakers on high temperature superconductivity—Prof. Paul Chu of the University of Houston, Dr. Laura H. Greene of Bell Communications, and Ms. Heidi Grant from San Jose, CA.

Prof. Paul Chu reviewed the history of high temperature superconductivity research and the discovery of superconductivity above 90 K, and he described current understanding of the occurrence of superconductivity at this high temperature. Chu also announced that his team has pushed the limits of superconductivity upward another 100 degrees, to the level of dry ice. He said samples prepared in his laboratory show the characteristics of superconductivity at 225 K (80°C). Chu stated that he has also seen evidence of superconductivity at even higher temperatures, but these samples were not stable.

Dr. Laura H. Greene addressed the scientific and technological challenges presented by high temperature superconductors, focusing on crystal structures; doping effects of isotopes, oxygen, and rare earth metals; critical magnet fields; and critical currents. Greene has worked with superconductors and superlattices at Bell Communications Research in Redbank, New Jersey. She began working with the new high temperature superconductors in December 1986.

Continued

The third speaker was Ms. Heidi Grant, a fifteen-year-old eighth grade student at Dartmouth Middle School, San Jose, CA. Grant, a B student whose favorite subjects are math and science, and whose goal is to swim in the 1992 Olympics, described how she made superconducting pellets and gave a demonstration of magnetic levitation. Her work on the superconducting pellets was done in her father's laboratory at night.

Los Alamos Scientists Unlock Fission Mystery

A Los Alamos National Laboratory team has discovered that measuring the number of neutrons given off prior to the splitting process can foretell the duration of a reaction. The team, led by Avigdor Gavron of the laboratory's Medium Energy Physics Group, originally began research using heavy ion beams to study the emission of neutrons. While Gavron's team was experimenting with these ions, it was discovered that an excess of neutrons was being emitted prior to the fission process. "We realized these neutrons can serve as a clock for the fission process, telling us how long it will take," said Gavron.

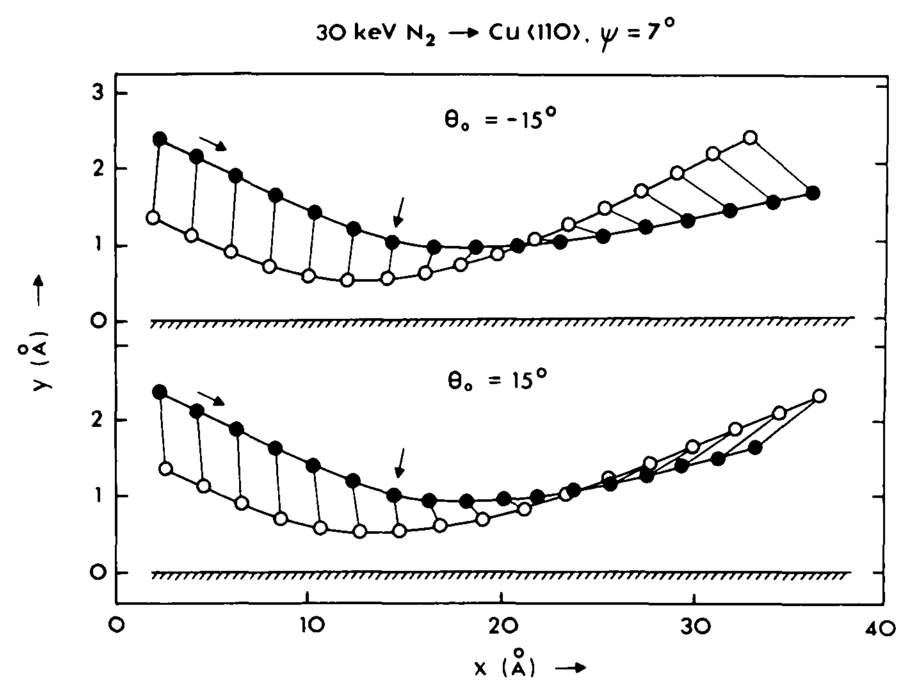
The laboratory experiments included colliding nuclei into each other at more than 100 million eV. "The nuclei come together and boil off some neutrons," said Gavron. "We noticed that the neutrons flew apart in all directions, which implied they were emitted before the fission process was completed." The speeds at which the nuclei were coming apart in the experiments were a phenomenal one-millionth of a millionth of a millionth of a second.

Experiments to verify the theory took place over five years at four national laboratories—Los Alamos, Oak Ridge, Brookhaven, and Lawrence Berkeley Laboratory. Other team members included H.C. Britt and J. Boissevain, J. Wilhelmy, M. Fowler, R. Nix, and A. Sierk. Also participating were A. Gayer, a guest scientist from Israel's Soreq Nuclear Research Center, plus scientists from the Louis Pasteur Institute in France and Max Planck Institut in West Germany. "We also benefited from collaboration with experimentalists at Oak Ridge National Laboratory in Tennessee and Georgia State University," said Gavron.

MRS

Editor's Choice

Figures appearing in the EDITOR'S CHOICE are those arising from materials research which strike the editor's fancy as being aesthetically appealing and eye-catching. No further criteria are applied and none should be assumed. When taken out of context, such figures often evoke images beyond and unrelated to the original meaning. Submissions of candidate figures are welcome and should include a complete source citation, a photocopy of the report in which it appears (or will appear), and a reproduction-quality original drawing or photograph of the figure in question.



V.I. Shulga (*Radiation Effects* **100** (1986) p. 71-84) is the source of the figure in this issue's EDITOR'S CHOICE. In a paper entitled "Surface Semi-channeling of Atomic and Molecular Ions," Shulga derives analytic expressions and performs computer simulations for the low angle scattering of atoms and molecules from the strings of lattice atoms along major crystallographic directions in the surface of a single crystal. This figure traces the trajectory of each atom of a N_2 molecule as it scatters from a <110> Cu atomic string. The N_2 molecular axis is oriented at + or -15° with respect to the string normal as the 30 keV N_2 impinges from the left onto the surface at a glancing angle of 7°. Note that the vertical (distance normal to the surface) and horizontal (distance parallel to the surface) length scales differ considerably. For these parameters the N_2 is dissociated by the collision. The choice of distorted length scales for the sake of clarity, the use of different symbols for each of the two N atoms of the dumbbell molecules, and the apparent crossing of the trajectories all serve to give the impression of a swinging rope ladder.

https://doi.org/10.1557/S0883769400067695 Published online by Cambridge University Press