## Massey Urges NSF Scientists to Help Washington Area Schools

National Science Foundation (NSF) Director Walter Massey is urging the agency's 400 scientists and engineers to get involved in Washington, DC area schools through activities that illustrate the excitement of learning science and mathematics.

Massey hopes professional scientific organizations will become more involved in conveying the importance and relevance of their work to their local communities, and have greater influence on the quality of education and career choices of young people. "I'm going to do everything I can to encourage scientists—whether in government, industry, professional societies, or foundations—to become more active in science education reform. NSF should lead the way, and this effort will help start that process."

The NSF policy represents a new concerted effort on the agency's part, beyond the recent years' push by government and industry, to redirect the way science is taught at the precollege level.

For the last seven years, NSF and corporate America have sponsored National Science and Technology Week to highlight the fun and excitement of science. This year, for the Week, special science education materials were sent to more than 500,000 teachers throughout the country. Additional instructional materials are available through the Foundation, including a "Scientist Survival Guide," which provides tips for scientists who are volunteering to work in an elementary classroom setting. Write to: National Science and Technology Week, Scientist Survival Guide, National Science Foundation, Rm. 527, 1800 G St. NW, Washington, DC 20550, or call (202) 357-9494.

## Researchers Announce Buckyball and n-Type Superconductors

Discoveries of new superconductors continue to surprise the materials world with the announcements of new organic superconducting buckyballs made in the United States and a liquid-nitrogen-level n-type superconductor found in Japan.

The buckyballs discovery at AT&T Bell Laboratories had researchers there "running around like school kids," according to a Bell Laboratories spokesman, and indeed was the more surprising of the two. It set a record for organic superconductors, easily besting the old IBM record by reaching a critical temperature of 18 K. The molecule is doped with potassium and referred to as $KC_{60}$.

The buckyball discovery was no fluke, as a group at the University of California, Los Angeles led by Robert Whetten confirmed the work within hours, and it has since been confirmed in Japan, where samples are being sold.

Bell Laboratories has in the past demonstrated that $C_{60}$ and $C_{70}$ become conductive when doped with alkali metals. In order to overcome a problem they had experienced with sample degradation, they used sealed tubes either in high vacuum or under partial helium pressure to carry out reactions with the alkali metal vapor. The $C_{60}$ was purified by chromatography of fullerite and heated at 160°C under vacuum to remove solvents.

The Bell Laboratories team, which was headed by Arthur Hebard, characterized both polycrystalline powders and thin-film samples. The evidence of zero resistance and the Meissner effect "unequivocally" demonstrated superconductivity.

A team led by Mikio Takano at Kyoto University has found what it believes is the first n-type superconductor operating at liquid nitrogen temperatures. Takano was able to take (Sr,Ba)CuO and get it to superconduct to 90 K in one phase and 60 K in another.

With n-type superconductors, the mechanism of superconductivity occurs via an electron carrier, similar in operation to an n-type semiconductor. This is different from the more common high-temperature superconducting p-type carrier, whose conduction method is holes, or missing electrons. While n-type superconductors have been discovered, their critical temperatures have never approached these levels. The result, according to Takano, is that "the door to a new area is now opened, in which high-pressure synthesis can provide us with a variety of brand new materials in the near future."

The (Sr,Ba)CuO compound features an "infinite stack layer composition" composed of a lamination of Sr(Ba) layers and $CuO_2$ layers, one alternately overlaid on the other. Infinite stack layering suggests exciting possibilities in making superconducting compounds because some high $T_c$ researchers have long believed that a superconductor's critical temperature can rise in relation to the number of copper-oxide layers included. While not always the case, this belief may be true if a conducting mechanism can be found to communicate between the layers.

Both discoveries are as exciting for what they suggest as for what they actually accomplish. Researchers at Bell Laboratories and elsewhere are attempting to find out if other carbon molecules are also superconducting, and there is renewed interest in the small kingdom that comprises organic superconductors. With the Kyoto work, much basic research needs to be completed. While this n-type superconductor is free of trivalent or quadrivalent cations found in other high $T_c$ superconductors, the Kyoto researchers have yet to isolate the phase or phases that are superconducting and have yet to determine the carrier sign.

## NAS Holds Annual Meeting

The National Academy of Sciences met for its 128th annual meeting in April. The Academy elected 60 new members, plus 15 foreign associates from nine countries in recognition of their distinguished and continuing achievements in new research. Among those honored was MRS member Robert A. Laudise, director of Materials Chemistry Research Laboratory, AT&T Bell Laboratories, Murray Hill, New Jersey. Election to the Academy is considered one of the highest honors accorded a U.S. scientist or engineer. NAS has 1,626 members plus 277 foreign associates.

### Pauling Honored

Also at the Academy's meeting, two-time Nobel Prize winner Linus Pauling received an illuminated scroll on the occasion of his 90th birthday honoring his lifetime achievements. NAS President Frank Press cited Pauling's teaching abilities and scientific inspiration in a variety of fields. Pauling received the Nobel Prize in chemistry for his research on the nature of the chemical bond, demonstrating that valent electrons can function simultaneously in more than one atom. Pauling's work also triggered new insight into the mechanics of antibodies and anesthetics, and led him to discover the genetic origin of sickle-cell anemia. He has published more than 650 scientific papers and some 200 articles on social and political issues.

### Press Defends Increased Science Funding

During the meeting, Press addressed the Academy concerning the current status of science in America. He disputed the view held by many in this time of tight budgets that the nation has reached the limits of growth in its scientific effort. He said that increased funding of science is warranted and he suggested doubling not just the NSF budget, but also the budgets of all the agencies of the federal government that depend on science, placing this as a goal for the 1990s. He says this is warranted because "science pays off" both in tangible and intangible benefits, not necessarily in a



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year or two, but within a decade. He does not see science funds directly competing with funds for social programs because "the dividends can be applied to improving the welfare of the nation."

## Princeton Lab and Trenton Schools Form Partnership

The Department of Energy's Princeton Plasma Physics Laboratory recently formed a partnership with the Trenton School District, New Jersey, in an endeavor to use its laboratories and business efforts to help strengthen math and science education. Initial DOE funding for the partnership is about $100,000.

The Princeton laboratory will provide the Trenton schools with teacher training enhancement programs, loans or grants of equipment and materials, in-classroom lectures and demonstrations, science fair assistance and judging, and special tours and events. Princeton University student volunteer tutors will also participate in the partnership.



## Ion Microtomography Useful for Detailed Shape, Density Measurements

Researchers at Sandia National Laboratories, Livermore, California, in collaboration with Lawrence Livermore National Laboratory and scientists at the University of Melbourne, Australia are developing ion microtomography (IMT) for characterizing the shape and density of materials.

IMT produces images of slices of objects similar to x-ray computer-aided tomography (CT) scanning, but with more detail, enabling it to see objects as small as one micron without expensive synchrotron x-ray sources. Instead of x-rays, IMT uses concentrated proton beams with energies in the MeV range. While a primary advantage of this technique is for biological samples because it causes less cell damage than x-rays, IMT is also useful for samples with low total density or where small density variations make x-ray analysis difficult. For example, IMT has been used to produce three-dimensional renditions of small junctions between two glasses with different densities. Also, desorption of protons varies less with atomic number than for x-rays, so conditions for imaging structures containing both low and high atomic number elements are more easily attained.

The technique could have industrial uses for materials used in microelectronics, nondestructive testing, fission, and fusion research. For example, IMT could be used to examine small structures or to inspect uniformity of very thin coatings on silicon chips. It also has potential for inspecting extremely small manufactured parts for flaws and weaknesses without the need for sectioning.

With IMT, a computer produces a three-dimensional likeness of the sample on a screen. The image can be rotated, or sliced in portions to reveal the interior or various planes passed through it. Biomedical researchers hope to look soon at tiny structures within individual cells. Sandia researchers are currently building a



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second-generation IMT system with improved resolution. The current resolution limit, produced by the University of Melbourne, is about 1/20 of a micron.

## Esther Conwell Receives Xerox Award

Esther Conwell, research fellow at Xerox's Webster Research Center, was honored with the Xerox President's Award for outstanding achievement, the highest honor Xerox bestows.

Conwell pioneered research in integrated optics and the use of certain polymers as semiconductors in copiers and electronic devices. Besides academic achievement, she has furthered public and academic policies to increase participation of women in science and engineering. She is also one of only two women to have been elected to both the National Academy of Engineering and the National Academy of Sciences.

Conwell received her BA degree from Brooklyn College and MS from the University of Rochester. Her doctoral thesis at the University of Chicago, a study of the problems of impurity scattering in crystalline semiconductors, is considered a classic contribution to the understanding of semiconductor physics. Afterward, she taught physics at Brooklyn College for five years, then did research with Bell Laboratories in semiconductors. This was followed by 20 years of fundamental studies in the properties of semiconductors at GTE Laboratories, where she advanced to manager of the physics department. She joined Xerox in 1972 as a principal scientist and is currently a research fellow there.

After years of major contributions to the understanding of transport effects in semiconductors, Conwell redirected her studies to the behavior of semiconductors in integrated-optics applications. For the past decade she has been addressing the transport properties of conductive polymers.

## Tressler Made Head of Penn State Materials Science and Engineering

Richard E. Tressler, professor of materials science and engineering, and director of the Center for Advanced Materials, has been appointed head of the Department of Materials Science and Engineering at Pennsylvania State University.

As founding director of the Center for Advanced Materials, Tressler helped build an internationally recognized advanced industrial materials development and applications research group. He will continue as an adviser to the Center and an active project leader. Tressler, a Penn State faculty member since 1972, also chaired the Ceramic Science and Engineering Program from 1980 to 1986.

A member of the Materials Research Society, Tressler is also vice president, treasurer, and Fellow of the American Ceramic Society. He is a member of several editorial





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boards for research journals and has served on numerous national committees, including the Materials Research Advisory Committee of the National Science Foundation and a panel of the National Council Committee on Materials Science and Engineering.

Tressler holds an MS in ceramics from the Massachusetts Institute of Technology and a PhD in ceramic science from Penn State.

## Gordon Bell Prize for Scientific Computing Goes to Oak Ridge Researchers

A team of researchers at the Department of Energy's Oak Ridge National Laboratory received the 1990 Gordon Bell Prize for superior effort in scientific computing. On the team were Al Geist, Malcolm Stocks, Benjamino Ginatempo, and Bill Shelton. The team won because of its price/performance ratio in calculations of the electronic structure of a high-temperature superconductor on parallel computers at Oak Ridge.

Their entry was cited for three major accomplishments: (1) a computation rate of 2.5 gigaflops, the first application program to exceed 2 gigaflops; (2) attaining a price/performance ratio of 840 megaflops per $1 million on an Intel computer, two times higher than last year's entry; (3) attaining 2,000 megaflops per $1 million using a network of IBM workstations working in parallel solving a single problem.

The researchers have been studying disordered materials, using the Intel machine to calculate their electronic properties and energetics. This would help scientists understand the behavior of high-temperature superconductors, metallic alloys, magnets, and many other materials. Problems, such as global climate modeling, gene sequencing, atomic physics, and plasma physics are also under study.

## Galayda Appointed Director of Argonne APS

John Galayda has been appointed director of the Advanced Photon Source (APS) Accelerator Systems Division at Argonne National Laboratory. The Division is responsible for technical construction for the APS beam acceleration and storage system, including research and development, design, procurement, test, assembly, and operation.

When completed, the APS will be a powerful x-ray source for materials research. Experiments will start in 1996. Basic research will be directed toward practical advances in metals, ceramics, alloys, composite materials, catalysts, petrochemicals, computers electronics, biology, medicine, and pharmaceuticals.

Before coming to Argonne, Galayda was associate department chairman for accelerators at the National Synchrotron Light Source at Brookhaven National Laboratory. He holds a bachelor's degree from Lehigh University and a PhD in quantum field theory from Rutgers University.

***Editor's Note:*** See article about APS in the July 1990 *MRS Bulletin*, p. 12-15.

## Parallel Computer Developed for Three-Dimensional Modeling

Researchers at Duke University and Cornell University, funded by the National Science Foundation, have developed a computer that uses application-specific parallel computing to analyze and depict three-dimensional objects.

The special-purpose machine, called the RayCasting Engine (RCE), provides an alternative to either serial computing or general-purpose parallel computing.

Serial computing, even with supercomputers, is often too slow and expensive for very complex problems, and existing general-purpose parallel computers are quite costly to program. The RCE uses thousands of individual processors in parallel, but then matches the computational structure of the problem, creating an application-specific computer. It can be used to design complex parts and automatically shape intricate surfaces with computer-controlled machine tools. The RCE allows machines to be built at multiple levels of performance by scaling the number of processors.

The Cornell-Duke team plans to explore how to integrate the RCE into existing commercial modelers. The scientists are also expanding the systems with additional processors and redesigning the RCE to plug into workstations.

Its designers believe that a commercial RCE could be available in a few years and cost less than $100,000.

## First National Science Bowl Won by Lubbock High School

The first annual National Science Bowl, held in Washington, DC and sponsored by the Department of Energy (DOE) and the Intel Corporation Foundation, was won by Lubbock High School of Lubbock, Texas, one of 18 teams competing in the final two-day contest, rounding up National Science and Technology Week. The Lubbock High



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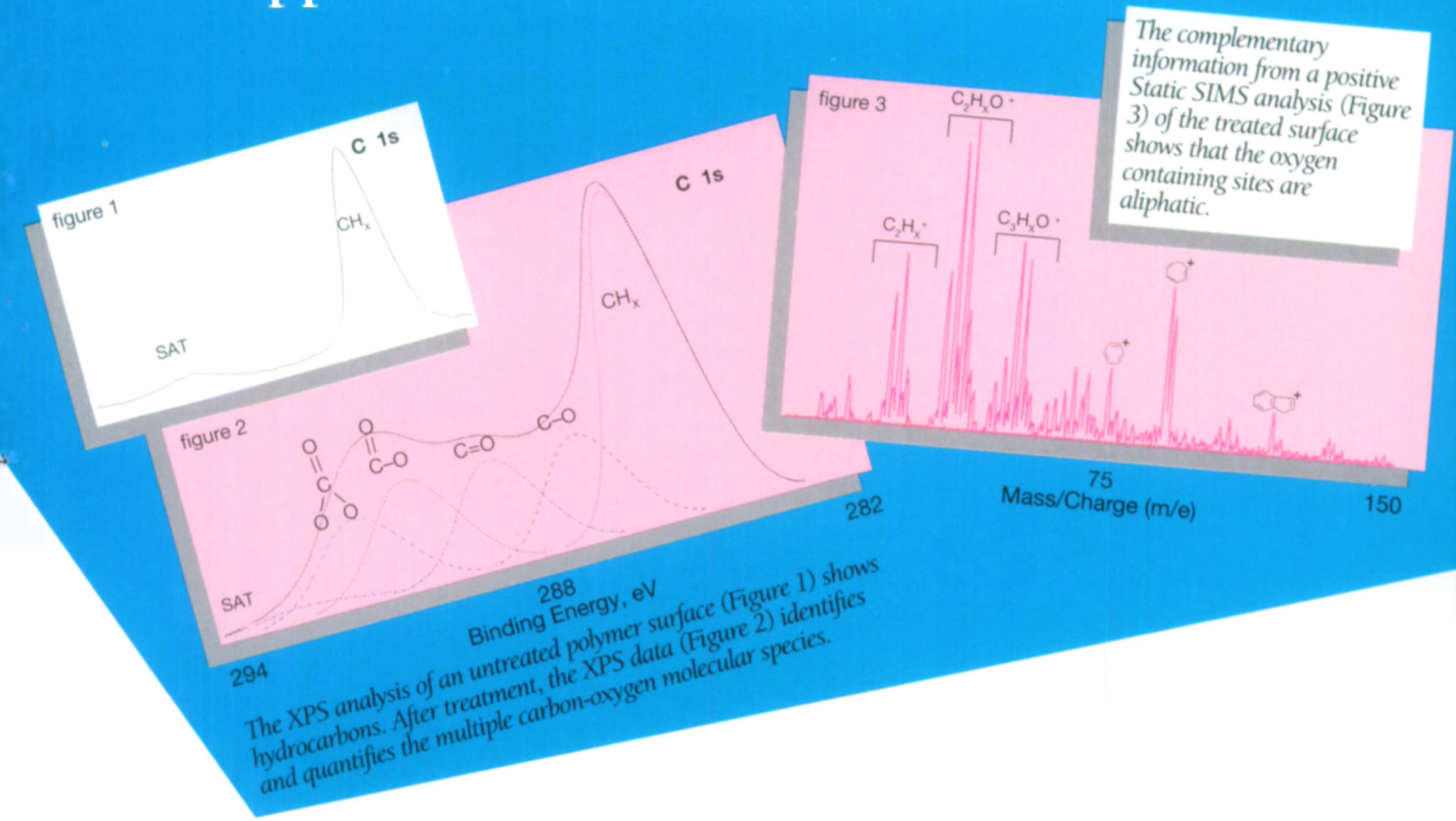
# How To Solve Polymer Surface Problems

## Application #1 — Surface Modification




*The complementary information from a positive Static SIMS analysis (Figure 3) of the treated surface shows that the oxygen containing sites are aliphatic.*

*The XPS analysis of an untreated polymer surface (Figure 1) shows hydrocarbons. After treatment, the XPS data (Figure 2) identifies and quantifies the multiple carbon-oxygen molecular species.*

When you modify a polymer, you change the surface characteristics. But how do you characterize the polymer after it's been modified — especially when the surface is only a few atoms thick?

Accurate identification of the complex changes in the top atomic layers of a polymer requires a detailed chemical composition analysis. The kind of detail only available using multiple surface analysis techniques.

X-ray Photoelectron Spectroscopy (XPS) and Static Secondary Ion Mass Spectrometry (SIMS) can tell you what you need to know. Together, these techniques provide:

- Quantifiable short range chemistry
- Mass fragment pattern information
- Molecular fingerprint identification.

Combining XPS and Static SIMS is not only the best way to solve polymer surface modification problems. . . in many cases, it's the only way.

**You're a phone call away from a solution!**

Using the Perkin-Elmer (PHI) 5500 MultiTechnique surface analysis system, our laboratory scientists have worked directly with polymer chemists to solve a wide range of problems, including contamination, surface modification, biocompatibility and adhesion.

If you want to know more about how XPS and Static SIMS surface analysis can help you understand your polymer applications, talk to one of our lab scientists today. Our number is (612) 828-6367.

We'll also send you a free package that includes our latest polymer Application Notes, Technical Bulletins and articles. Or, if you prefer, fax us your request at (612) 828-6322.

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School team will represent the United States in International Science School this summer in Australia.

The National Science Bowl is a tournament-style academic competition between teams focusing on science and mathematics. Since February, 18 DOE facilities have conducted regional matches, leading to this highly competitive event. More than 4,000 students from more than 500 high schools participated.

Over 10,000 questions were developed by DOE laboratory scientists for the occasion. The subject categories included biology, chemistry, physics, and computer science.

Second place was won by the New York team representing Brookhaven National Laboratory. Honorable mentions were captured by Thomas S. Wootton High School (Rockville, Maryland) representing DOE Headquarters and by Beavercreek High School (Beavercreek, Ohio) representing DOE's EG&G Mound Facility.

Prizes for the top four teams include: IBM computers and printers, loaned by DOE; modems donated by IBM to connect the schools to the National High School Supercomputer, a joint project of DOE and Cray Research; and an opportunity for teachers from the top four schools to be trained at the Supercomputer Teachers Program at Lawrence Livermore National Laboratory this summer.

## Japanese Select Roy for Honors

Rustum Roy, Evan Pugh professor of the Solid State at Pennsylvania State University, was chosen by three Japanese scientific organizations for three honors. He has been elected as a Foreign Associate by the Engineering Academy of Japan, chosen as an honorary member of the Ceramic Society of Japan (the only foreign citizen ever so honored), and on May 31 in Tokyo received the International Award of the Japan Fine Ceramics Association, a consortium of 100 leading ceramics companies.

Roy, a member of the committee that formally founded MRS in 1972, served MRS as president (1974), councillor, editorial boards member, symposium organizer, and *Journal of Materials Research* principal editor.

## Alfred to Develop Aircraft Glass for PPG

Under a $120,000 contract with PPG Industries, researchers at the New York State College of Ceramics at Alfred University will look at ways to improve a special glass composition used in a de-icing mechanism for airplane windshields.

The proposed process will consist of a paste of glass and metal powders in an organic medium, screen-painted, dried, and fired on a windshield. The metal constituent allows an electric current to pass through the layer, heating the windshield and melting ice, a critical problem for airplanes at very high altitudes.

In the contract, PPG's Aircrafts Product Group, Huntsville, Alabama, and the Glass Research Center in Pittsburgh, Pennsylvania, established guidelines for the material. It must be easily manufactured and not toxic to workers making it. It must adhere very well to the windshield. Also, it is critical that the material withstand extreme temperature changes. Windows of a plane sitting on the ground may reach 175°F, while a few minutes after takeoff, at an altitude of 35,000 feet, the temperature may dip below zero.

The work is expected to take a year and a half.

## High $T_c$ Superconductor Leads to Be Developed

A $200,000 cost-shared, one-year research agreement to develop and test electrical leads made from high-temperature superconductors has been announced by Argonne National Laboratory and Ceracon, Inc. The electrical leads will be used to conduct current from room-temperature devices to machines, experiments, and instruments at temperatures as low as 4 K.

Argonne will supply Ceracon with calcium-doped yttrium-barium-copper oxide. Ceracon will use its proprietary process to form the material into wires, cylinders, and other commercial shapes suitable for leads.

Argonne will measure the ability of Ceracon's leads to carry current in the presence of various magnetic fields and at various temperatures. The results will help scientists develop shapes best suited for leads that use Ceracon's materials and processes. Ceracon will then build prototype leads for further testing at Argonne. □




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