MS&E NEWS

April 2001

Department of Materials Science & Engineering

Cornell University

Also in this issue

Mesoscale Processing Facility in Bard Hall to Open in April

The Mesoscale Processing Facility, a state-of-the-art laboratory now being set up on the third floor of Bard Hall, will be dedicated and officially opened on April 26.

Present for the dedication of the facility will be a major donor, William J. Hudson, former president of AMP, Inc., who is a Cornell alumnus and a member of the advisory council for the College of Engineering.

Hudson retired in 1999 from AMP, the world's largest manufacturer of electronic connectors. His career included research and development as well as administration; he holds 12 patents. His 1956 Cornell degree is in electrical engineering, and he also earned a master's degree from Drexel University.

A plaque to be placed in the new Mesoscale Processing Facility will read:

The Mesoscale Processing Facility
Given by William J. Hudson, Jr. '56 EE
in memory of his father,
William J. Hudson '31 ME

Potential users of the new Mesoscale Processing Facility pose with the first piece of equiment to be installed: a new cryoultramicrotome. The initial facility director, Associate Professor Ulrich Wiesner, is behind the Cornell mascot. Left to right are: George Malliaras, Phong Du, Surbhi Mahajan, Anurag Jain, Hooisweng Ow, Vikram Joshi, Wiesner, Peter Simon, Yuanming Zhang, Carlos Garcia, Shefford Baker, and Yuri Suzuki. Malliaras, Baker, and Suzuki are assistant professors in MS&E. The others—all working in Wiesner's research group—are Simon and Zhang, postdoctoral associates; Du, Mahajan, Jain, and Ow, graduate students; and Joshi, an MS&E major.

The main focus of the new facility will be research on polymeric materials, according to MS&E Professor Ulrich Wiesner, who will serve as the initial director. In addition to Wiesner, MS&E faculty members who are active in this area are Christopher Ober, Emmanuel Giannelis, David Grubb, and George Malliaras.

The facility will be managed by the Cornell Center for Materials Research (CCMR), and will serve users from a number of departments. It will provide researchers with shared equipment and also provide expert training of students, scientists, and engineers in experimental techniques.

Adding to the effectiveness of the laboratory will be access to other facilities on campus, and the possibility of collaborative work. These units include the Cornell Nanofabrication Facility, the Nanobiotechnology Center, the Cornell High Energy Synchrotron Source (CHESS), and the Advanced Electronic Packaging Facility.

Work on Nanotechnology Building to Begin in June

Groundbreaking for Duffield Hall on the Engineering Quadrangle is expected to take place in June, according to Bob Stundtner, the project manager. Construction is scheduled to be completed by the end of 2003.

The new building will provide research and teaching facilities in the areas of nanotechnology and nanobiotechnology. These units include the Cornell Nanofabrication Facility, which is currently located in Knight Laboratory, and the Nanobiotechnology Center, now in the Biotechnology Building.

The three-story structure, budgeted at about $58.5 million, will be located west of Phillips Hall and north of Upson Hall.

MS&E NEWS

Published by the Department of Materials Science and Engineering, Cornell University, Bard Hall, Ithaca, NY 14850–9963

Editor: Gladys McConkey

Department telephone: 607/255–9617

World Wide Web address: www.mse.cornell.edu

Recent issues of *MS&E News* are available on the Web.

Administrative Staff Notes

Recently appointed to the front-office administrative staff are Patty Baranski, who serves as receptionist and assistant to the department director, and Joseph Sweet, the coordinator for student programs.

Baranski is not new to MS&E; previously she worked with the Electronic Packaging Program.

Sweet came to MS&E from the College of Human Ecology, where he was office manager in admissions and student and career services. He has also worked for the Cornell library in the restoration of brittle books, served as facilities manager for Historic Ithaca, was a freelance actor for 15 years, and worked as a computer programmer and systems analyst. A Cornell graduate in fine arts, he maintains a home studio for oil painting.

From the Director

There was a lot to catch up on in this issue of *MS&E News*. Over the past year, a number of exciting events have occurred in the department.

■ Continuing a tradition among our new hires, George Malliaras received a Faculty Early Career Development award from the National Science Foundation to support his work on organic optoelectronics. This prestigious award will give Malliaras, like his colleagues Yuri Suzuki and Shefford Baker before him, an excellent start on a research and teaching career.

■ The success of MS&E in the rapidly developing area of biomaterials was demonstrated by the recent awarding to Stephen Sass of a multi-million-dollar grant from a new biotech company; this venture will be featured in a future newsletter. We are currently carrying out a search for a new faculty member in the biomaterials area to further expand our capabilities.

■ Ulrich Wiesner has spearheaded the foundation of a new facility focussed on the creation and processing of materials on the important micron length scale. This now-finished facility was made possible by the very generous gift of William Hudson, Jr. ’56 EE, former president of AMP, in memory of his father, William Hudson ’31 ME. Facilities such as this are important assets of Cornell University, and MS&E will benefit immensely from this new one.

■ Our ties to industry will grow through the recent formation of the MS&E Advisory Board that will meet for the first time on May 9, 2001. We are looking forward to input from industry on the direction of our department, its research, and the undergraduate teaching program.

■ Among the continuing successes of MS&E are the accomplishments of its students—that is where the greatest strength of this department lies. I am confident that the current students featured in our final article on student outreach will be just as successful as prior generations of graduate and undergraduate students. — *Christopher Ober, Director, Department of Materials Science and Engineering*

Malliaras Wins NSF Young Investigator Award

George Malliaras, an assistant professor in MS&E since early 1999, recently received a Faculty Early Career Development Program grant (Young Investigator Award) from the National Science Foundation. The grant is for $450,000 over five years.

The funding will enable Malliaras to develop a program of research and education in organic semiconductor interfaces, an area he believes will be important to progress in organic optoelectronics, his specialty field. The program will advance fundamental understanding of organic interfaces, he said, and lead to the design of interfaces with improved charge injection properties.

The field of organic optoelectronics has progressed rapidly in the past few years, Malliaras said, because of the development of mechanically flexible electronic devices based on polymers and small organic molecules. These include light-emitting diodes, thin-film transistors, photodiodes, and photovoltaic cells—devices that promise to revolutionize information display and processing.

Malliaras’ previous research has included both study of the optoelectronic properties of polymers and small organic molecules, and the

Malliaras

design, fabrication, characterization, and computer modeling of organic optoelectronic devices.

Malliaras received a B.Sc. degree in physics from Aristotle University in Greece in 1991. He was awarded a Ph.D. in mathematics and physical sciences, with highest honors, by the University of Groningen, the Netherlands. His doctoral research was on phototrefractivity in polymers.

After serving as a postdoctoral fellow at Groningen, he joined the IBM Almaden Research Center, where he conducted research on organic LEDs. In 1994 his work on LEDs was included in the American Institute of Physics annual review of research highlights.

RESEARCH UPDATE

Magnetic Phenomena on Nanometer Scale Offer New Ways of Storing Information

by Yuri Suzuki

A fundamental limit of silicon-based microelectronics is being approached as the speed and density of integrated circuits continue to increase rapidly. When miniaturization is no longer sufficient, what can be done?

Researchers—including those in my group at Cornell—are seeking new paradigms for information storage and transfer based on fundamentally new phenomena or new materials.

Research in the area of magnetics, including both fundamental science and device physics, has enabled the magnetic storage industry to make significant technological advances. A major achievement a decade ago was the development of a new type of device for reading magnetic media—the magnetoresistive (MR) head—which is now commonly found in computer hard drives. The first-generation read heads are made of meallic alloys.

More recently, giant magnetoresistance (GMR) materials consisting of metallic multilayers were developed as second-generation MR head materials and are now in production. Still under development are so-called "colossal" magnetoresistance (CMR) materials that have even greater potential for storage applications.

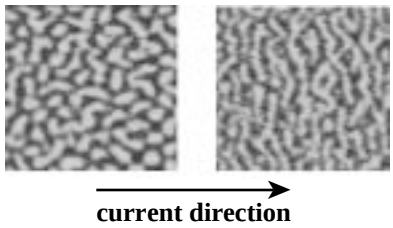
How do MR materials work? Very briefly, certain magnetic materials exhibit different electronic properties depending on the direction in which they are magnetized by an external magnetic field. Specifically, they undergo a change in resistance. Such changes can be brought about by the local magnetic fields of magnetic recording media, and so differences in the local fields can be sensed by an MR read head.

In the conventional MR materials, the magnetic fields act directly on conduction electrons and scattering impurities.

In the multilayered GMR materials, the magnetoresistive effect is associated with spin-dependent scattering; these materials provide increased sensitivity over conventional inductive and permalloy MR heads, and thus allow much higher storage densities.

The so-called "colossal" magnetoresistance (CMR) materials have been the subject of an enormous amount of research because of their anomalously large resistive response to magnetic fields. The mechanism behind this anomalous behavior cannot be explained just in terms of carrier hopping that is enhanced in the presence of magnetic order; it requires lattice distortions.

In our work so far, we have successfully used lattice distortions in CMR thin films to tune the magnetic properties and thus manipulate the magnetic domain structure. For example, we have induced perpendicular magnetic anisotropy and thus created perpendicularly magnetized domains on a very fine scale—about 200 nm in length. We imaged these domains directly at room temperature using magnetic force microscopy at zero applied field (see the figure). We also measured transport when a current was passed through the material.



Magnetic image of a CMR thin film at zero applied field. The image reveals domains with magnetic moments pointing in and out of the plane (indicated by the light and dark regions). The two images are of the same film, but with a magnetic field applied either perpendicular (at left) or parallel (at right) to the plane of the film before the measurement is made.

When current is passed through films in such magnetic states, we can measure the effect of the domain boundaries on the transport.

With this technique, we have been able to probe the contribution of magnetic domain boundaries to the magnetoresistance, and have found it to be an order of magnitude larger than would be expected without lattice distortion.

The development of such new magnetic materials and new techniques for the formation of nanostructures with those materials, accompanied by an understanding of the processes that dominate magnetism at the nanometer-length scale, promises to have profound implications for the future of magnetic storage.

Yuri Suzuki received her Ph.D. from Stanford University in 1995, held a postdoctoral position at AT&T Bell Laboratories (now Bell Laboratories, Lucent Technologies), and then joined the MS&E faculty as an assistant professor in January 1997.

She has received a Young Investigator Award from the Office of Naval Research, a Faculty Early Career Development Award from the National Science Foundation, the Robert Lansing Hardy Award from the Minerals, Metals & Materials Society, and a David and Lucile Packard Foundation Fellowship.

Her current research funding is from NSF, ONR, the Packard Foundation, Corning Inc., and IBM.

New materials and new techniques may provide solutions to limits on miniaturization.

Media Coverage Follows Wiesner's Participation in Symposium for Young German and American Scientists

Wiesner

"It is quite probable that in the future we will use what we learned by going down in length scale for going up again."

A meeting of some 80 young German and American chemists, held near Munich last August, brought media attention in both countries to the work of a member of Cornell's MS&E department—Associate Professor Ulrich Wiesner.

Organized by the American Chemical Society and its German counterpart, the aim of the first German-American Frontiers of Chemistry Symposium was to strengthen the ties between scientists in the two countries and to provide an opportunity for young leaders in cutting-edge research to learn about each others' work.

Wiesner, one of 24 symposium speakers, discussed his work on nanostructured organic-inorganic hybrid materials.

Newspapers and magazines in both countries reported on the symposium. For example, an extensive article, "Chemists at the Cutting Edge," was published in *Chemical & Engineering News* (and in its online news magazine). A well-known German newspaper, the *Frankfurter Allgemeine Zeitung*, ran an article in which Wiesner's work was featured. Also, his work was discussed in a program on public radio in Germany.

An issue that drew some media comment was the development of a "brain drain" from Germany to the United States. Ed Wasserman of the American Chemical Society noted in his opening remarks at the symposium that although there has been a long history of scientific cooperation between the two countries, in recent years the flow of young chemists has become more one-sided, largely because of a language barrier: most German scientists know English, but fewer American scientists are familiar with German.

This issue was stressed in the news magazine of the Association of German Engineers (VDI). An article titled (in translation) "The Brain Drain Is Enormous" quoted Wiesner on the subject.

Wiesner, who joined the faculty at Cornell in 1999, was educated in Germany. During his undergraduate years, he spent a semester at the University of California at Irvine on a German Academic Exchange Service scholarship.

He received his Ph.D. from the Max-Planck-Institut für Polymerforschung in Mainz in 1991. After postdoctoral research in Paris, he returned to the Max-Planck-Institut as a staff scientist. He finished his habilitation in physical chemistry at the University of Mainz in 1998.

In 1999 Wiesner received the Carl Duisberg Memorial Award of the German Chemical Society.

In addition to the research on organic-inorganic hybrid materials, his current work includes studies of anionic polymerization, block copolymers, and the dynamics of heterogeneous polymers, with applications ranging from microelectronics to nanobiotechnology.

Moving Toward Complexity

Remarks by Ulrich Wiesner

I studied chemistry in Germany in the eighties. I still remember all the discussions and concerns about specialization driving diverging disciplines and the resulting inability of talking a common, comprehensible language in the natural sciences.

Today we are at the beginning of a new millenium. For the natural sciences it is an incredibly fascinating time. In contrast to the eighties, our languages seem to be converging again. Biology is believed to be the new leading science. Nanotechnology seems to be ubiquitous. Today it is clear that soft matter, based essentially on the chemistry of carbon, already does, or will soon, allow generation of more diverse electronic, magnetic, optical, mechanical, and biological properties.

What is next after nanotechnology? It is quite probable that in the future we will use what we learned by going down in length scale for going up again. While the first process is more analytic, the latter will be more synthetic in nature. One fundamental issue will then be the behavior of complex systems. Synthesizing and understanding a complex system based on multiple subunits leading to synergistic effects is a considerable task; nonetheless, it seems a logical pathway for development, since nature itself has taken it.

MS&E Professors Take Part in Fall MRS Meeting

Participants in the annual fall meeting of the Materials Research Society, to be held November 26–30 in Boston, will include three Cornell MS&E faculty members.

Assistant Professor Yuri Suzuki is one of the four meeting chairs, who are responsible for programming for the 37 symposia.

A technical symposium on "Organic Optoelectrical Materials, Processing, and Devices" will be co-chaired by Assistant Professor George Malliaras, and one on "Bioinspired Materials: Moving Towards Complexity" will be co-chaired by Associate Professor Ulrich Wiesner.

The meeting chairs, in addition to Suzuki, are Bruce Clemens of Stanford University, Jerry Floro of Sandia National Laboratories, and Julie Kornfield of the California Institute of Technology.

MS&E Research Team Wins International Prize for Contributing to Environmental Safety and Health

Development of a safer, more environmentally beneficial, and less expensive processing method for use in microelectronics has brought international recognition to a MS&E graduate student and her faculty adviser. Gina Weibel and Professor Christopher Ober were presented with a plaque and a cash award at the annual meeting of the Semiconductor Safety Association (SSA) in April.

The award was shared with a Massachusetts Institute of Technology team in chemical engineering who collaborated with Weibel and Ober. The MIT researchers are graduate student Hilton Pryce Lewis and his professor, Karen Gleason. At the meeting, Weibel and Pryce Lewis presented a paper on the collaborative project.

The innovative process the Cornell–MIT group developed uses an electron beam rather than light to directly pattern a low-dielectric-constant (low-k) insulating material. Fluorocarbon films prepared at MIT by chemical vapor deposition were patterned and developed at Cornell. The development process uses supercritical CO_2 rather than an organic solvent.

"By directly patterning the insulative material," Weibel said, "no sacrificial photoresist is needed, and the multiple manufacturing steps associated with applying and patterning the photoresist are eliminated. Because organic solvents are eliminated from both the deposition and development steps, the process is less hazardous to the environment, employees, and budget."

The annual award, in recognition of contributions to environmental health and safety factors within the semiconductor industry, is sponsored by the SSA, the Semiconductor Research Corporation, and International SEMATECH, a consortium of semiconductor companies from seven countries.

A letter from International SEMATECH stated that "the nine judges from the semiconductor industry agreed that [this] innovative research makes a major contribution toward the semiconductor industry's roadmap and toward advancing the environmental goals of the industry."

Weibel

Stucky of UCLA Gives Annual Johnson Lectures

Composite materials were the subject of the MS&E department's annual Herbert H. Johnson Memorial Lectures on November 6, 7, and 8, 2000. The speaker was Galen D. Stucky, professor of chemistry at the University of California at Santa Barbara.

The lectures, on the three successive afternoons, were titled "Mesoscale Synthesis, Structure and Function," "Light and Nanostructured Composite Materials," and "Composite Materials Synthesis: Learning from Nature."

Before joining the faculty at Santa Barbara in 1985, Stucky held positions at the University of Illinois, Sandia National Laboratory, and the DuPont Central Research and Development Department. He has been active in the American Chemical Society, serving as associate editor of the *Journal of Organic Chemistry* and as chairman of the Inorganic Division.

The lecture series is named in honor of the late Herbert H. Johnson, who was director of the MS&E department at Cornell from 1970 to 1974 and then director of the Materials Science Center (now the Cornell Center for Materials Research).

Nanobiotechnology Center Receives NSF Funding

A facility at Cornell that is of interest to researchers in MS&E, the Nanobiotechnology Center, recently received $20 million in special funding from the National Science Foundation. It is one of five centers in developing fields of science and technology that were selected by NSF from nearly 500 applicant organizations. Funding is also provided by New York State and Cornell.

Cornell is the lead institution in the center, which has academic collaborators from Princeton University, Oregon Health Sciences University, Clark Atlanta University, and Howard University. Collaborators also include researchers at the Wadsworth Center of the New York State Health Department, and representatives from industry and government.

The center was established in 1999 in recognition of the emergence of nanobiotechnology, which involves collaboration among life scientists, physical scientists, and engineers. The center will foster interdisciplinary research that probes the possibilities of integrating artificial and natural systems through nanomicrofabrication. Nanobiotechnology is expected to yield new insights into how biological systems function and also lead to the design of new kinds of micro- and nanofabricated devices.

Correction:

An obituary notice about John Perry Howe which appeared in the February 2000 issue incorrectly stated that Howe was director of the MS&E department from 1962 to 1965. Actually, during those years, he was head of the Department of Engineering Physics and Materials Science, which was created in 1962 (the same year in which the graduate field of materials science and engineering was established).

In 1965 the Department of Engineering Physics and Materials Science was divided once again and the Department of Materials Science and Engineering established.

(The above information was provided by Professor Arthur Ruoff, who came to Cornell in 1955 as a member of what was then organized as the Department of Mechanics and Materials.)

Alumni Profile

At Motorola Beth Keser Realizes her Undergraduate Goal: To Work on Polymers and Electronic Packaging

The most important part of her Cornell experience was participating in the undergraduate research program.

From the time she was an undergraduate in MS&E at Cornell, she knew she wanted to do work in polymers for the semiconductor and electronic packaging industry. Now she is a technical staff scientist at Motorola's Interconnect Systems Laboratories in Tempe, Arizona, doing what she wanted to do.

Beth Keser (Beth Schneggenburger during her undergraduate years) graduated from Cornell in 1993, studied for her doctorate at the University of Illinois at Urbana-Champaign on a five-year fellowship, and then returned to the company she had worked for as an undergraduate in the Engineering Cooperative Program.

The most important part of her Cornell experience, Beth indicated in a recent e-mail correspondence, was participating in the undergraduate research program. For three semesters she worked with Professor Christopher Ober in research on block copolymer resists, a project that resulted in a publication, a preprint, and two patents. Then, in her senior year, she worked with Professor Edward Kramer in research on block copolymers for her senior thesis. This also resulted in a publication.

As a co-op at Motorola, she worked at two of the company's wafer fabrication facilities during two semesters. Again a publication ensued: a paper on plasma-enhanced chemical vapor deposition of thin films on gallium arsenide.

It was in a course offered by Professor Che-Yu Li that Beth's interest in electronic packaging took root. "Electronic packaging seemed to combine my interest in the semiconductor industry and my passion for polymer research," she said.

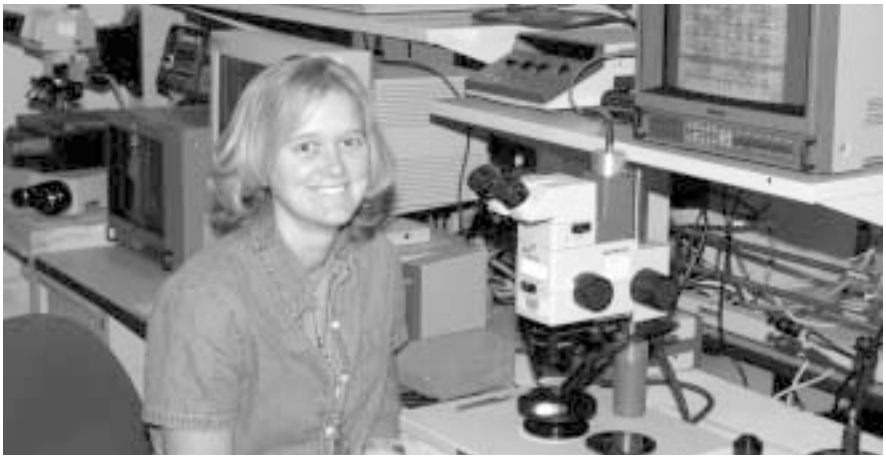
After graduation and a month's travel in Europe, she returned to work with Ober once again before entering graduate school. Beth met her husband, Milan Keser, in graduate school; they married in 1996. Milan earned a Ph.D. and is currently working at Intel in Chandler, Arizona.

Beth began her employment at Motorola after receiving her Ph.D. in 1997. She soon became leader of a new project on Wafer Level Packaging (WLP). "This new technology," she explained, "allows certain devices to be packaged and tested completely at the wafer level—a batch-processing method that saves on packaging time, cost, testing, capital, and inventory."

Beth finds Arizona an exciting and beautiful place to live. "I love to hike and mountain bike in the desert," she said, "and in the summer, when it is hot, there are mountains 90 miles away where we backpack, camp, and fish." Beth is also active in the Phoenix women's Ultimate Frisbee team.

"Without my undergraduate co-op experience, I never would have considered moving to the Southwest to work for Motorola, and I would not have had hands-on experience with semiconductor processing," she reflected. "And without the undergraduate research program, I would never have discovered my love of research and experimentation. Overall, my experiences at Cornell and the opportunities available to me there have completely shaped my life and career."

Below: Beth Schneggenburger Keser on the job at Motorola



Thursdays at 4:30 in Bard 140

April 5 Michael Sefton, University of Toronto, "From Microencapsulating Cells to Growing a Whole Heart."

April 12 John Bird, Dept. of Earth and Atmospheric Sciences, Cornell, *topic to be announced.*

April 19 Guillermo Bazan, Center for Polymers and Organic Solids, University of California, Santa Barbara, "Strategies for Optimizing Interchromophore Interactions in Organic Materials."

April 26 Lars Hultman, Dept. of Physics and Measurement Technology, Linkoping University, "Properties of Fullerene-Like Carbon Nitride Films."

May 3 Douglas C. Allan, Corning Incorporated, "Photonic Crystals."

May 10 George Malliaras, Cornell, "Charge Injection at the Metal/Organic Interface."

Degrees Awarded to MS&E Students

Thirty-two MS&E seniors received Cornell B.S. degrees in May 2000, and 19 graduate degrees were awarded during the year.

■ Ph.D. degrees were awarded in May or in August to the following recipients, listed with their advisers and dissertation topics:

Luke Andre Emmert (Professor Rishi Raj). "Studies of the Coincident Interfacial Structure and the Desorption Kinetics of Ultrathin Films of Aluminum Oxide on Silicon (111)."

Charavana Kumara Gurumurthy (Professor Edward Kramer). "Sub-critical Crack Growth along Polymer Interfaces."

Chungping Long (Professor John Blakely). "Supersonic Jet Epitaxy of Wide Band Gap Semiconductor."

Lei Tian (Professor Rüdiger Dieckmann). "Trace Diffusion Studies on LCD Glass Substrates and Indium Oxide."

■ M.S. degrees were awarded to Danny Chen, Guohan Hu, and Sergei Mikhailovich Krasulya in January, and to Jonathan B. Shu in May. Six students were awarded degrees in August: Howard Champoux, Li Liu, Kee-Chul Chang, Mingqi Li, Gina L.Weibel, and Shenzhi Yang.

■ M.Eng. (Materials Science) degrees were awarded in May to Yu-Ching Lee, Frank Mischler, Jesse Phou, and Philip Ray-Chee Poh. Lee, who studied in Taiwan as an undergraduate, worked with Professor George Malliaras. The other three are 1999 graduates of Cornell; their M.Eng. project advisers were, respectively, Professors Michael Thompson, J. Peter Krusius, and Dieter Ast.

In August the M.Eng. recipients were Robert D. Burak, a Cornell graduate who worked with Professor J. Peter Krusius, and Guangrui Xia, a graduate of Tsinghua University in China, whose project adviser was Professor George Malliaras.

■ B.S. degrees were all awarded in May. Members of the class of 2000 are listed at right.

Of those who indicated their plans after graduation, about half were headed to positions in industry and half were planning to enter graduate school.

Two Seniors Share Amoco Prize

The annual Amoco Prize for outstanding senior thesis in MS&E was awarded jointly to Yana Matsushita and Panitarn Wanakamol.

The prizes were presented on graduation day by Christopher Ober, director of the department. Each prize-winner received a certificate and a cash award.

The prizes are part of Amoco's program of support for undergraduate research in MS&E.

The Cornell MS&E Class of 2000

Daniel J. Allen
Charles A. Basinger
Erika M. Bacon
Amitava K. Bose
Sarah Calve
Nathan Chau
Charlton J. Chen
Zung-Sun Choi
James A. Colket
Dragana Culjkovic
Jesse Darja
Faisal Dawood
Joseph A. Dion
Jeffrey L. Dittmar
Linnea A. Hartsuyker
Alex N. Iglecia
Christopher F. Keimel
Emily J. Klein
Yu-Ching Lee
Suparna Malik
Yana Matsushita
Michael U. Mercado
Naa-Dei Nikoi
Ronald E. Paryl
Philip Poh
Ahman S. Ragab
Kevin A. Reigeluth
Seana Richardson
Albert W. Tu
Panitarn Wanakamol
Evan L. Williams
Brice G. Wu

Cora Bangs Retires after 20 Years at MS&E

It was fitting that graduate students were among those who gathered in the MS&E lounge a few months ago for a reception honoring Cora Bangs. After more than 20 years with the department, most of them spent looking after graduate student affairs, Bangs was retiring.

Bangs came to MS&E in 1979 as a part-time technical typist. Soon she was appointed graduate field assistant, coordinating student programs, and later she assumed responsibility for keeping track of many undergraduate affairs as well.

Her other hat is as flotilla commander of the local Coast Guard auxiliary, a civilian group that works with the Coast Guard on local safety issues. At the university, she has been active in the Cornell Recreation Connection, which arranges events and trips for faculty and staff.

In addition to enjoying her contact with students, Bangs said, she appreciated the supportiveness of others at the university with similar responsibilities.

In retirement, Bangs is spending more time in her home stained-glass studio, fashioning windows and objects such as sun-catchers and music boxes. She has been exhibiting at two shows every year and hopes to expand the enterprise.

Cora and her husband, Dick, who is a network engineer at Therm, Inc., continue to live in Ithaca.

Cora Bangs accepts a gift from the graduate students at the reception in her honor. She was also honored at a dinner attended by faculty and staff members and long-time associates.

Attention Alumni!

☛ Alumni and their families and friends are invited to attend the MS&E breakfast to be held during Cornell reunion June 7–10. The breakfast get-together will be held at 8:30 on Saturday, June 9, in the Bard Hall Lounge. Reservations should be made with Carol Armstrong: 607–255–9617; ca20@cornell.edu.

☛ Please send news about where you are and what your are doing to: grubb@ccmr.cornell.edu. And please indicate whether we have permission to list your e-mail address on our Web page.

Undergrads Present Popular Exhibit for Engineering Day

On Engineering Day at the Mall, members of the undergraduate Materials Research Society at Cornell manned a table with eight demonstrations and activities.

"We had by far the most exciting table for both children and parents," claimed Jarrett Silver, a junior in MS&E who was an active participant.

Hundreds of mall visitors stopped at more than a score of tables set up in the Pyramid Mall concourse on Saturday, February 17. The event, sponsored by the College of Engineering and the local Sciencenter, is held annually in connection with National Engineers Week. Displays are set up by student engineering groups and by a few local industries.

Professor Michael Thompson suggested many of the MRS displays and activities and Cris McConkey, technician in the senior laboratory, helped the students with details, Silver said. Twelve MRS members participated.

The displays and hands-on activities at the MRS table were described by Silver:

Levitating Superconductor. Awe-struck children and parents watched as a superconductor floated over a magnet cooled in "smoking" liquid nitrogen.

Silicon Manufacturing. From Sand to Electronics. Adults especially loved this display.

Happy-Sad Balls. Children were asked to pick which of two balls that look and feel the same would bounce.

Polymer Alignment. We had a contest to see who could stretch a polymeric string the farthest. (The greatest length, about 50 inches, was achieved by Mike Thompson, who came by and cheated, since he already knew about the time-dependent properties of polymers.)

Lis Roberts '02 amazes a family with the ceramic hammer at the MRS table.

Strain Hardening. Paper clips were used to demonstrate that metals get harder with repeated bending.

Ceramic Hammer. Kids and adults pounded nails into a piece of wood with a hammer that did not break as a ceramic cup would.

Shape Memory. Materials frozen in strange shapes returned to their natural shapes when heated back up.

Biomaterials. A touchable display showed body replacement parts—a heart valve, a hip joint, and an artery.

Students who took part in planning, preparing, and manning the MRS table for Engineering Day at the Mall are: juniors Ken Diest, Bob Young, Lis Roberts, Jarrett Silver, and Louis Klapp; and seniors Steve Wolf, Ryan Luby, Nate Eisenger, Phil Smith, Dan Jacobs, John Riley, and Vikram Joshi.

☛ MRS plans to expand its activities by participating in other local events, including Cabin Fever, a university event for young people in the community, and the Egg Drop contest, sponsored each spring by the Sciencenter. Anyone interested in joining in is asked to contact Jarrett Silver at jls@cornell.edu.

Students Have Their Say at Departmental Party

Skits satirizing the faculty were a highlight of the department's Christmas party for all members of the MS&E community—students, faculty, and staff.

Also featured was musical entertainment by a faculty ensemble—Jack Blakely and Yuri Suzuki (violins), Shef Baker (flute), and Pat Ober (keyboard).

Plaques and gifts were presented to staff members for long years of service to Cornell. Carol Armstrong was recognized for 25 years as an administrative assistant in MS&E, and Cora Bangs for 20 years with the department.

MS&E News
Cornell University
Bard Hall
Ithaca, NY 14853-9963