Materials Processing Center/Microphotonics Center

This report discusses the FY2006 activities of the Materials Processing Center (MPC) and its major affiliate, the Microphotonics Center (MPhC). MPC is an interdisciplinary center within MIT's School of Engineering; MPhC is a center within MPC. MPhC and MPC share staff in a common headquarters space. During FY2006, the staff numbered seven, including the director, Professor Lionel Kimerling (Department of Materials Science and Engineering).

About the Materials Processing Center

MPC exists to create opportunities for industry and government to take advantage of the wealth of exciting materials science and engineering research taking place at MIT. From better batteries to stronger metals to silicon lasers, materials science and engineering at MIT are always on the cutting edge.

Graduate students tour the Characterization Lab in Building 12 as part of the kickoff meeting for the Multidisciplinary University Research Initiative (MURI) program in Silicon Lasers and Nanophotonics.

As one of the leading research universities in the world, MIT is a fertile ground for materials innovation of all types. With so many impressive ideas and breakthroughs, it is no wonder that MIT routinely leads all US universities in patents granted. The sheer volume of new knowledge being generated at MIT can be almost overwhelming. When a company or federal agency has an interest in materials innovation, MPC acts as a guide to information, facilities, and researchers relevant to the particular needs of that organization.

One of the biggest advantages of MPC is its structure as a "virtual center," without facilities, laboratory space, or equipment as such; its function is to bring people and resources together in "intellectual space" to examine problems and pursue opportunities with a science-to-systems approach. With its finger on the pulse of all things materials-related at MIT, MPC is able to assemble faculty resources and leverage existing knowledge to help companies address their challenges and create opportunities.

MPC/MPhC continues to expand its collaborations with other materials-related centers across the campus to provide a common and guided gateway to the current maze of possibilities outside visitors face when approaching MIT with a materials interest. MPC maintains relationships with the Center for Materials Science and Engineering (CMSE),

Department of Materials Science and Engineering (DMSE), the Institute for Soldier Nanotechnologies (ISN), the Industrial Liaison Program (ILP), the Research Laboratory of Electronics (RLE), the Materials Systems Laboratory (MSL), the Microsystems Technology Laboratory (MTL), the Media Lab, and, soon, the Computer Science and Artificial Intelligence Laboratory (CSAIL). The Materials@MIT gateway web initiative (currently cosponsored by MPC, CMSE, and DMSE) also encourages all campus organizations involved in materials research to participate.

About the Microphotonics Center

The primary focus of MPhC is the interdisciplinary convergence of electronics and photonics. In addition to several traditional research programs with individual companies, recent MPhC accomplishments include two major federal programs and a new phase of the MPhC Consortium.

Federal Programs

MPhC is proud to assist in our nation's defense by working to advance emerging technologies that keep our armed forces on the forefront of military capability. Two major Department of Defense (DoD) programs, the BAE Systems-led Defense Advanced Research Projects Agency (DARPA) Electronic and Photonic Integrated Circuits (EPIC) program (in collaboration with Lucent, Cornell, and Columbia) and the Air Force Office of Scientific Research (AFOSR) Multidisciplinary University Research Initiative (MURI) program in Silicon Lasers and Nanophotonics (in collaboration with seven leading universities), are currently under way through MPhC.

MPhC Consortium

The MPhC Consortium features the Communications Technology Roadmap (CTR) program and its industry-led technology working groups. The Consortium has just launched a dynamic second phase of its groundbreaking CTR program that features direct interaction between academics and industry to formulate a roadmap for the future of the microphotonics industry. So far, this exciting initiative has involved 70 organizations worldwide.

About the MPC Industry Collegium

For the past quarter century, MPC has acted as a hub for cooperation among the many MIT researchers exploring materials science issues from the perspectives of their individual academic specialties. The knowledge and experience of MPC can help to open up the breadth of the MIT materials community to industry and government interests in materials science. The personal attention and guidance of MPC can provide invaluable assistance to any enterprise seeking a solution to an issue or an opportunity in materials science, engineering, or processing.

When people from industry want to explore innovative materials processing research ongoing at MIT, the MPC Industry Collegium can be an indispensable tool. Expanding on MIT's traditionally close ties with industry, the Collegium provides a direct link between the MIT materials community and the short-, medium-, and long-term needs of its member companies.

The Collegium consists of domestic and international companies in a range of industries, from traditional structural materials to biomaterials. For member companies, the Collegium provides broad access to MIT's materials community as well as one-on-one access to faculty, research staff, and students. For more information about the Industry Collegium, visit http://mpc-web.mit.edu/about_mpc/industryColl.php.

Advancing Materials Research at MIT

The MPC functions as a liaison between the cutting-edge materials research being performed here and other materials science, engineering, and processing interests within and outside of MIT. Interdisciplinary collaboration on research initiatives, graduate education, technology transfer, continuing education of industry personnel, and communication among industrial and governmental entities are MPC's priorities.

The faculty involved with MPC are constantly contributing new discoveries and insights. So far in 2006, the press reported on MPC-affiliated researchers involved in research that has produced the following, and more:

- a new type of lithium battery for hybrid electric cars
- a way to shrink tumors with a laser
- printable water-attracting and water-repelling surfaces
- a way for structures to morph from one shape to another
- a method for making safer metal alloys
- ideas to double or triple the capacity of solid-state batteries
- a way to use nanofibers to connect neurons
- ideas that could lead to drastic improvements in body armor
- a self-assembled electronic device of virus nanowires
- ways to determine best practices in recycling electronic items
- a way to boost conductivity of lithium ion phosphate by eight orders of magnitude
- a new technique of continuous flow lithography with many possible applications
- new ways to predict the crystal structures of materials
- organic solar cells with the potential to outperform today's silicon photovoltaics
- sophisticated optical system of light-detecting fibers
- ideas to increase the power and flexibility of electronic devices while dramatically reducing their power consumption

The dynamic research environment at MIT fosters creativity and innovation leading to inventions that a short time ago would have been beyond our wildest dreams. MIT researchers have big dreams—and they work hard to make them a reality. That drive and talent are available to assist not only other researchers around the world, but also the industry, our nation, and our planet. Behind the scenes, MPC is helping faculty to perform that research and helping to pair the science with its potential applications.

Summer intern Adam Zeiger at work in the laboratory of Professor Krystyn Van Vliet (DMSE).

A major priority of MPC is its outreach to new materials faculty and researchers at MIT as well as to the global materials community. MPC has more than a dozen visiting scientists working within the center. The center is proactive in inviting faculty to participate in its research activities and educational programs, including developing new initiatives, symposia, seminars, and summer student internship projects.

Vertical Integration

The secret to MPC's success is taking the science and moving it with a vertically integrated team up through the systems level. Materials innovation and process innovation, already interdisciplinary since the field's inception, are at the center of even broader interdisciplinary activity; virtually every academic and industrial constituency is realizing the time for bottom-up innovation is here. Specialists from the device and systems level experience difficulty in choosing and acquiring appropriate materials technologies and research and development (R&D) pathways. Due to the new bottom-up idea that system-level value can originate from atoms, molecules, and materials, there is a paucity of leaders who can comfortably and accurately plan "atoms-to-commerce" visions. The emergence of vertically integrated thinkers on the revenue side (i.e., some traditional sources of research financing in government and industry) needs to be encouraged and placed on firmer pedagogical grounds.

As an organization dedicated to building community and interdisciplinary cooperation, MPC must embrace these changes to create maximum opportunity for students and professors. This requires MPC to continue to supply technology leadership and information consolidation to an even broader population. Traditionally, MPC has been an interface for industry to the MIT community. Today MPC is becoming an interface for systems integrators (industrial and government) to gather information about bottom-up opportunities in general. This is a significant shift in role, and the MPC community has responded well. Recent programs have followed a new path in which MPC is a consolidator of information and technology leadership not only across MIT but across other universities, equipment suppliers, materials suppliers, and outsourced R&D contract facilities. Essentially, the trend appears to be the need for government and industry to have a one-stop shop for technology leadership in building system-level value through atoms, molecules, and solids.

MPC History and Mission

MPC was established 25 years ago in response to a recognized national need to improve the knowledge base and streamline technology transfer in the field of materials science and engineering. Materials science traverses all the physical sciences. Materials processing, as MPC defines it, covers a wide range of types of materials and crosses traditional departmental and school boundaries.

The MPC mission is to provide an environment where students and professionals from industry, government, and academia collaborate to identify and address pivotal multidisciplinary issues in materials processing and manufacturing in a way that

- unites the MIT materials community
- creates new knowledge
- produces knowledgeable people
- promotes the exchange of knowledge in the service of our country and in the context of the global community

Uniting the Materials Community

With dozens of faculty members doing materials research at MIT, multiple centers devoted in whole or in part to promoting or performing materials research, and hundreds of graduate and undergraduate students and other researchers, the materials community at MIT is a vibrant, diverse group. We are united as a community in that we are committed to advancing materials science, engineering, and processing—but because to grow as a community and truly leverage our collective brainpower resources, it is vital to connect with each other in more ways than simply a broad common goal, MPC creates opportunities for the materials community to come together—in collaboration, in education, and in celebration.

Because MPC is dedicated to collaboration and community, we seek to interact with other materials-related centers on campus, including, as mentioned before, CMSE, ISN, RLE, MSL, MTL, and the Media Lab. We also maintain a close relationship with DMSE. MPC works closely with ILP as well, providing specific guidance to companies with materials-related needs. We are also in the process of initiating an exciting new collaboration with CSAIL.

Our moving closer to other centers—particularly CMSE—will create synergies both intellectually and administratively. Our strategy is to improve our position as an information resource for the campus community and portal for Consortium/

Collaborating on the summer research internship: MPC associate director George Kenney, administrative officer Jonathan Bartels, and CMSE director Michael F. Rubner.

Collegium member companies. Meanwhile, with our program sponsors and research alliance partners, we face the ongoing challenges of program and intellectual property management and are developing the tools and processes for meeting these challenges. We consider our key value to be our building of interdisciplinary faculty teams to develop new areas for intellectual activity and research.

Materials@MIT Gateway Web Initiative

MPC has joined with CMSE and DMSE to launch the Materials@MIT gateway initiative. Materials@MIT will be the internet gateway to the breadth of the materials research community at MIT. This website, scheduled for launch at http://materials.mit.edu in fall 2006, will be the internet home for a repository of information related to materials research at MIT—and at the same time, the starting point from which a site visitor can reach any other point in the MIT materials research community. The site will feature:

- detailed information about the full range of materials research projects under way at MIT;
- news about the hottest advances in materials science, engineering, and processing;
- pages about shared experimental facilities at MIT;
- event listings for materials-related educational outreach activities; and
- links to the individual websites of every materials-related laboratory, department, center, and professor on the MIT campus.

The Materials@MIT initiative was spearheaded by MPC and CMSE and has recently expanded to include DMSE. The participation of any and every materials-related organization on campus will be welcomed and encouraged.

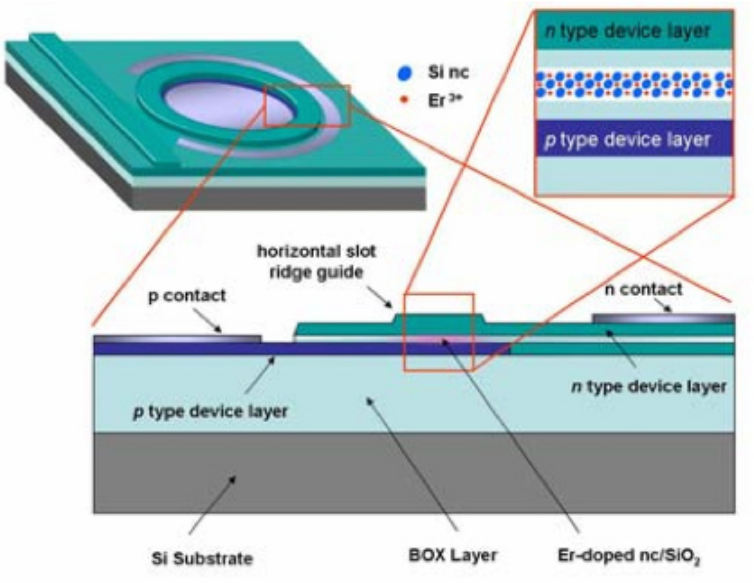
Materials research at MIT is a digest of materials research performed at MIT by MPC-affiliated faculty and others during the previous calendar year. The 2005 research digest, produced together with CMSE, was distributed entirely via the MPC website. The 2006 research digest will be published on the Materials@MIT community site.

Creating New Knowledge

Focus on Interdisciplinary Research Collaborations

Fostering cooperative inquiry and experimentation in the cross-disciplinary area of materials science and engineering is the cornerstone of MPC. The MPC strategy includes leveraging core federal research funding within the MIT materials community into expanded industrial–academic collaborations. Center research covers a broad range of materials and processes via a number of common themes. Foremost among them is the control of materials structure, properties, and performance in an ecologically and economically sound manner. Our philosophy focuses on an understanding of processing fundamentals to control internal structure, from the nanoscale to the macroscale, thereby optimizing a material's properties and performance.

MPC builds relationships with faculty by familiarizing itself with their current research projects, future interests, and resource needs; by bringing industries' materials and processing needs and interests to them; and by inviting them individually or in teams to collaborate with industry. MPC provides seed research program development funding to new faculty members and teams and assists with proposals, budgets, and the administration of research accounts. During FY2005, there were more than 50 faculty and senior research staff members with active accounts in MPC. The faculty who have had some affiliation with MPC hail from nine departments in the Schools of Engineering; Science; and Humanities, Arts, and Social Sciences, as well as the Sloan School of Management.



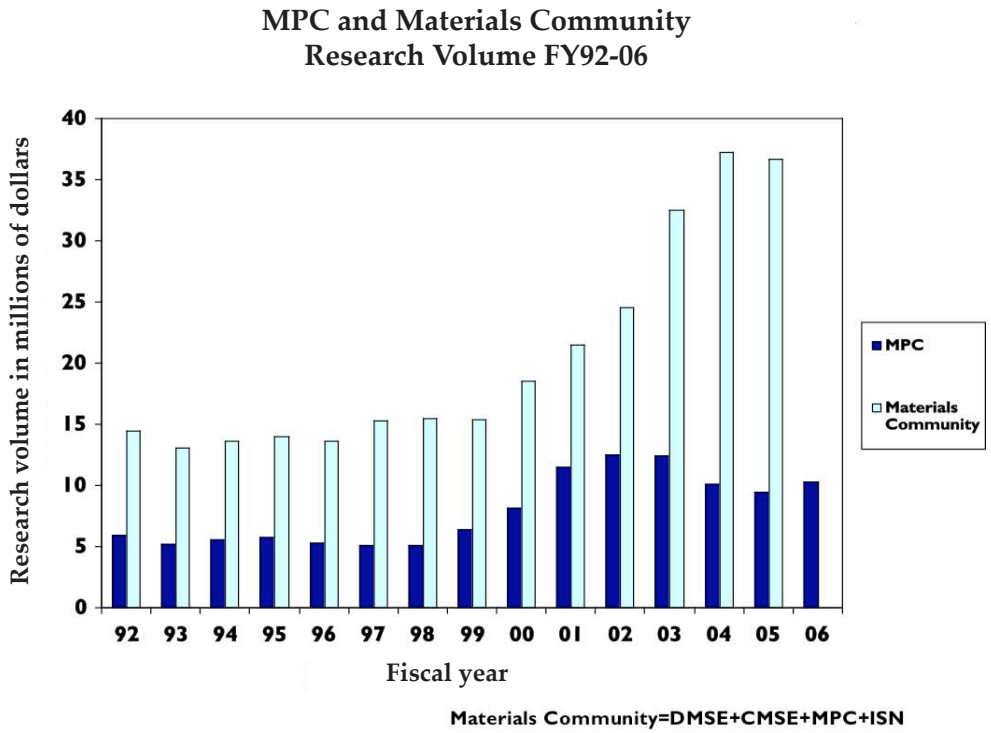
Microphotonics Center research includes work on devices such as the erbium-doped silicon nanocrystal slot laser diode.

During FY2006, MPC continued to focus on the development of microphotonics projects through MPhC, which conducts collaborative research focused on advancing basic science and emerging technology to enable the convergence of electronics and photonics. As a research community dedicated to optimizing interdisciplinary academic and industrial collaboration to advance basic science and precompetitive technology in areas relevant to applied microphotonics, MPhC engenders R&D cross-fertilization leading to innovation. The vision of MPhC is a future where the microphotonics platform enables enhanced information access, bandwidth, reliability, and complexity that extends the advance of silicon integrated circuit technology. MPhC has several major research thrusts in addition to individual faculty members' research. MPhC research programs have continued to generate significant new intellectual property for their sponsors in FY2006.

Research Volume

MPC and MPhC total research volume was $10.3 million in FY2006. Our five priority research areas are medical materials, photonics, energy, environment, and nanotechnology. Campus materials research volume across MPC, CMSE, ISN, and DMSE has steadily increased each year since 1999, reaching nearly $37 million for FY2005.

In addition to the primary research volume of $10.3 million, MPC also supports a secondary research volume of nearly three-quarters of a million dollars to other centers.



MPC researchers are sponsored not only by a variety of companies but also by nearly every major federal research-sponsoring agency, including the National Science Foundation (NSF), Department of Energy, National Institutes of Health, Office of Naval Research, DoD, and AFOSR.

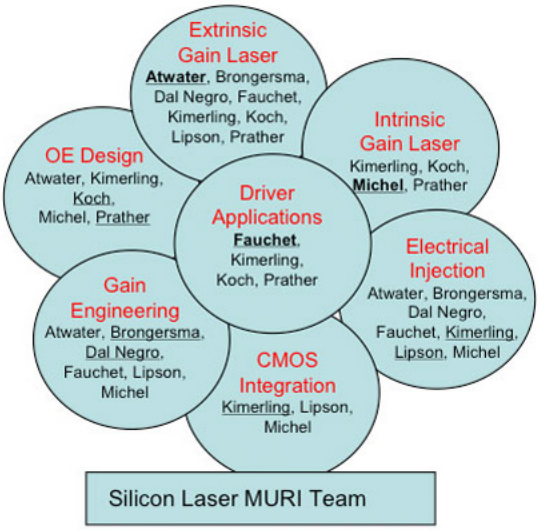
Federal Programs

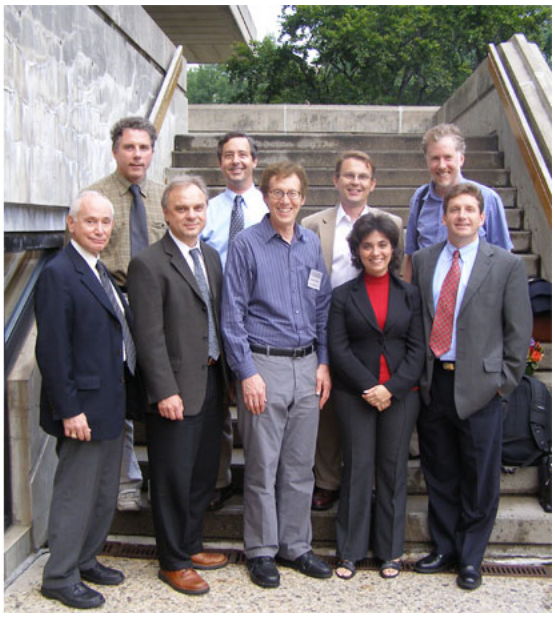
DARPA EPIC Program

One of the largest federal programs of MPhC is the Application-Specific Electronic and Photonic Integrated Circuits (AS-EPIC) program, sponsored by DARPA . This major, multiyear research contract (awarded in December 2004) is funding a collaboration led by BAE Systems Information and Electronic Warfare Systems (http://www.baesystems.com/), with MIT, Lucent Technologies, Applied Wave Research, Cornell University, and Columbia University.

The overall DARPA EPIC program supports research intended to produce novel approaches that "enable revolutionary advances in science, devices, and/or systems" in three areas: CMOS-Compatible High Performance Si Nanophotonic Devices, Application-Specific Electronic and Photonic Integrated Circuits, and Novel Photonic Devices. MPhC's project is in the second area of interest—fabrication and demonstration of AS-EPICs.

On the cutting edge of integrated circuit research is the convergence of electronics and photonics, which incorporates both electronic and photonic functionality on the same chip, using common CMOS processing methods. The chips being designed as part of





The MURI team and their areas of collaboration. Front row (L to R): Lionel Kimerling, MIT; Gernot Pomrenke, AFOSR; Richard Soref, DoD; Michal Lipson, Cornell; Dennis Prather, University of Delaware. Back row: Harry Atwater, Caltech; Philippe Fauchet, University of Rochester; Tom Koch, Lehigh; Jurgen Michel, MIT. (Not pictured: Mark Brongersma, Stanford; Luca Dal Negro, Boston University).

this AS-EPIC program will integrate photonic devices/circuits that are being fabricated at BAE System's Manassas facility. Within the wider context of relevance to DoD applications, there are two specific goals of the program: to fabricate a functional AS-EPIC using CMOS-compatible processing, and to create a design and integration path to AS-EPICs exceeding the performance of typical discrete devices.

For more information about the EPIC program, visit http://mphotonics.mit.edu/about_mphc/EPIC.php.

MURI Silicon Lasers and Nanophotonics Program

The MIT Microphotonics Center is proud to announce the award of a multidisciplinary university research initiative (MURI) from AFOSR. This project, titled Electrically-Pumped Silicon-Based Lasers for Chip-Scale Nanophotonic Systems, is led by Professor Lionel C. Kimerling, director of MIT's MPC and MPhC, and includes collaborators from seven leading research universities: Boston University, Caltech, Cornell University, Lehigh University, Stanford University, University of Delaware, and University of Rochester.

AFOSR, a component of the Air Force Research Laboratory, manages the Air Force's basic research program in support of Air Force goals of "control and maximum utilization of air and space." The MURI program, sponsored by DoD, sponsors large-scale, multidisciplinary research projects that represent exceptional opportunities to contribute technology applicable to national defense. The awards provide support for research, graduate students, and laboratory instrumentation development.

The MURI program was kicked off July 20–21, 2006, at a meeting at MIT. The faculty and graduate students involved in the program enjoyed the opportunity to meet face to face and explore this promising research project. Graduate students from other institutions were taken on a guided tour of the Substrate Engineering Laboratory in Building 13 and the Characterization Laboratory in Building 12. Leaders of various project areas spoke about their research and how it relates to the project.

For more information about MURI, visit http://mphotonics.mit.edu/about_mphc/MURI/MURI.php.

Producing Knowledgeable People

As part of the MIT community, the first priority of MPC is to educate the next generation of materials processing research scientists, engineers, and leaders. To this end, MPC initiates programs to enhance the intellectual vitality of the materials processing community at MIT. We measure the value of these programs by the breadth of the materials arena they address, by the new and creative collaborations among faculty and students they catalyze, and by the degree of attention to the multidisciplinary nature of the materials science, engineering, and processing they generate.

MPC places great importance on publication in pursuit of its outreach goals. The internet is our main mode of information distribution. MPC supports interdisciplinary research teams with secure websites for data sharing, teleconferencing and videoconferencing facilities for meetings, and staff support for research project management.

As of this year, the MPC website at http://mpc-web.mit.edu features links to current materials news stories from MIT and around the world. Updated frequently, the MPC homepage features articles of interest to all materials science researchers, and the MPhC homepage features the subset of those articles relevant to the microphotonics community. The homepages feature only the most recent articles, but links to all the articles that have been featured so far remain available in an archive.

Another important outreach mechanism is the poster session. In FY06, MPC sponsored or cosponsored three poster sessions: the Summer Internship Poster Session (August 11), the Materials Day Research Review Poster Session (October 11), and the MIT Energy Poster Session (May 12). The MIT Energy Poster Session was part of "Energy 2.0—The MIT Energy Conference."

Summer Research Internship Program

MPC does not limit its educational outreach to the MIT community. For 24 years, MPC has sponsored (now cosponsored with CMSE) a summer internship program for promising undergraduate researchers from other colleges and universities around the country. The MPC summer internship (a nine-week program from June 11 to August 12 of this year) is an NSF Research Experience for Undergraduates that brings the best science and engineering undergraduates in the country to MIT for graduate-level materials research in the laboratories of participating faculty members. The program culminates in a poster session held in Lobby 13, where the students present their research to the MIT community.

The 2006 program involves 13 faculty members and 14 bright, motivated students from schools including Cornell, Rutgers, Howard, and State University of New York. Project areas include quantum information processing, organic light-emitting diodes, polyelectrolyte multilayers, photovoltaic cells, and photonic waveguides.

For more information about the MPC/CMSE Research Experience for Undergraduates summer internship in materials science, visit http://mpc-web.mit.edu/about_mpc/summerscholars.php.

Summer intern Frajovon Talley of Howard University describes the research she performed in the laboratory of Professor Francesco Stellacci to CMSE director Michael Rubner.

Materials Day

Sharing knowledge and insight with others in the materials science and engineering field can lead to new ideas, new collaborations, and new breakthroughs. Once a year, we invite the materials community to a celebration of all that has been accomplished over the past year. We call this celebration Materials Day. It is a way to honor people, recognize important achievements, and talk about the future.

An autumn event, Materials Day, features a daylong symposium on a featured topic followed by a graduate student/postdoc poster session. The posters are judged by a panel of representatives from industry, and the poster winners are presented with certificates and $500 prizes.

The theme of the Materials Day 2005 symposium, chaired by Professor Michael Rubner (director of the Center for Materials Science and Engineering), was "Interdisciplinary Research Groups at the Frontiers of Materials Science and Engineering."

CMSE's interdisciplinary research groups (IRGs) investigate fundamental scientific questions and pathways to reach significant technological goals that can be properly explored only in a collaborative, multidisciplinary mode. The four current IRGs include the following:

- microphotonic materials and structures
- electronic transport in mesoscopic semiconductor and magnetic structures
- nanostructured polymer assemblies
- science and engineering of solid-state portable power sources

MPC director Lionel Kimerling and Industrial Advisory Board member Ernest Littauer congratulate the poster contest winners.

Materials Day 2005 featured both ongoing research and results to date of these efforts via faculty presentations and an extensive poster session. MPC normally awards three $500 prizes to the three best posters. This year, however, there was an unprecedented five-way tie! Rather than engage in a tie-breaking round of judging, MPC elected to award $500 prizes to all five winning posters:

- "Quantum Dot LEDS—From Physical Concepts to Device Fabrication" (Polina Anikeeva and LeeAnn Kim; advisors, Vladimir Bulovic and Moungi Bawendi)
- "High-Flux, Fouling Resistant Nanofiltration Membranes with Tunable Pore Size" (Ayse Asatekin; advisor, Anne Mayes)
- "Integrated Mesoscopic Metal-Insulator-Semiconductor Fiber Devices by Composite Material Processing" (Mehmet Bayindir; advisor, Yoel Fink)
- "Identifying Key Components of Anti-Fouling Surfaces: Effects of Mechanical Compliance and Surface Charge on Bacterial Attachment Using Polyelectrolyte Multilayers" (Jenny Lichter; advisor, Michael Rubner)
- "Superhydrophobic Textiles by Electrospinning" (Minglin Ma; advisor, Greg Rutledge)

To download the presentations from Materials Day 2005, visit http://mpc-web.mit.edu/about_mpc/MatDay/MatDay05.php. Materials Day 2006 is scheduled for October 11, 2006.

Promoting the Exchange of Knowledge—Industry and Government Partnerships

MPC works to promote the exchange of knowledge in the service of our country and in the context of the global community. In addition to federal programs to bolster national defense through advancing technology through MPhC, MPC's events, programs, and publications help to foster knowledge transfer within the MIT materials community and to the outside world. MPC has an active Industrial Advisory Board, composed of industry leaders from a spectrum of small to large companies.

In FY2006 MPhC continued major research programs with industry affiliates. MPhC also maintained its relationship with the sponsors of its major research programs, visiting industrial scientists affiliated with these programs are appointed through MPC.

MPhC Consortium

The MPhC Consortium consisted in FY2006 of 10 member companies from the materials-to-systems technology supply chain of the computing, data communications, and telecommunications sectors.

The MPhC Consortium announced a new structure this year, with expanded membership. The new consortium was launched November 17, 2005, when its board of directors, composed of key representatives from MIT and the industry, gathered at MIT's Endicott House for a kickoff meeting intended to lay the infrastructure for the next phase of CTR activities. Technology working groups (TWGs) for CTR II were initiated, and the initial TWG developments were presented at the May 2006 meeting of MPhC. Several topics for collaborative research projects were also identified. For more information about the MPhC Consortium, visit http://mphotonics.mit.edu/about_mphc/consortium.php.

Communications Technology Roadmap II

The MPhC Consortium leveraged the findings of the earlier Communications Technology Roadmap I Project begun in fall 2000, launching CTR II this year. CTR II is designed to assess business and technology strategies, leverage collective resources, and provide a forum for industry to interact with academia. Codirecting the next phase of the CTR program are Professor Randolph Kirchain (DMSE) and Professor Lionel Kimerling.

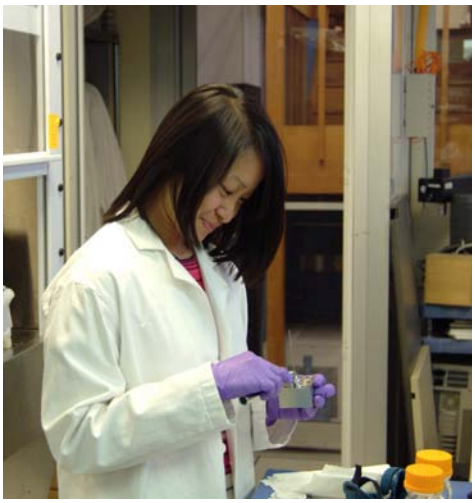
Three TWGs are meeting regularly to focus on specific areas of interest. The CTR II TWGs are as follows:

- Cross Market Applications—Characterizing Technical Requirements & Architectural Options,
- Realizing a CMOS (Si) Platform, and
- Integration, Packaging, & Interconnection.

For more information about the CTR program, visit http://mph-roadmap.mit.edu/.

Outlook

Interdisciplinary collaboration among the various fields of inquiry related to materials science, engineering, and processing is the prime focus of MPC. Over the next few years, there are five key trends in materials science that will affect MPC. The first—interdisciplinary research teams with vertical integration to applications—is a wonderful confirmation of the idea, which MPC has always promoted, that strategically bringing together specialists from various academic specialties can produce a synergistic whole that is far more than the sum of its parts. Another key trend—vanishing academic department boundaries—has resulted in dual appointments for some new faculty. The interdepartmental faculty member is a great example of how the entire community is moving toward more interdisciplinary pursuits. A third key trend is a new type of triangular industry–government–university partnership, such as the EPIC program



Summer intern Christine Hsieh pursuing research in the laboratory of Professor Ian Hunter (Mechanical Engineering).

described earlier in this report. More intellectual property (IP) creation, a fourth key trend, is related to the collaboration we help arrange. Industry expects more IP, so more collaboration means more IP creation. The application-rich nature of industry enables researchers to do what we do best—develop basic, fundamental research and then apply it when we get the opportunities. The last—but by no means least—key trend that will affect MPC going forward is the fact that materials innovation is ambient in our 21st century world. As more and more of the scientific community around the world begins to focus on materials science, engineering, and processing, we may look forward to a truly exponential increase in new ideas, materials, and applications.

The long-term strategic vision of MPC must be to act as the intellectual leader in materials innovation and processing across the MIT community and the external community and interface with government and industrial systems integrators. The short-term plan is to continue building the relationship base to act as this central consolidator and leader in the materials community. In each sector of MPC research activity, system integrators must be identified and relationships established. This process in the defense sector is well under way, and the process has also started in the biomaterials/biotechnology area. With system integrator relationships growing, key community membership of individuals and resources outside the MIT community can also be folded into the MPC community.

One major challenge at MIT is the need for a better sense of community. MPC has provided, for the past quarter century, a successful means of achieving a better sense of community within the School of Engineering. Looking ahead, MPC anticipates that the next quarter century will be even more exciting than the first, as collaborative initiatives with other materials research organizations on and off campus take shape and take flight.

Lionel C. Kimerling
Director
Professor of Materials Science and Engineering

More information about the Materials Processing Center and Microphotonics Center can be found at http://mpc-web.mit.edu/ and http://mphotonics.mit.edu/.