Materials Processing Center

The Materials Processing Center (MPC) was established as an interdisciplinary center within the School of Engineering in response to a recognized national need to improve the materials processing knowledge base and to streamline the process of translating materials research results into industrial innovations and applications. MPC is now in its 33rd year.

Following a science-to-systems approach, MPC works with faculty to assemble resources and leverage existing knowledge to help companies and federal agencies address fundamental challenges through research and create opportunities through technology transfer. The MPC supports over 60 faculty and senior research staff with proposals for research and post-award program management. In addition, it provides administration services and liaison support with industry contacts outside MIT. The center also organizes events for the broader materials research community at MIT, which includes more than 195 faculty.

Research volume for MPC over the past year was $17 million, a decrease of 15% over the previous year, returning to the level of two years ago. A significant portion of this decrease can be attributed to the ending of stimulus funding, primarily associated with research on materials for energy in the Advanced Research Projects Agency program (ARPA-E). MPC continued to support its two subcenters—the Solid State Solar Thermal Energy Conversion Center (S^3TEC) and the Microphotonics Center (MPhC)—as well as professor Harry Tuller's large multi-faculty program in chemomechanics of far-from-equilibrium interfaces. MPC also anticipates the creation of two additional subcenters in the coming year based on new support, one in the area of quantum coherent materials and the other in electrochemical energy storage.

Industry Collegium and External Advisory Board

The MPC Industry Collegium consists of 10 companies that provide direct financial support for the center's discretionary activities through annual donations. Representatives from these companies work with MPC throughout the year to identify opportunities for collaboration and participate in MPC's annual Materials Day symposium and poster session. Longstanding collegium members include Agoria-Belgium Consortium, Ishikawajima-Harimi Heavy Industries, Merck KGaA, Michelin, Raytheon, Toyota, and Applied Materials–Varian Semiconductor Equipment. Growth of collegium membership is a high priority for MPC. This year, Lockheed Martin, POSCO (formerly Pohang Iron and Steel Company), and Hyosung joined as members of the MPC Industry Collegium.

The MPC external advisory board meets for a full day after the Materials Day event each year. MPC's director and staff report on the prior year's activities and present on planned initiatives and goals for subsequent years. In addition, new faculty present their planned research for the year and senior faculty discuss major new initiatives. The external advisory board provides valuable advice on program development and management. It also assists in identifying opportunities for interactions with industry.

The board meeting culminates in an oral and written report to the dean of the School of Engineering or a designated representative. Current board members represent 3M, Applied Materials–Varian Semiconductor, Alcatel-Lucent Bell Laboratories, Charles Stark Draper Laboratory, Compaq Computer Corporation, General Motors, Harmonic Inc., Lockheed Martin Corporation, Lord Corporation, Midrange Systems EMC, Norton, Novartis Pharmaceuticals, Saint-Gobain S.A., Sandia National Laboratories, and Solvay Advanced Polymers.

New faculty members who spoke at this year's board meeting included professor William Tisdale (Department of Chemical Engineering [ChemE]), professor Jeremiah Johnson (Department of Chemistry), professor Antoine Allanore (Department of Materials Science and Engineering [DMSE]), and professor Niels Holten-Andersen (DMSE).

Solid State Solar Thermal Energy Conversion Center

MPC completed its fourth year supporting the Solid State Solar Thermal Energy Conversion Center, a US Department of Energy (DOE) Basic Energy Sciences–sponsored Energy Frontier Research Center (EFRC). Led by professor Gang Chen (Department of Mechanical Engineering), the center is a multidisciplinary effort that includes leading researchers from the fields of physics, chemistry, materials sciences, and electrical and mechanical engineering. The center's research focus in basic science on energy transportation in nanostructured materials and devices has applications in conversion of thermal energy to useful electrical energy from heat sources including solar.

Research is based on three major areas: (1) the study and control of photons for solar thermoelectric and thermo-photovoltaics, (2) the understanding of electron and phonon transport, and (3) high-temperature reliability. The core activities of the center are focused on the investigation and development of thermoelectric materials, the collection and conversion of heat energy into electrical energy, and thermo-photovoltaics for high-efficiency energy conversion of solar energy into electricity. Key to the energy conversion process is the ability to understand phonon transport processes in these materials, combined with the design and fabrication of highly selective surfaces to serve as efficient photon emitters in the case of thermo-photovoltaic systems. Investigation of the material systems requires use of unique and adapted characterization tools, such as thermo-reflectance, acoustic wave, and phonon tomography (at Oak Ridge National Laboratory).

Highlights of scientific achievements from research efforts by center members include the demonstration of coherent phonon heat conduction in superlattices, the development of experimental techniques for extending thermal conductivity spectroscopy to measure phonon mean free paths below 100nm in semiconductors, the development of an electron cloaking concept to improve electronic power factor, and the modeling and experimental demonstration of the enhancement of ZT in SiGe alloys by modulation doping, a technique which results in simultaneous improvements to three parameters in ZT.

Based at MIT, S^3TEC supports the research efforts of 12 principal investigators, multiple academic disciplines, and student and postdoctoral members assigned

from various research teams. Co-principal investigators include professors Mildred Dresselhaus (Department of Physics and Department of Electrical Engineering and Computer Science [EECS]); Eugene Fitzgerald (DMSE); John Joannopoulos (Institute for Soldier Nanotechnologies); Sang-Gook Kim (Mechanical Engineering); Keith Nelson (Chemistry); Yang Shao-Horn (Mechanical Engineering); Christopher Schuh (DMSE); Marin Soljacic (Physics); and Evelyn Wang (Mechanical Engineering). Partners and collaborating organizations include professor Cyril Opeil from Boston College, professors Theodore Borca-Tasciuc and Ganpati Ramanath from Rensselaer Polytechnic Institute, Dr. David Singh and Dr. Olivier Delaire from Oak Ridge National Laboratory, and professor Zhifeng Ren from the University of Houston. The center was officially launched in August 2009 for a five-year period, based on meeting annual reporting requirements. The goals of the research center are to enable highly efficient harvesting of heat energy from multiple high-temperature processes, such as power plants, chemical plants, and engines (e.g., turbines and automobiles), in addition to realizing more efficient collection of the full solar energy spectrum into usable, sustainable green energy.

Microphotonics Center

The Microphotonics Center was established in 1999 based on research on high-index contrast photonic devices and the anticipated challenges in supporting exponential growth in communication bandwidth demand in the telecommunications and data communications technologies enabling the information age.

MPhC features the Communication Technology Roadmap (CTR) program and its industry-led technology working groups (TWGs). The consortium, directed by MIT staff and one representative of each member company, forms the board of directors. Phase II of CTR was completed in 2009.

The center's focus of effort with its members is the development of a communications technology roadmap that seeks to identify technology barriers and opportunities that will support the communications industry supply chain demands for increased information capacity with higher bit rate, smaller form factor, and lower energy-consuming technology.

MPhC's activities are supported by over 20 participating companies and organizations and include regular meetings of its board, comprising members from industry, universities, and other industry standards groups such as the International Electronics Manufacturing Initiative, the Optoelectronics Industry Development Association, and Sematech. The TWGs are chartered by the board membership. MPhC hosts two meetings at MIT each year for members, invited speakers, and guests. Interest in the center's activities has grown significantly over the past three years, as represented by the number of individuals and organizations present at the meetings. Fifty-one organizations—representing industry, government, and university groups—participated in the most recent meeting, in April 2013, an increase of 100% from 2010. Members over the past year have included Advanced Micro Devices, Alcatel-Lucent, Analog Devices, Advanced Photonic Integrated Circuits (APIC) Corporation, Corning, Electronics and Telecommunications Research Institute, Fujitsu, Hewlett Packard, International Business

Machines, Intel Corporation, Kotura, Nippon Electronics Corporation (NTT), NTT Electronics Corporation America, and Silicon on Insulator Technologies.

Organization of the road-mapping effort originated with the formation of three technology working groups: cross-market applications; complementary metal-oxide-semiconductor (CMOS) platform; and integration, packaging, and interconnect. Working group activities helped to support the funding of three CTR fellows, who worked closely with each working group, resulting in the authorship of white papers under the diligent direction of industry-based working group leaders.

The CTR program is in its third generation or phase, with a growing membership and a new structure for engagement and deliverable work products addressing industry concerns for scaling limits and energy. Phase III working groups have been organized to look at four key aspects of scalability: energy, infrastructure, copper, and networks. Consortium members are working to form a consensus on identifying the parameters, needs, and distinctions between short-term and long-term communication links. Shifting from a four-year, 200-page document, CTR III is publishing shorter, more frequent white papers on a revolving timeline to better match the industry cadence of a typical product cycle. The center has released three TWG reports under CTR III: Scaling Limits and Energy (2010), Scaling Limits for Copper Interconnects (2011) and On-board Optical Interconnection (April 2013). The most recent report focuses on baseline optical PCIe3.0+, the next generation data signaling bus ideally suited for high performance graphics cards, and dimensions of computational scaling within an open architectures forum dealing with the challenges of multicore processing.

Singapore–MIT Alliance for Research and Technology Low Energy Electronic Systems

The Singapore–MIT Alliance for Research and Technology (SMART) Low Energy Electronic Systems Interdisciplinary Research Group, directed by Professor Fitzgerald and managed through the MPC, is now in its second year. This program has an MIT/MPC research volume of $1.7 million per year, with a corresponding Singapore volume of about three times that. The program aims to identify new integrated circuit technologies that become the new added value for reduced energy per function, lower power consumption, and higher performance systems, based on the use of current silicon integrated circuit wafer processing infrastructure and integration of compound semiconductor device technology. A major research facility has been constructed in Singapore for this program. The facility includes two state-of-the art metal organic chemical vapor deposition systems, as well as other facilities such as a wafer bonding and chemical mechanical polishing system dedicated to this program. Coupled with other facilities available through collaborations with the Nanyang Technical University (NTU) and the National University of Singapore (NUS), full capabilities for III-V device processing on silicon substrates are now available. Collaboration with Global Foundries in Singapore has also been established for silicon CMOS wafer processing, establishing the ability to create novel monolithic III-V and silicon CMOS using foundry design platforms.

The SMART program involves eight MIT faculty and one MIT senior research scientist, as well as their students and postdocs based at MIT. Thirteen faculty from NTU and NUS are also involved in collaborative research. Seventeen MIT staff and postdocs are now supported in Singapore for research based there. A number of NTU and NUS students are also involved in the program.

Selected New Programs with Industry

MPC continues to support faculty research efforts with industry collaboration over a wide range of materials science–based applications, from metallurgical coatings for strength and corrosion resistance to integrated photonics, solar cells, and batteries. MPC supports many ongoing research programs with faculty, including professor Christopher Schuh's research with Mitsubishi Materials and POSCO; professor Lionel Kimerling's programs with Chanel, Samsung, and a separate multicenter program that includes faculty from the Computer Science and Artificial Intelligence Laboratory and the Research Laboratory of Electronics on integrated photonics with APIC Corporation; Professor Allanore's program with Terrativa; professor Donald Sadoway's research with NorCo; principal research scientist Randolph Kirchain's research with Hydro Aluminum; and senior research associate Jurgen Michel's research with Samsung and APIC Corporation.

MPC also supports faculty with the establishment and operation of consortium research programs with industry. Two ongoing programs for 2013 include the Materials Systems Laboratory (professor Joel Clark, director), and the Microphotonics Center (professor Kimerling, director).

Promotions and Selected Honors and Awards

MPC faculty received numerous awards and honors, as individually reported in the reports of their home academic departments. Of special note are:

Jeff Gore, Lanthan career development assistant professor of physics, received a four-year, $1,131,603 grant from the National Institutes of Health (NIH) National Insitute of General Medical Sciences to pursue research into cooperation and cheating in the evolution of antibiotic resistance in bacteria. The research addresses the rise in antibiotic resistance among bacteria to the most widely used class of antibiotic medicines, called beta-lactam antibiotics. Bacteria can develop resistance to antibiotics like penicillin by expressing an enzyme, beta-lactamase, which inactivates the antibiotic. The Gore Lab uses experimental microbial populations to study fundamental questions in evolutionary systems biology and theoretical ecology. The Research Project Grant (R01) is the oldest NIH grant program. The first-year allocation of $283,311 for the NIH R01 award began on April 1, 2013. In February 2013, Professor Gore received a $1.5 million award from the Paul G. Allen Family Foundation to conduct research into the evolutionary origins of cooperation by applying game theory to how single-celled yeast make decisions about consuming and sharing sugar. The Allen Award is managed by the Department of Physics.

Harry Tuller, DMSE professor of ceramics and electronic materials, was selected to receive the Helmholtz International Fellow Award from the Helmholtz Association of German Research Centers. This award was established with the focus of strengthening cooperation with the world's best researchers. Professor Tuller was invited to spend time at the Helmholtz Center for Materials and Energy in Berlin (Helmholtz-Zentrum Berlin für Materiallen und Energie) and to serve as a mentor through the Helmholtz Management Academy. He was also elected vice president and president-elect of the International Society of Solid State Ionics at its meeting in Kyoto, Japan, the week of June 2, 2013. Professor Tuller's Crystal Physics and Electroceramics Laboratory is conducting research on the fundamental understanding of the coupling between electrochemical ion transport and mechanical stress in transition and rare earth metal oxides that are key to energy applications.

Pablo Jarillo-Herrero, the Mitsui career development assistant professor in contemporary technology in the Department of Physics, was one of two MIT assistant professors to be named the Navy's Office of Naval Research Young Investigator. This program is designed to attract young scientists and engineers who show exceptional promise for outstanding research and teaching careers. Professor Jarillo-Herrero was selected from among hundreds of applicants for the honor, which includes a three-year research grant worth up to $510,000. His work under the program is titled "Quantum Transport and Optoelectronics in Atomically Layered Materials."

Mildred Dresselhaus, Institute Professor and professor of electrical engineering and physics, won the Enrico Fermi prize, one of the oldest and most prestigious awards for scientific achievement. The presidential award carries an honorarium of $50,000 (shared) and a gold medal. The award granted her an audience with President Obama. In September 2012, she traveled to Oslo to dine with Norway's King Harald and was the sole recipient of the $1 million Kavli Prize in Nanoscience. The award cited her "for her pioneering contributions to the study of phonons, electron-phonon interactions, and thermal transport in nanostructures." The Kavli Prize in Nanoscience is awarded to researchers who have made significant contributions to the science and application of the atomic, molecular, chemical, and biological properties of structures at the nanometer scale. Also in September 2012, president Rafael Reif presented Professor Dresselhaus with MIT's Lifetime Achievement Award.

Promoting Exchange of Knowledge

As part of the MIT community, MPC's first priority is the education of 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.

This year, MPC associate director Mark Beals, in collaboration with the MIT Industrial Liaison Program (ILP), brought news of current MIT faculty research to MPC's Industry Collegium members, interested businesses, and universities during a visit to Bangkok, Thailand; Taipei, Taiwan; and Tokyo, Japan, from April 1–10. His presentations covered research in carbon nanotubes by professors Brian Wardle and Carl Thompson (director of MPC), and Professor Shao-Horn; anti-fogging polymer coatings by professors Michael

Rubner and Robert Cohen; silicon photonics by Professor Kimerling and Dr. Michel; solar thermalphotovoltaic research by Professor Chen and S^{3}TEC; graphene by Professor Jarillo-Herrero; and other research by professors Marin Soljacic and Katharina Ribbeck, and Professors Wang, Kim, Allanore, and Sadoway, among others. Topics highlighted were adapted for each seminar based on the interests of the companies in attendance.

Beals focused on energy-related research for Siam Cement Group, which is celebrating its 100th anniversary in business this year and has interests in chemicals and paper, including natural fiber products. Siam Cement is an ILP member as well as an MPC Industry Collegium member. Beals also visited PTT (formerly Petroleum Authority of Thailand) Public Company Limited, Thailand's national energy company, which has interests in oil, natural gas, and lubricants.

In Taiwan, Beals's host was the Epoch Foundation. Two seminars were hosted while he visited Taiwan. The first was hosted by the Epoch Foundation and included participation by professors and students from National Taiwan University. The Epoch Foundation is made up of 26 Taiwanese companies and actively supports entrepreneurship, particularly in new technologies. The second seminar was held at Taiwan Semiconductor Manufacturing Company's Fab 12 R&D Center in Hsinhu.

In Tokyo, Japan, Beals updated local ILP members on materials research associated with the faculty at MIT. Companies represented included Nissan Motor Company, Honda, Osaka Gas, Dai Nippon, Fujitsu, Mitsui, Ricoh, Astellas Pharma, and Sekisui. The meeting was held in the Keidanren Kaikan part of Tokyo, just outside the Emperor's Palace.

Communications and Outreach

The increasing shift to online information transfer has catalyzed a more focused initiative utilizing the website as a campus-wide materials reporting resource. The MPC website has become a highly successful portal for materials news and events within the MIT community. This year, the website was redesigned by Maria Aglietti, senior communications officer, to highlight the news stories generated on a monthly basis for the new e-newsletter. The e-newsletter is sent to anyone who has attended a Materials Day event or who has signed up to receive it on the website. MPC has also started using social media (Twitter, Facebook, and Google+) to communicate with its audience.

The addition of a science writer position to the communications team has given MPC the opportunity to keep the website fresh, with new content added daily. The science writer, Denis Paiste, who brings many years of experience in the newspaper industry, writes feature articles highlighting faculty and student research for the e-newsletter. The addition of this position has given MPC more visibility not only within the materials community but also within the MIT community. Paiste has submitted stories to the MIT news office and several have been selected to be highlighted on the MIT news website. Paiste not only produces news stories on cutting-edge research but also provides the corresponding images and video.

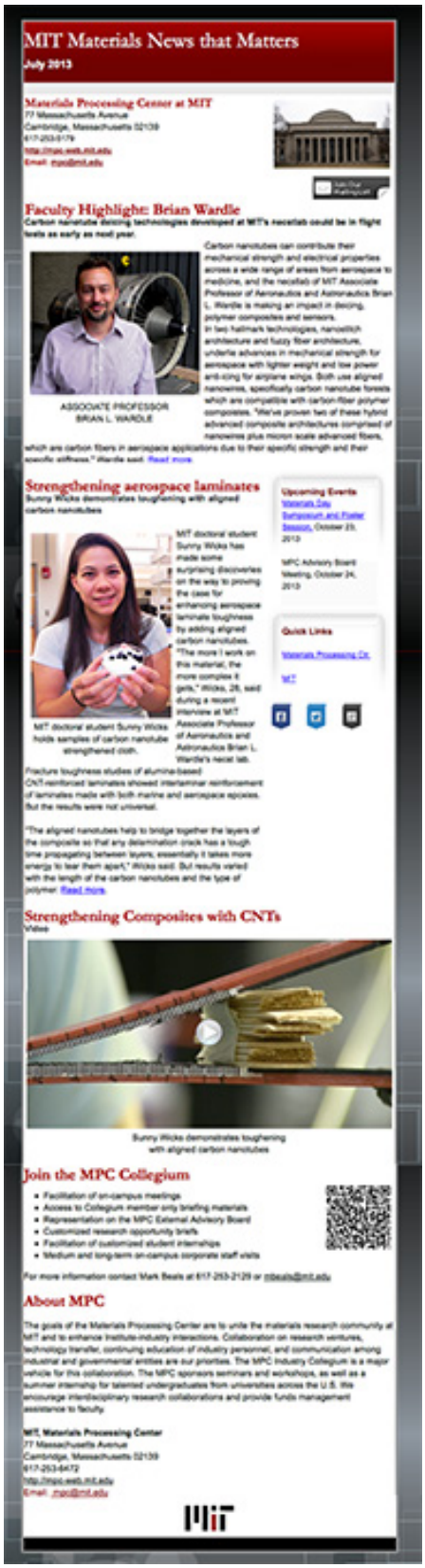

Figure 2: The MPC e-newsletter, sent out monthly.

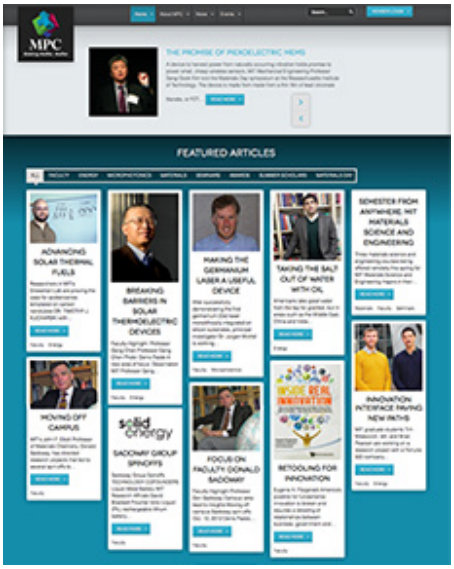

Figure 1: Screen capture of the new MPC website homepage featuring a news and announcements segment that can be sorted by topic.

Summer Research Internship Program

MPC does not limit its educational outreach to the MIT community. For 30 years, it has co-sponsored with the Center for Materials Science and Engineering (CMSE) a summer internship program for promising undergraduate researchers from other colleges and universities nationwide. The MPC-CMSE summer internship is a National Science Foundation Research Experience Program for undergraduate students. The program brings the best science and engineering students in the country to MIT for graduate-level materials research in laboratories of participating faculty. The program culminates in a poster session, held in the lobby of Building 13, where students present their research to the MIT community.

The 2013 nine-week program ran from June 9 to August 10 and involved 18 faculty and 18 students from schools including Texas A&M University, the University of Pennsylvania, the University of West Georgia, Universidad del Turabo (Puerto Rico), the University of Massachusetts Amherst, Rutgers University, North Carolina Agricultural and Technical State University, Xavier University of Louisiana, the University of North Dakota, Virginia

Polytechnic Institute, Louisiana State University, Iowa State University, Washington University in St. Louis, Rice University, and Northern Kentucky University.

Figure 3: 2012 summer scholars

Materials Day

Sharing knowledge and insight with others in the materials science and engineering field can lead to new ideas, collaborations, and breakthroughs. Once a year, the materials community is invited to Materials Day, a celebration to recognize and honor the many important accomplishments and achievements of the past year and to talk about the future.

Held in the fall, Materials Day is a daylong symposium on a featured topic related to materials science and processing, followed by a graduate student/postdoctoral associate poster session. The Materials Day 2012 Symposium focused on computational materials and looked back at the 33-year legacy of MPC and how its widening focus has come to define an interdisciplinary hub of activity today. Seven presentations were made over the course of the day, from both faculty and industry professionals, drawing a crowd of more than 154 attendees.

Invited speakers and their talk titles included Dr. Lon E Bell, Amerigon, "Thermoelectrics: A Promising Material System for Solid State Power Generation Waste Heat Recovery and Thermal Management;" Professor Chen, Mechanical Engineering Department "Nanostructured Materials for Thermoelectric Energy Conversion;" Dr. Sergio Kapusta, Shell International Exploration and Production Company, "Materials Challenges of Future Energies;" professor Rahul Sarpeshkar, EECS, "Glucose-powered Medical Implants;" Professor Kim, Mechanical Engineering Department, "The Piezoelectric MEMS [Micro-Electro-Mechanical Systems] Energy Harvesting: A Reality Soon;" Dr. David Eaglesham, Pellion Technologies, "Thin-film PV [Photovoltaics] for Low-cost Solar;" Professor Fitzgerald, DMSE, "Silicon-based High Efficiency Solar: Technology and Opportunities;" and Professor Thompson, DMSE and MPC director, who led the opening welcome presentations.

The poster session that followed panel presentations and discussions included over 75 posters presented by graduate students and postdoctoral associates from departments including Chemical Engineering, Chemistry, Civil and Environmental Engineering, Electrical Engineering and Computer Science, Aeronautics and Astronautics, Materials Science and Engineering, Mechanical Engineering, Nuclear Science and Engineering, Biological Engineering, and Physics. The posters were judged by a panel of representatives from industry as well as members of the MPC advisory board. Winners received award certificates and $500 prizes. Poster session winners were:

Ahmed Al-Obeidi, DMSE
"Silicon Nanowires for Energy Storage in Microsystems"
Sponsor: NSF
Faculty advisor: Professor Thompson

David Cohen-Tanugi, DMSE
"Graphene as a Desalination Membrane"
Faculty advisor: Professor Jeffrey Grossman

Hyomin Lee, Chemical Engineering
"Zwitter-wettability and Antifogging Coatings with Frost Resisting Capabilities"
Faculty advisors: Professors Rubner and Cohen

Materials Day 2013 is scheduled for October 23, 2013.

Figure 4: Materials Day 2012 Poster Session winners, from left to right Carl V. Thompson, director, MPC; Rodolfo Camacho-Aguilera, Materials Science and Engineering; Ahmed al-Obeidi, Materials Science and Engineering; Hyomin Lee, Chemical Engineering; Dr. Ernest Littauer, advisory board chair; Mark Beals, associate director, MPC

Research Volume

MPC's five priority research areas are medical materials, photonics, energy, environment, and nanotechnology. Total expenditures under MPC totaled $17million in FY2013 (-15%). Major program expenditures included Professor Chen's S^3TEC DOE

Energy Frontier Research Center work on solar thermal energy, professor Alexander van Oudenaarden's NIH funding on stochastic gene expression and signal transduction in single cells, Professor Fitzgerald's (and seven co-principal investigator's) work on lattice engineering substrates for disruptive electronics by Singapore's National Research Foundation, Professor Sadoway's ARPA–E program on liquid metal batteries, and Professor Thompson's Iberian Nanotechnology Lab's research collaboration on nanoscience and nanotechnology, co-shared with the Microsystems Technology Laboratory.

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, DOE, NIH, the Defense Advanced Research Projects Agency, the Air Force Office of Scientific Research, the Office of Naval Research, and the US Army Research Laboratory.

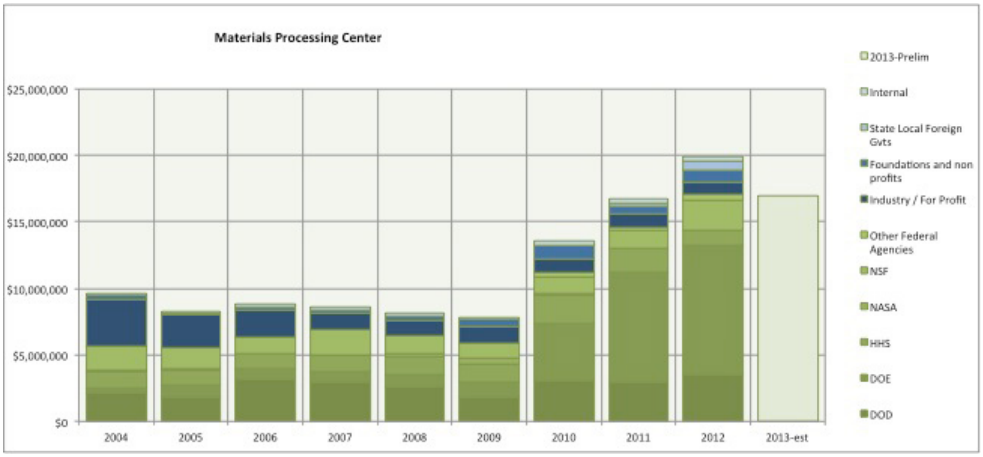

Figure 5: MPC sponsored research volume, spanning FY2004–2013

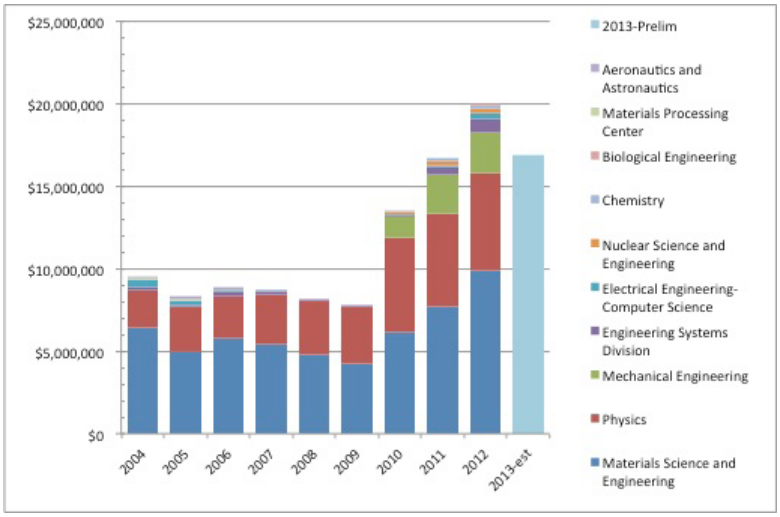

Figure 6: MPC academic affiliations 2013

Overview and Outlook

MPC has experienced a sustained period of growth in research volume, which increased from $8 million in FY2009 to $20 million in FY2012. In the past year, however, we saw a drop in research volume by 15% to $17 million. Professor Sadoway's ARPA-E program, which was on stimulus funding, has come to its natural end, resulting in a $2.5 million decrease in MPC FY2013 research volume. There will be an additional drop of $0.8 million associated with the end of this program in FY2014. There were also other, smaller programs affected by the end of the stimulus funding, but there appears to have been little effect so far of the sequestration process. In FY2013, the Iberian Nanotechnology Laboratory–MIT program also came to an end as a consequence of the financial crisis in Spain and Portugal. The end of this program was not anticipated, and while the impact on FY2013 research volume was relatively small—$0.4 million per year—the program had been designed to generate a much higher steady research volume of $3.5 million per year, split between MPC and the Microsystems Technology Laboratory. It is unfortunate that this program was terminated before it had a chance to reach its full potential. In addition, the winding down of Professor van Oudenaarden's large research program as he transitions to his new home in the Hubrecht Institute also affected FY2013 research volume.

While the FY2013 research volume was down compared to FY2012, aside from the issues previously outlined, an upward trend in volume was sustained. This trend should continue. The research programs of relatively junior faculty, such as Professors Gore and Jarillo-Herrero of Physics, and Professor Allanore, of DMSE, are growing at a rapid pace. A new NSF Science and Technology Center for Integrated Quantum Coherent Materials, directed by professor Raymond Ashoori of Physics, will begin in August 2013 and will have a steady state research volume of $1 million per year. In addition, an MPC-based proposal was selected for first-round funding as a SkolTech research center—the Center for Electrochemical Energy—and its annual budget is expected to be $2.5 million per year in the steady state. It should be noted, though, that the start of this program has been delayed for almost a year and it is not yet clear when it will officially start. The S^3TEC research is in its final year, and a proposal for renewal will be developed. This EFRC program is supported through the annual DOE budget, not through stimulus funds. Taken together, it seems likely that the research volume in MPC will remain in the $18 million to $20 million range for the next few years, with some possibility for growth.

Over the past year, MPC has expanded its services to the MIT and external communities. In FY2012, Gilbert Cordova joined MPC as a senior financial administrator, joining administrative officer Jonathan Bartels, to double staffing in the financial area and provide more extensive and customized financial services to faculty. These include the development of new tools and capabilities to provide budget projections for the entire funding portfolio of a group or program, and to provide these projections for various scenarios. In FY2013, MPC created a temporary position (renewed annually) for a science writer. Denis Paiste joined the center and—working with senior communications officer Maria Aglietti—played a key role in enabling the development of the electronic newsletter, which has been a resounding success both in MIT internal community building and in outreach to the external community. An increase in personnel in the

communications area was also critical for the redesign of the MPC website and the development of new print documents describing MPC activities. Because of the increased staffing, MPC is now also able to offer website development support to MPC faculty.

MPC activities such as Materials Day and the summer internship program for undergraduates are made possible through funds received from members of the MPC Industry Collegium. The collegium membership had gradually declined over the past decade and this year MPC sought to attract new members, providing motivation for the development of the e-newsletter and the redesign of the new website. As part of its rebranding process, MPC developed new marketing materials and brochures, and changed its logo. The new brochures clearly articulate the current benefits and value added of becoming a collegium member. MPC has also worked closely with ILP in identifying ILP current and potential member companies that are likely to benefit from MPC Industry Collegium membership. As a result of this effort, the collegium membership has grown by three this year, to a total of 10. MPC plans to continue to amplify this trend in the coming year.

The commitment by MIT to build a new nanofabrication and materials facility (nMASS) will have a hugely beneficial impact on the materials research community at MIT. The building of nMASS is probably the most important event for the materials community in the last several decades and will require the demolition of Building 12, which is the site of MPC headquarters. The Building 12 location is the most logical choice for the new building; however, MPC staff is understandably anxious to know what the next few years will hold in terms of change(s) in location. This could be an important opportunity to make a move that will be beneficial even if Building 12 remains in place.

MPC looks forward to continuing its work with individual faculty members and teams of faculty to develop and support new interdisciplinary research programs. As always, the center will continue to search for new ways to interact with industry in order to create collaborations that promote the two-way exchange of expertise and lead to the development of new materials and processes that provide a sustainable improvement in the quality of life worldwide.

Carl V. Thompson
Director
Stavros Salapatas Professor of Materials Science and Engineering