

Federal Agency Representatives Detail AMPP Implementation at MRS Forum

Representatives from the U.S. Department of Energy, NASA, the National Science Foundation, and NIST gathered at the MRS Forum on Advanced Materials Processing to describe their programs for implementing the 1993 Presidential initiative on materials, the Advanced Materials and Processing Program (AMPP). The Forum was held during the 1992 MRS Spring Meeting in San Francisco.

Karl Erb, acting associate director for physical sciences and engineering, Office of Science and Technology Policy (OSTP), explained the history of events leading to the development of the AMPP and identified its goals. The AMPP was developed under the aegis of the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET), which is chaired by OSTP Director D. Allan Bromley.

The broad goal of the program, said Erb, is "to improve the manufacture and performance of materials to enhance U.S. quality of life, national security, and industrial productivity and economic growth." This goal recognizes that materials science is not an orphan, but a critical and enabling technology, he said. "Materials science is now seen as...an endeavor that has everything to do with the economic competitiveness of the nation in the future."

The resulting 1993 federal budget request for the AMPP is \$1,821.4 million, an increase of \$1,62.8 million more than was appropriated in FY 1992. Erb described the 10% increase as significant in a year when total domestic discretionary expenditures are being limited.

The requested funds would be divided among synthesis/processing (also the largest dollar increase, \$65 million); theory, modeling, and simulation; materials characterization, education/human resources (the largest percentage increase, 36% or \$5.8 million); and national user facilities.

Editor's Note: During the Forum, Karl Erb and other speakers referred attendees to an upcoming comprehensive published inventory of all federal agency activities involving the AMPP. That 380-page inventory, *Advanced Materials and Processing: The Fiscal Year 1993 Program*, is scheduled to be available near the end of July. It details the AMPP-related activities of the 10 federal agencies participating in the program: Departments of Agriculture, Commerce, Defense, Energy, Health and Human Services, the Interior, and Transportation; Environmental Protection Agency; NASA; and the National Science Foundation.

If you are interested in obtaining a copy of this 380-page report, please circle Reader Service Card No. 75. The *MRS Bulletin* understands there is no charge for the report.

Also available is *Advanced Materials and Processing: The Federal Program in Materials Science and Technology*, a 64-page brochure that introduces the AMPP and the administration's proposed FY 1993 AMPP budget. For a copy of this free 64-page brochure, circle Reader Service Card No. 80. DOE Plans Extensive Implementation

Iran L. Thomas, director of the U.S. Department of Energy's Division of Materials Sciences in the Office of Basic Energy, described the DOE as the federal government's largest supporter of materials R&D. "Practically everything we do in the Department of Energy to try to improve efficiency and prevent materials from falling apart...is limited by the properties of existing materials," said Thomas.

The DOE actually falls behind the Department of Defense, Health and Human Services, and NASA in total requested R&D support (\$73.63 billion) for FY 1993 and is slated for almost the lowest monetary increase (\$0.1 billion) in the administration's total requested increase of \$2.5 billion. But, requested AMPP R&D funding for DOE is the largest. DOE's request (excluding classified research) is \$678 million; DOD is next with \$432 million (also excluding classified research); then NSF, \$319 million; NASA, \$154 million; HHS, \$82 million; USDA, \$66 million; DOC \$48 million; other, \$44 million.

The two DOE offices with the largest proposed increases under the AMPP are energy research and conservation and renewable energy. The \$52 million increase for energy research (includes fusion energy and operation and construction of major facilities) brings the FY 1993 request to \$418 million. The request for conservation and renewable energy is up \$25 million from FY 1992. This area also includes two new initiatives, automated ceramic manufacturing (directed toward ceramic engine components) and lightweight transportation materials, with respective funding of \$3 million and \$2 million.

Thomas recommended three sources for information about DOE programs:

- **Materials Sciences Programs FY 1991** — Describes all the materials sciences programs supported by DOE's Division of Materials Sciences. For a copy, Circle Reader Service Card No. 83.
- **Energy Materials Coordinating Committee (EMaCC) Publication** — Contains information about materials programs throughout the DOE, including names and phone numbers for contact persons. For a copy, circle Reader Service Card No. 84.

- **Application and Guide for the Special Research Grant Program (DOE)** — Circle Reader Service Card No. 85.

NASA Stresses Integration of Efforts

Samuel Venneri, director of the Space Research Division in NASA's Office of Aeronautics and Space Technology, said that NASA's philosophy to implement the AMPP is based on linking industry and university personnel with NASA's own researchers for a complete follow-through on designing and engineering materials for specific conditions.

"There has to be integrated product team development," said Venneri. "Our philosophy at NASA is to have that occur between the materials suppliers, the vendors, as well as the primes [such as Boeing or McDonnell-Douglas] where those materials systems get utilized."

Venneri used examples from NASA's plans for supersonic aircraft, subsonic transportation, and space-related missions to describe NASA's approach to implementing the AMPP. NASA is working with industry to develop a viable technology for a mach 2.5, 300-passenger, 5,000-mile range aircraft certifiable for 60,000 flight hours and beyond for the year 2000+. "Basically, materials is the fundamental show-stopper for that coming into being," he said.

Space systems, for example, will require space curable adhesives, an aero-braking shield material with more heat resistance than current shuttle ceramics, and alloys for nuclear propulsion. "We're looking at 4,000-degree reactor systems, refractory-reinforced alloys...developing shielding concepts to protect the crew from space-based radiation as well as from the reactor itself."

NASA's FY 1992 budget for materials research is roughly \$130 million, not including shuttle improvement or designing space station modules, said Venneri. The requested FY 1993 increase is about \$15 million, a 10% growth, to support high-speed civil transport materials research.

NSF Plans Major AMPP Initiatives

Jagdish Narayan, director of the National Science Foundation's Division of Materials Research, described three major NSF initiatives—materials synthesis and processing, computational approaches to real materials, and materials education—already in progress and scheduled for expansion under the AMPP's proposed FY 1993 budget. He also announced an advanced manufacturing initiative that he hopes will become a FCCSET initiative in FY 1994.

Nine NSF divisions are participating in the materials synthesis and processing initiative, and 682 proposals are already under

tative, and 682 proposals are already under evaluation, said Narayan. The Division of Materials Research (DMR) is a major participant in this \$20 million (new money) endeavor, with about 50% of the funding. Present areas of emphasis—electronic and photonic, biomolecular, structural, magnetic, and superconducting materials—combine base and enhanced elements but will all be equal under the AMPP, said Narayan. The next solicitation for proposals under this initiative and the deadlines have not yet been set, but if you would like to be put on the list for information when it becomes available, circle Reader Service Card No. 90.

Under the AMPP, FY 1993 funding for the advanced manufacturing initiative would increase 31% over FY 1992 to \$104.5 million. The NSF's focus would be on total integration of design, manufacturing, and management processes for rapid prototyping of new products and manufacturing systems. The DMR would focus on *in-situ* process control down to the atomic level, sensor materials and process integration, and novel and improved processing and manufacturing methods.

Of the proposed \$318.5 million AMPP increase (20% over FY 1992), 50% of this increment would go to individual investigator awards and 50% to small groups and centers, said Narayan.

Other Agencies Plan AMPP Enhancements

Lyle Schwartz, director of NIST's Materials Science and Engineering Laboratory, spoke strongly about the opportunities offered by the AMPP. "For the last two decades, I've been hearing people in the materials field say, over and over again, 'If only we could get our act together and speak with one voice before the Congress...we'd finally have our opportunity'....Let me emphasize that if we're going to have such a chance, it is here, it is now, and it is this program."

Schwartz described the AMPP not as the perfect solution, but as a continuing activity with open channels of communication. "We want to hear from you; we want to find out what we haven't done," he said.

Schwartz focused the rest of his comments on characterizing the philosophy underlying other federal agencies' AMPP plans.

NIST's materials effort includes \$45 to \$50 million in-house in Commerce Department money, with about 40% more from other agencies working with NIST, he said. NIST is especially proud of its cold neutron research facility, the only such U.S. facility comparable with those in Europe and Japan, said Schwartz. AMPP enhancements, a 10% increase in budget, will focus on intel-

ligent processing of materials, materials for electronic interconnects, and functionally gradient materials. These projects all involve interaction with industry and consortia (helping form them if necessary) and CRADAs.

The Department of Transportation, with a 76% budget increase under the AMPP, will concentrate on pavement and structures technology and the problem of aging aircraft. According to a DOT spokesperson, a 1% increase in the durability of materials could save the nation \$30 billion.

The U.S. Department of Agriculture's AMPP enhancements are based on a 16% budget increase. They center on developing agricultural materials from vegetable oils, bioplastics, and national paper and wood recycling for new materials.

The Environmental Protection Agency has a \$3 million investment in R&D, mostly in materials and would receive a 29% increase under the AMPP. "The lack of investment [in materials R&D] by EPA might be considered a serious national issue because we are concerned about regulations made in the absence of good understanding of the implications," said Schwartz.

Health and Human Services, which comes in for a 7% increase under the AMPP, has a broad-based agenda of enhancements. Biomaterials scientists have essentially developed all the materials on the shelf, said Schwartz. They recognize that to further improve compatibility with body parts and extend lifetimes, they will have to develop new materials, he continued.

The Department of Defense has no AMPP enhancements planned for FY 1993. The DOD is in a two-year budget process, and the AMPP came along when it had already submitted its budget request to Congress, he explained. Rather than change the FY 1993 request, DOD is planning FY 1994 AMPP emphasis on electronic, photonic and structural materials (especially composites); sensor-based processing and smart materials; and theory, modeling and simulation of materials processing and manufacturing. DOD's major goal will be to reduce materials and device/component costs.

For expanded information about all the federal agencies' participation in the AMPP, Schwartz recommended consulting the AMPP inventory, *Advanced Materials and Processing: The Fiscal Year 1993 Program*. (To get your copy, see *Editor's Note* on p. 22.)

Commerce Department Announces 27 ATP Awards

Representatives from the advanced materials community, particularly those in electronic materials, were beneficiaries of a large share of the 27 awards presented as part of

the recently announced second phase of the U.S. Department of Commerce's Advanced Technology Program (ATP). Despite the fact that the government intends to ante up some \$90 million, this was only the second round of what promises to be an ever-expanding program. With industry's contribution, the total reaches \$190 million to fund "emerging technologies."

"Our participants ranged from very small firms with a handful of employees and some good ideas to some very large companies, and included consortia of both groups," said Commerce Secretary Barbara Franklin. "Outstanding proposals came from exciting new fields including advanced materials, biotechnology, high-temperature superconductivity, electronics, and computing."

The next solicitation is expected to begin in July and close in September, according to a spokesman at the National Institute of Standards and Technology, which manages the program. For information, contact Advanced Technology Program, Room A 430, Administration Bldg., NIST, Gaithersburg, MD 20899; phone (301) 975-2636.

The following list identifies awards of interest to the materials community.

Synthesis and Processing of Nanocrystalline Ceramics on a Commercial Scale, awarded to Nanophase Technologies Corp. Nanocrystalline ceramics could provide solutions to the problems of using additives to improve the qualities of often hard-to-form ceramics. In many instances, such additives end up as impurities in the final product. Total ATP request is \$944,000; the company, with the help of Caterpillar, Inc., intends to provide \$2.065 million.

Development of Cost-Effective Routes to Compatibilize Polymers in a Commingled Waste Stream, awarded to Michigan Molecular Institute. The institute is receiving \$2 million from ATP during the three-year program and providing \$3.8 million on its own funding. The program aims to improve the properties of recycled plastics by adding minor amounts of a second material, such as a block or graft copolymer. Aiding in the effort are Waste Alternatives, USA Resource Technologies, Eastman-Kodak Co., and the University of Florida.

Advancement of Monocrystalline Silicon Carbide Growth Processes, awarded to Cree Research, Inc. A world leader in silicon carbide technology, Cree now produces high-quality silicon carbide crystal boules in one-inch diameters. The group proposes to greatly reduce the defect density and increase the boule size. They also hope to significantly improve the current epitaxial deposition and doping process, which they hope will eliminate barriers to more widespread commercialization. Total ATP request is \$1.957 million; Cree will add \$435,000.

Integrated Force Array, awarded to the Microelectronics Center of North Carolina (MCNC). This three-year program has a total request of \$1.2 million; MCNC will contribute

\$718,000 over that time. MCNC, which is composed of North Carolina industry, universities, and government, intends to develop manufacturing technology for very large-scale arrays of electrostatic force cells. Such an Integrated Force Array would resemble a thin plastic membrane and be composed of millions of microscopic cells. The idea is to capture electric static force naturally given off by electrical energy and convert it to motion with high efficiencies and low mass.

Novel Near-Net-Shape Processing of Engineered Ceramics, awarded to Garrett Ceramic Components, a unit of Allied-Signal Aerospace. The total request for the three-year program is \$1.16 million, with Garrett contributing \$954,000. The company would develop a technique initiated at the Oak Ridge National Laboratory known as gel casting. The hope is to machine advanced engineering ceramics more uniformly using the process.

Cyclic & Thermoplastic Liquid Composite Molding for Automotive Structures, awarded to Ford Motor Co. and General Electric. The project length is five years and ATP is

providing \$5.29 million to go with \$5.5 million from Ford and GE. The group hopes to use the technology to make the U.S. auto industry more competitive by providing lighter weight materials for cars through further developing thermoplastic processes.

Ultra-High Density Magnetic Recording Heads, by the National Storage Industry Consortium. The five-year program requests \$5.5 million and will chip in \$6.25 million of its own. The Consortium proposes to develop the underlying technology for radically new magnetic storage based on the recently discovered giant magnetoresistive effect. The target is a data recording head capable of recording at a density of 10 gigabits per square inch. Seven companies and six universities are involved.

Polymeric Switches for Optical Interconnects, by IBM, a 3-year deal requesting \$1.8 million and providing cost sharing of \$2.24 million.

Thermal Insulation Materials—Morphology Control and Processes for the Next Generation of Performance, by Armstrong World Industries, Inc., requesting \$1.87 million for a

three-year program and providing \$2.65 million in cost sharing.

Neural Network Control and Sensors for Complex Materials, proposed by Honeywell, Hercules Aerospace, Sheldahl, and 3M Co. The five-year request is for \$2.35 million and the team will provide \$2.45 million.

NCMS Rapid Response Manufacturing, awarded to the National Center for Manufacturing Sciences, which includes Ford and General Motors, among others, with input from DOE's Oak Ridge National Laboratory. Total request is \$19.75 million over five years, with matching funds of \$26 million.

X-Ray and Neutron Focusing and Collimating Optics, awarded to X-Ray Optical Systems, Inc. Total ATP request for the 3-year radiography program is \$1.9 million with the company providing \$371,000.

Hybrid Superconducting Digital System, awarded to a consortium including Conductus, Inc., TRW, Hewlett-Packard, Stanford University, and U.C. Berkeley. Total request is \$7.4 million with a like amount coming from the consortium.

Manufacturing Technology for High-Performance Optoelectronic Devices Based on Liquid Phase Electro-Epitaxy, awarded to AstroPower, Inc. Total request is \$1.4 million with the company providing \$1.58 million.

High-Temperature Superconducting Racetrack Magnets for Electric Motor Applications, awarded to American Superconductor Corp., in collaboration with Reliance Electric Co. and Oak Ridge National Laboratory. The 3-year request is \$1.88 million with cost-sharing funds of \$2.56 million.

Monolithic Multiwavelength Laser Diode Array Spanning 430 to 1100 nm, awarded to Spectra Diode Labs and Xerox Corp. Total request is \$8.9 million over five years, with the companies providing \$9.1 million.

Development of Advanced Technologies and Systems for Controlling Dimensional Variation in Automobile Body Manufacturing, awarded to the Auto Body Consortium. Total request is \$4.8 million, with the consortium providing \$9 million over the three-year life.

Cyclic Thermoplastic Liquid Composite Molding for Automotive Structures, awarded to Ford Motor Co. and General Electric. The five-year program centering on polymer composites entails over \$10 million to be split about evenly.

Scalable High-Density Electronics Based on Multiform Modules, awarded to the American Scaled-Electronics Consortium. The Consortium is requesting \$2.8 million and providing \$2.9 million.

A Feedback-Controlled Metalorganic Chemical Vapor Deposition Reactor, awarded to Spire Corp. A total request of \$1.2 million with cost-sharing funds from Spire of \$973,000 for the two-year program.

PREAMP-Pre-competitive Advanced Manufacturing of Electrical Products, awarded to the South Carolina Research Authority. The consortium will spend \$10.8 million and is asking \$5.2 million.

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