

NMAB Report Identifies Critical Materials R&D for 21st-Century Defense

Computational modeling and simulation and the establishment of a centralized database of materials and their properties were among the chief recommendations of a report issued in October from the National Research Council's National Materials Advisory Board (NMAB) on materials research to meet 21st-century defense needs. Sponsored by the Department of Defense (DoD), the study identifies critical materials and processing research and development (R&D) that will be needed for the year 2020 and beyond.

"New materials and processing methods are crucial to the improved performance and reliability of advanced weapons," said Harvey Schadler, now retired from General Electric's Corporate R&D Center, who chaired the NMAB Committee on Materials Research for Defense After Next, the group charged with conducting the study. "Our goal is to get the full materials community to interact with the full defense community, in order to create better awareness of the link between advances in materials research and how they might impact the future of defense in the next 20 years," he said.

The DoD conducts studies regularly, but this one was unique in both its scope and its futuristic focus.

"Rather than focusing on very narrow areas of materials science, the idea was to get a group to take a broad look at what might be out there in materials science that could have a positive impact on defense," said Steven Wax, the Defense Advanced Research Projects Agency (DARPA) liaison to the committee. "Answering either question alone—'What's the future of materials science?' 'What's the future of defense?'—is difficult. Addressing how the two merge is twice as hard. We didn't want them [the study members] to solve today's problems, we wanted them to look at solving tomorrow's problems with tomorrow's materials technologies. That's a much more daunting task."

During the initial phase, the committee met with technical representatives of the military services and DoD agencies, the directors of service laboratories, and managers of DoD agencies in order to understand DoD's vision of current and future weapons, systems, and logistics requirements. It also met with materials experts from industry, academia, and national laboratories to identify cutting-edge research that could pay off in the 20- to 30-year time frame. The results were documented in an interim report released in January 2001.

For the second phase, the committee

appointed five technical panels to explore in depth the new opportunities in their areas of materials research and relate them to DoD needs: structural and multifunctional materials, energy and power materials, electronic and photonic materials, functional organic and hybrid materials, and bio-derived and bio-inspired materials. Each panel worked independently, and their conclusions were ultimately merged into five central—though inter-related—recommendations.

Foremost was the recognition of the importance of computational modeling and simulation in the design of new materials.

"Frankly, that's where the cost efficiencies will occur," said Schadler. "It will also help speed the process of discovery, especially when combined with the recommendation to establish a database of materials and their properties." Potential benefits include a better ability to predict and select new materials, improved design processes for structural composites, and the design of materials with extreme properties.

Another recommendation was that the DoD should make research investments that promote the convergence, combination, and integration of biological, organic, semiconductor, photonic, and structural materials—concepts that are expected to be major themes for defense systems of the future.

"Statistically speaking, history has shown that major advances often occur at the points of convergence among disparate areas," said Schadler. "So if you want to improve the probability of making groundbreaking new discoveries, that's where you should look." The DoD should also make research investments that promote the discovery and characterization of new materials with unique or substantially improved properties, according to the report.

Lewis Slotter, associate director of materials and structures at the Office of the Deputy Undersecretary of Defense for Science and Technology, cited the report's recognition of the criticality of materials processing, and the value of continued advances in this area, as another significant finding, particularly for novel and developed areas of materials science such as large-scale processing of nanomaterials and biomimetic materials manufacturing.

According to the report, "These materials must first be processed and demonstrated successfully in the laboratory on a small scale before there can be practical and robust methods for scale-up to sufficient quantities."

Finally, the committee outlined several recommendations for management processes to accelerate the transition of

materials from concept to service.

"The committee recognized that realizing the revolutionary new defense capabilities that materials science offers will depend on more than just R&D," said Schadler. "Innovative management will also be needed to reduce risks in translating basic research into practical materials, and to promote cross-fertilization of scientific fields that traditionally have had little experience or contact with each other."

The DoD's response has been positive. Slotter found it "gratifying" that the report "largely validated the general direction of DoD materials research." He added, "[T]he report does a very fine job showing that materials advances do have a significant impact on defense materials and capabilities." He expects that the document is likely to have an impact on how materials researchers and users in the defense community approach selecting materials, and that it will prove useful for longer-range planning. Nonetheless, it is difficult to predict the study's potential impact.

"These are exciting new areas of science, but we have no idea where some of these discoveries will be important, much like no one could predict the computer revolution that resulted from the discovery of semiconductors 50 years ago," said Schadler. "Our report is intended to provide guidance for future policy decisions, not to dictate to the DoD what those should be."

Julia Phillips, a committee member and materials scientist at Sandia National Laboratories, said she hopes the study will ultimately influence funding decisions at federal agencies that support materials research.

However, Wax said, "It's difficult to say how studies like this directly affect funding priorities. The payoff for the DoD will come when researchers start applying their discoveries to the defense sector."

JENNIFER OUELLETTE

Violeta Braach-Maksvytis to Head the Office of Australia's Chief Scientist

Australian Federal Science Minister Peter McGauran announced in September that Violeta Braach-Maksvytis will join Australia's chief scientist, Robin Batterham, and his team in promoting the value of science to the country. Braach-Maksvytis currently holds positions as a member of the Commonwealth Scientific and Industrial Research Organization's (CSIRO's) executive team, is co-director of CSIRO Nanotechnology, and is chair of the CSIRO Science Forum, with responsibility for CSIRO's strategic investments in the emerging sciences. She holds 25 patents in the field of nanotechnology.

Report Issued on Australian Survey on Commercialization of Research

At least 250 new start-up companies could be created by 2004 as a result of the Australian federal government's investment in research, according to the National Survey of Research Commercialization, meeting the five-year target proposed by a working group of the Prime Minister's Science, Engineering, and Innovation Council (PMSEIC) in 2001. Among the research projects profiled in the survey is the development of nanoscale cerium oxide slurries and research advancements into the behavior of magnetic materials in biological systems.

The study sought base-line data on the commercialization of research in 2000 from 34 universities, 15 medical research institutions, and all 21 research divisions of the Commonwealth Scientific and Industrial Research Organization (CSIRO). It was carried out jointly by the Australian Research Council (ARC), the National Health and Medical Research Council (NHMRC), and CSIRO. The report was released on September 20.

The Minister for Education, Science, and Training, Dr. Brendan Nelson, said, "Improving the effectiveness of how our society captures the benefits of university research is an important component of higher-education policy development. The information from this survey will provide a valuable contribution to the debate."

The report found that universities held equity in almost eight of every ten of their start-up companies and the adjusted gross income from 417 licenses yielded \$99 million in 2000 for the survey respondents.

The full report is available from the ARC Web site at www.arc.gov.au.

India Calls for Attention to Benefits of Nuclear Energy

Policy makers in India view nuclear terrorism as the largest hurdle in the promotion of nuclear energy. India has called for an integrated view of technology, safety, safeguards, and the newly emerging scenario with respect to nuclear terrorism and finding holistic answers that would help eliminate the barriers to large-scale development of nuclear power in a sustainable manner. The call was made in mid-September by Anil Kakodkar, chair of the Atomic Energy Commission and leader of the Indian delegation at the 46th General Conference of the International Atomic Energy Agency (IAEA) in Vienna.

Kakodkar said that at the present juncture, nuclear power is simultaneously witnessing stagnation, renaissance, and growth in different parts of the world. He said that stagnation is mainly due to

threats of nuclear terrorism as well as the failure of policy and opinion makers to realize the positive contribution that nuclear energy can make in the context of climate change and sustainability.

Irish Council for Science, Technology, and Innovation Delivers Statement on Measuring and Evaluating Publicly Funded Research

The Irish Council for Science, Technology, and Innovation (ICSTI) issued its report on "Statement on Measuring and Evaluating Research" in late August. Edward M. Walsh, chair of ICSTI, said that the key role of ICSTI policy is signaled in the National Development Plan 2000–2006 and reflected in the initiatives of the Higher Education Authority (HEA), Science Foundation Ireland, and the full range of state agencies supporting the evolution of Ireland as a "knowledge-based society." The statement provides a structured survey of the principal indicators and techniques used internationally to measure STI policy activities and to assess their impacts. The report can be downloaded from the publications page of Forfás, the National Policy and Advisory Board for Enterprise, Trade, Science, Technology, and Innovation, at Web site www.forfas.ie.

Busquin Calls on Public and Private Sectors to Increase European R&D Investment

European Union (EU) Research Commissioner Philippe Busquin has called on both the public and private sectors to play their part in increasing research and development (R&D) investment in Europe. Speaking at the Commissariat à l'Énergie Atomique (CEA) on September 10, Busquin said that Europe's underinvestment in R&D is principally due to the private sector, whose investment in R&D represents only 1.1% of the EU's gross domestic product (GDP), compared with 1.8% in the United States and 2.1% in Japan. He emphasized, however, that public authorities also have a role to play.

"Above all, it is a matter of improving the conditions for investment: human resources and capital markets, entrepreneurial spirit, the competition environment, and regulation favorable to innovation," Busquin said.

The commissioner also called for changes to EU's industry policy, highlighting biotechnology and fuel-cell technology as two areas where an appropriate indus-

trial policy is needed.

He said, "An important factor in the success of these initiatives is an attempt at coherence between, on the one hand, R&D, which creates these new opportunities, and on the other hand, [...] the regulatory framework, which makes faster commercialization of new technologies possible."

During a visit to the Jülich Research Center in Germany the same day, Busquin announced the forthcoming establishment of a high-level group on hydrogen to foster the development and use of hydrogen and fuel-cell technologies. The group will include senior representatives from leading European research centers, fuel-cell system and component producers, energy companies and utilities, automotive companies, and the public-transportation sector. The high-level group is expected to work with the commission in the preparation of a strategic research agenda.

NSTF of South Africa Issues Call for Nominations in Science

The National Science and Technology Forum (NSTF) of South Africa is awaiting nominations for individuals who have made the most significant contribution in science, engineering, and technology, thereby establishing themselves as role models. The deadline is **January 31, 2003**.

The annual awards program, now in its fifth year, is a part of the NSTF's effort to encourage South African businesses and institutions to continuously invest more financial resources in science and technology and encourage more young South Africans to devote their energies in this field so that sufficient new technology is developed to underpin national economic growth. Awards will be made to three individuals in South Africa who have made the most significant contributions to science, engineering, and technology (1) over a lifetime; (2) through research and innovation over the last two years; and (3) over the last two years through activities other than research and innovation, and who represent role models for others to follow. The awards program also includes a category for organizations. The award recipients will be announced in May 2003.

More information and nomination forms may be obtained from Web site www.nstf.org.za or by e-mail from the NSTF Secretariat, Mrs. Wilna Eksteen, at nstf@csir.co.za. The nomination forms are to be submitted to the NSTF Secretariat or delivered to NSTF, Room 326, Building 41, the CSIR Campus, Meiring Naude Road, Brummeria, Pretoria, South Africa. □

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