

Materials Science Thought Leaders Examine Global R&D Trends

Lynne Robinson



Human progress has largely been defined by the materials that form the basis of transformative technologies. In the last century, investments in research and development (R&D) have been critical to ensuring the deployment of new materials required for the advancement of solutions to the world's most pressing needs, with R&D support considered a leading indicator of a nation's innovative capacity and a precursor to its future growth, productivity, and sustainability. Exploring the connections between fundamental R&D and materials science, within the context of a complex and often volatile global economy, is the focus of a signature event being developed for the TMS 2013 Annual Meeting and Exhibition—the *Acta Materialia* Materials and Society Award Special Symposium.

The symposium, slated for Tuesday, March 5 from 2 to 5 p.m. in the Lila Cockrell Theater of the San Antonio Convention Center, is being organized to honor the accomplishments of Jeffrey Wadsworth, the 2013 *Acta Materialia* Materials and Society Award winner. (See sidebar article for details.) The symposium topic—Global R&D Trends: Implications for Material Sciences—examines ideas that Wadsworth himself has helped shape

as the chief executive officer and president of Battelle Memorial Institute, the world's largest nonprofit research and development organization. Kevin Hemker, the Alonzo G. Decker Chair of Mechanical Engineering, Johns Hopkins University, and symposium organizer, said that a goal of the event is to “provide the materials community with an insightful perspective on the globalization of research and development, as told by some of our most highly respected members.”

Hemker also noted that the symposium provides an opportunity to highlight Wadsworth's contributions as a tireless champion for the importance of materials science and engineering (MSE) in addressing societal needs. “Jeff is an extremely talented scientist with an innate sense of scientific curiosity,” Hemker said. “He also possesses great leadership and vision and a passion for service to society. It is rare to find an individual that possesses all of these traits, as well as the infectious enthusiasm that Jeff brings to everything that he does.”

Keynote Preview: “A Global Race for Discoveries”

Wadsworth will open the event with his keynote, “The Evolving R&D Model: International Trends and U.S.

Competitiveness.” The themes that he raises in this discussion will be illuminated by a series of talks by thought leaders representing key facets of the MSE enterprise. (See sidebar article, “Who's Who at the *Acta Materialia* Materials and Society Award Special Symposium.”)

Said Wadsworth, in previewing a few of the points he will make in his address, “Typically, in a global recession, there is the temptation to reduce R&D. This has not occurred. Countries and companies have recognized the link between R&D and economic prosperity and have decided to increase spending amidst the global economic slowdown.”

“However, in this age of instant gratification, there is an expectation that increased R&D funding will generate greater financial returns in a shorter amount of time,” Wadsworth continued. “This is unrealistic, as research and basic science can take years to produce tangible results. Unfortunately, many do not understand this relationship, which is leading to some questionable actions and programs.”

With this increase in total global R&D investment, Wadsworth observed that there has also been a noticeable shift in spending patterns. “The U.S. still leads in world innova-

ABOUT JEFFREY WADSWORTH



Jeffrey Wadsworth

The *Acta Materialia* Materials and Society Award recognizes outstanding contributions to understanding the relations between materials technology and society, and/or contributions to materials technology that have had a major impact on society. Said George T. (Rusty) Gray, fellow, Los Alamos National Laboratory, and chair, Board of Governors of *Acta Materialia*, Inc, on Jeffrey Wadsworth's selection as the 2013 recipient of this prestigious honor, "Jeff represents a seminal example of a researcher whose career has demonstrated outstanding capabilities and contributions in MSE. Simultaneously, he has impacted the effective and economic use of materials in the marketplace and the application of materials developments to national issues. His leadership and vision in and for materials science has strongly and directly affected the development and implementation of policy with regards to furthering the impact of MSE on our society."

Wadsworth has been president and chief executive officer of Battelle Memorial Institute since January 2009. Prior to this position, he led Battelle's Global Laboratory Operations business, overseeing six major laboratories for the U.S. Department of Energy (DOE), one for the U.S. Department of Homeland Security, and one for the United Kingdom's Department of Energy and Climate Change. He also led the expansion of Battelle's operations into China, Japan, Korea, and India and the development of partnerships with the private sector in those nations.

Wadsworth was educated at Sheffield University in England, where he earned both a bachelor's degree and Ph.D. in Metallurgy. Sheffield also later awarded him a Doctor of Metallurgy degree for his published work, as well as an honorary Doctor of Engineering degree—the university's highest recognition. Wadsworth came to the United States in 1976 and has worked at Stanford University, Lockheed Missiles and Space Company, and Lawrence Livermore National Laboratory. In 2002, he joined Battelle and served as a member of the White House Transition Planning Office for the U.S. Department of Homeland Security. From 2003 to June 2007, Wadsworth was director of Oak Ridge National Laboratory, the DOE's largest multipurpose science laboratory.

A 2000 TMS Fellow and TMS member since 1976, Wadsworth has authored or co-authored nearly 300 scientific papers and one book, and has been granted four U.S. patents. He was elected a member of the U.S. National Academy of Engineering in 2005 and the Chinese Academy of Engineering in 2012. His technical contributions are recognized internationally in the fields of superplasticity of metals and ceramics, refractory metals, high temperature materials, and Damascus and other ancient steels. As a board member of Achieve, Inc. and the Business Higher Education Forum, Wadsworth is committed to leading national efforts to enhance science, technology, engineering, and math (STEM) education.

"It is a great honor to receive this award," said Wadsworth. "Equally important, it reminds me of how fortunate I have been in my career to have had wonderful mentors and colleagues."

tion, but other countries are catching up," he said. "We are now in a global race for discoveries."

Wadsworth further noted that the current R&D environment differs greatly from the previous model dominated by corporations that supported large, complex programs such as Bell Labs and GE Labs. "We are currently in a period of 'open innovation,'" he said. "With increased globalization, R&D is no longer the sole domain of corporations. Companies such as Proctor and Gamble have revamped their R&D department in an attempt to acquire a significant percentage of their product ideas from external sources."

While the R&D process varies across industries and countries due to unique constraints and different levels of sophistication, Wadsworth maintains that this "willingness to consider ideas from outside the company" is a trend that needs to be universally addressed. "There are still many industries that only seek internal ideas and

miss the opportunity to tap a global network of talent," he said.

Another development that Wadsworth believes could benefit all industries is the approach used by many successful enterprises to incorporate business and process improvements into product development. "Apple is an example of a company that has developed new business and process models along with new products to completely change an entire industry," he said.

Opportunities for Materials Science

As R&D continues to shift and evolve on a global scale, Wadsworth said that materials science innovations will be as critical as ever to the realization of significant breakthroughs impacting on the health and well-being of the world community. In addition to enabling advances in such "high tech" areas as health care and electronics, Wadsworth stressed that technologies

ensuring access to basic needs—an adequate food supply, clean water, and safe and stable energy sources—are also dependent on materials science innovations.

"Materials science will play a leading role in overcoming these challenges," he said, "but in order to do so, there needs to be a renewed emphasis on scientific discovery and leadership, global R&D collaboration, and the ability to adapt to an increasingly dynamic marketplace."

Wadsworth said that the MSE community also needs to look outward and "educate both politicians and the public on why materials science is important for society and our economy. People do not realize how long-term technology investments have led to discoveries such as silicon for information technologies or metallurgy in space exploration. We need to consistently remind people how materials science has contributed to our prosperity."

WHO'S WHO AT THE ACTA MATERIALIA MATERIALS AND SOCIETY AWARD SPECIAL SYMPOSIUM

CRAIG R. BARRETT

Retired Chief Executive Officer/Chairman of the Board, Intel Corporation

Topic: Research and Development—The Key to Competitiveness in the 21st Century



Craig R. Barrett

Craig Barrett joined Intel Corporation in 1974 and held the positions of vice president, senior vice president, and executive vice president from 1984 to 1990. In 1992, he was elected to Intel's Board of Directors and promoted to chief operating officer in 1993. Barrett became Intel's president in 1997 and chief executive officer in 1998. In 2009, he stepped down as chairman of the Board, a post he had held since 2005.

A winner of the 1969 TMS Robert Lansing Hardy Gold Medal, Barrett currently chairs *Change the Equation*, a national coalition on STEM education. He also co-chairs the Lawrence Berkeley National Laboratory Advisory Board, is international co-chair of the Skolkovo Foundation Council, and serves as a faculty member of the Thunderbird School of Global Management.

SIEGFRIED S. HECKER

Co-Director, Center for International Security and Cooperation;

Emeritus Director, Los Alamos National Laboratory

Topic: Challenges for a Global Nuclear Energy Future



Siegfried S. Hecker

Siegfried Hecker is co-director of the Stanford University Center for International Security and Cooperation and senior fellow of the Freeman Spogli Institute for International Studies. Joining the Los Alamos National Laboratory as a technical staff member in the Physical Metallurgy Group in 1973, he served as chair of the Center for Materials Science and division leader of the Materials Science and Technology Division prior to becoming director of the laboratory. A 1998 TMS Fellow, Hecker began his professional career as a senior research metallurgist with the General Motors Research Laboratories in 1970.

Hecker's research encompasses plutonium science, nuclear weapon policy and international security, and cooperative nuclear threat reduction. Over the past 20 years, he has fostered cooperation with the Russian nuclear laboratories to secure and safeguard the stockpile of ex-Soviet fissile materials. His current interests include the challenges of nuclear India, Pakistan, and North Korea, the nuclear aspirations of Iran, and the peaceful spread of nuclear energy in central Asia and South Korea. Hecker is a member of the National Academy of Engineering, Foreign Member of the Russian Academy of Sciences, and Fellow, American Academy of Arts and Sciences.

WILLIAM D. NIX

Professor Emeritus, Lee Otterson Professor of Materials Science and Engineering, Stanford University

Topic: Linking the Challenges of Materials Technology with Opportunities in Materials Research



William D. Nix

William Nix is a pioneering researcher in the mechanical properties of materials. At Stanford, he directed the Center for Materials Research, chaired the Materials Science and Engineering Department, and mentored 77 Ph.D. graduates, many of whom hold prestigious appointments in universities worldwide.

A 1988 TMS Fellow, Nix has co-authored nearly 450 scholarly publications, including the textbook, *The Principles of Engineering Materials*. He has been elected to the National Academy of Sciences, the American Academy of Arts and Sciences, and the National Academy of Engineering.

SUBRA SURESH

Director, National Science Foundation

Topic: Global Science and Engineering



Subra Suresh

Subra Suresh was unanimously confirmed by the U.S. Senate as the director of the National Science Foundation (NSF) in September 2010. He leads the only U.S. government science agency charged with advancing all fields of fundamental science and engineering research and related education.

Prior to assuming his current role, Suresh served as the dean of the School of Engineering and the Vannevar Bush Professor of Engineering at the Massachusetts Institute of Technology (MIT). His experimental and modeling work on the mechanical properties of structural and functional materials, innovations in materials design and characterization, and discoveries of possible connections between cellular nanomechanical processes and human disease states have shaped new fields in the intersections of traditional disciplines.

A 2000 TMS Fellow, Suresh has co-authored more than 240 journal articles, registered 21 patents, and written three widely used materials science books. He has been elected to the U.S. National Academy of Sciences, National Academy of Engineering, American Academy of Arts and Sciences, Spanish Royal Academy of Sciences, Spanish Royal Academy of Engineering, German National Academy of Sciences, Royal Swedish Academy of Engineering Sciences, Academy of Sciences of the Developing World, Indian National Academy of Engineering, and Indian Academy of Sciences.