Productive Nanosystems: Launching the Technology Roadmap

Don’t miss this important event!
For 20 years, researchers have explored the amazing promise of atomically-precise manufacturing. Now, for the first time, the Technology Roadmap for Productive Nanosystems will show the way forward, and the payoffs along the road, to this ultimate technological revolution.

Over the last two years, under Battelle’s leadership, and hosted by four U.S. National Laboratories, researchers from academia, government, and industry have met to chart paths toward advanced, atomically-precise manufacturing. The resulting roadmap reveals crucial challenges and unexpected opportunities in the next steps forward. Join us for two intensive days with leading experts as we explore the power of advanced “bottom-up” nanotechnologies.

Why You Need to Be There
This unique event will address your questions, show how to fulfill the enormous promise of nanotechnology, and explore a wide range of applications:
- Super-efficient energy collection and storage
- Medical devices to detect and treat diseases at their earliest stages
- Next-generation computation
- Advanced sensors
- High-performance aerospace materials
- Intelligent materials and devices
- Many other technologies

Who Should Attend?
Anyone interested in unlocking the potential of productive nanosystems should attend, including:
- Research and development
- Design and engineering
- Manufacturing management
- Strategic planning
- Public policy makers
- Technology transfer specialists
- New product and business development
- Economic development
- Educators
- Media

The full spectrum of organizations involved in nanotechnology will be represented at this event including corporations, research institutions, investors, economic development organizations, public policy groups, educators, and government agencies.

Bonus: The Roadmap on CD
Following the event, SME will provide participants with access to presentations and technical papers from the event through a private website. In conjunction with Foresight Nanotech Institute and Battelle, participants at the event will receive a CD-ROM containing the Technology Roadmap for Productive Nanosystems.

Acknowledgements
The organizers of the Technology Roadmap for Productive Nanosystems would like to thank the Roadmap Partners: Biotechnology Industry Organization, Electric Power Research Institute, NanoBusiness Alliance, Nano Science and Technology Institute, SEMI, and the Society of Manufacturing Engineers. Special thanks also goes to The Waitt Family Foundation and Sun Microsystems for financial support of the project.
For complete description of all presentations, visit www.sme.org/nanosystems.
Wednesday, October 10

7:45 AM – 8:00 AM
Coffee and refreshments

8:00 AM – 8:30 AM
**DNA Nanotube-Enabled Alignment of Membrane Proteins for NMR Structure Determination**

The construction of atomically-precise, micron-length nanostructures that enable structure determination of membrane proteins, which represent the majority of drug targets, will be presented. Detergent-resistant liquid crystals of 0.8-μm-long DNA nanotubes that enable weak alignment of detergent-reconstituted transmembrane domain of the T-cell receptor have been generated. The use of DNA nanotube struts to self-assemble icosahedral cages that are 100 nanometers in diameter and future application as encapsulation devices and drug delivery vehicles will also be discussed.

William M. Shih, Harvard Medical School and Department of Cancer Biology, Dana-Farber Cancer Institute

8:30 AM – 9:00 AM
**Single-Atom Manipulation and the Chemistry of Mechanochemistry**

Central to advanced molecular manufacturing is the expectation of single-atom control for the fabrication of nanostructures and, eventually, productive nanosystems. Quantum chemical studies of candidate single-atom assembly structures are an important design tool, providing both a means to design optimization, and the ability to predict failure rates and defect structures associated with potentially reactive molecular species.

Damián G. Allis, Research Fellow, ICPRFP; Senior Scientist, Nanorex; and Theorist in Residence, Syracuse University

9:00 AM – 9:30 AM
**Biological and Nanoscale Systems**

The need to understand and engineer systems on similar scales presents a mutually beneficial merging of bio- and nano-sciences. This convergence can result in an unprecedented understanding of biological function and opportunities to apply biology’s engineering principles. An example of this will be presented, highlighting how the physical characteristics of the cell can be mimicked with nanomaterials to create novel analytical devices and to reveal details of natural cell function.

Mitchell J. Doktycz, Research Staff, Oak Ridge National Laboratory

9:30 AM – 10:00 AM
**Atomic-Scale Device Fabrication in Silicon**

A complete fabrication strategy towards atomic-scale device fabrication in silicon using phosphorus as a dopant in combination with scanning probe lithography and high purity crystal growth will be demonstrated. This process has been used to fabricate conducting nanoscale wires with widths down to ~8 nm, tunnel junctions, single electron transistors, and arrays of quantum dots in silicon. An overview of the devices made with this technology and some of the challenges to achieving atomically-precise devices will be presented.

Michelle Simmons, School of Physics, University of New South Wales, AUSTRALIA

10:00 AM – 10:30 AM
Break

10:30 AM – 11:00 AM
**Nanotechnology in Singapore: Towards Atomic-Scale Manufacturing**

The Agency for Science, Technology and Research (A*STAR) of Singapore has identified several strategic areas that include nanomagnetics, nanomicro fabrication, nanophotonics, and nanobiomimetics with applications in engineering sciences and human health. For example, at IMRE, activities in atomic scale technology focus on atomic scale manipulation and miniature scanning probe-type devices.

Khiang Wee Lim, Executive Director, Institute of Materials Research and Engineering (IMRE), SINGAPORE

11:00 AM – 11:30 AM
**Information Technology: Toward the Atomic Scale**

New lithographic processes, combined with increasingly sophisticated processes of natural pattern formation (templated and directed self-assembly), will enable us to learn to build objects with complex structure defined down to the atomic scale. This will require judicious choice of building blocks, clever dynamical steering of the self-assembly process, and design of structures that are tolerant of some defects. Although this is a long-term vision, sophisticated self-assembly processes are already beginning to enter high-volume semiconductor manufacturing.

Thomas Theis, Director, Physical Sciences, IBM Watson Research Center
Molecular Manufacturing

The 2007 winner will present the award-winning work in the area of theory. Previous winners include:

- Erik Winfree and Paul Rothemund, California Institute of Technology
- Christian Joachim, Center Nationale de la Recherche Scientifique, FRANCE
- David Baker, University of Washington and Brian Kuhlman, University of North Carolina
- Don Brenner, North Carolina State University
- Mark Ratner, Northwestern University
- Uzi Landman, Georgia Tech
- Ralph Merkle, Zyvex and Stephen Walch, ELORET NASA Ames

12:00 PM – 12:30 PM

**Feynman Prize Winner: Experimental**

The 2007 winner will present the award-winning work in the area of experimental. Previous winners include:

- Christian Schafmeister, University of Pittsburgh
- Homme Hellenga, Duke University
- Carlo Montemagno, University of California at Los Angeles
- Chad Mirkin, Northwestern University
- Charles Lieber, Harvard University
- Stan Williams and Philip Kuekes, HP Labs and James Heath, University of California at Los Angeles
- Phaedon Avouris, IBM
- Reza Ghadiri, Scripps Research Institute

12:30 PM – 1:45 PM

**Luncheon**

1:45 PM – 2:15 PM

**Low Cost, Atomically-Precise Manufacturing of Defense Systems: Progress and Applications**

Productive nanosystems based on molecular machines are the only known technological approach that can satisfy the manufacturing objective of making large objects to atomic precision at a lower cost. Productive nanosystems will allow the manufacture of structural materials that approach their theoretical strength limits—about 100 times stronger than today’s metals and plastics—enabling the DoD to substantially reduce energy consumption and environmental pollution.

*David R. Forrest, Engineer, Naval Surface Warfare Center and President, Institute for Molecular Manufacturing*

2:15 PM – 2:45 PM

**Molecular Design of Solid State Lighting for Energy Efficiency**

Solid-state lighting based on inorganic III-nitride light emitting diodes is already achieving market penetration in niche segments. Examples from semiconductor technology and biology will be used to illustrate the importance of molecular scale precision for high efficiency solid-state lighting. The challenges, progress, and remaining roadblocks to a viable organic solid-state lighting technology will be discussed.

*Paul E. Burrows, Laboratory Fellow, Pacific Northwest National Laboratory*

2:45 PM – 3:15 PM

**A Comparison of Nanotechnology-Enabled Photovoltaic Materials and Devices with Near-Term Commercialization Potential**

Several photovoltaic technologies that are viable for near-term commercialization, within approximately five years, will be compared and contrasted. Not all of these nanotechnology-enabled technologies. The prospects of such technologies being deployed in wide-scale photovoltaic applications in the near term will be examined. Several of these technologies are being developed through the Wright Center for Photovoltaics Innovation and Commercialization (PVIC), a program funded by the Ohio Third Frontier Program.

*Robert J. Davis, Director, Nanotech West Laboratory, The Ohio State University*

3:15 PM – 3:45 PM

**Break**

4:45 PM – 5:00 PM

**Closing Remarks**

**LOCATION AND LODGING**

**DoubleTree Hotel Crystal City—National Airport**

300 Army Navy Drive

Arlington, VA 22202-2891 USA

**Room Reservations:** Call the hotel directly at +1 (703) 416-4100 and mention SME and this event to receive the reduced room rate of $169/night (single and double). Rooms that are not reserved by September 17, 2007, will be released. After this date, room availability and SME’s reduced rate cannot be guaranteed.

**Location/Hospital Amenities:** The Doubletree Hotel Crystal City is a full service, upscale contemporary hotel featuring spacious, well-appointed rooms and suites with a long list of amenities, including high-speed internet access, fitness room, indoor heated pool, and sight seeing tours. A popular destination with locals as well as visitors, the DoubleTree’s Skydome Lounge is the area’s only revolving rooftop lounge featuring excellent views of the Capital and the Potomac.

Visit [www.sme.org/nanosystems](http://www.sme.org/nanosystems) to make reservations online and for driving directions.
PRODUCTIVE NANOSYSTEMS: LAUNCHING THE TECHNOLOGY ROADMAP

OCTOBER 9–10, 2007
DOUBLETREE HOTEL CRYSTAL CITY—NATIONAL AIRPORT • ARLINGTON, VIRGINIA USA

REGISTRATION FORM – Early registration discount ends September 17, 2007

PRIORITY CODE: ____________________________________________________ (located above mail address panel or at the bottom of email)

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PLEASE PRINT: [ ] Mr. [ ] Dr. [ ] Prof. [ ] Ms. [ ] Mrs.

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Select your ONE primary job function (if student select other).

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Select the number of employees at your organization.

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Q [ ] 100-249 [ ] 7 [ ] 2,500 and Over

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<td>SME and Endorsing Partners Member Rate (CF0/REG17)</td>
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Registrations will not be processed without complete payment information. Please make check or money order payable to SME in U.S. funds.

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*Members of Endorsing Partners: To obtain the membership rate please phone, fax, or mail your registration form. At this time, online registration is only available to SME members, nonmembers, and purchasers of a new SME membership.

ON-SITE REGISTRANTS: On-site registration is on a space-available basis. Payment is due on-site.

CANCELLATIONS: Cancellations will receive a full refund if made on or before September 28, 2007. Beginning September 29, 2007, cancellations will receive a 50% refund. You must obtain a cancellation number from our registrar to verify your cancellation. Confirmed registrants who do not notify SME of their/her cancellation are not eligible for a refund.

METHOD OF PAYMENT: Checks and money orders should be made payable to SME in U.S. funds. SME accepts VISA, MasterCard, Discover, and American Express.

PROGRAM CHANGES: SME has the right to amend this program as necessary. In the event of a cancellation, SME is not responsible for incidental costs incurred by registrants. We recommend purchasing refundable airline tickets.

DISABLED PERSONS ACCOMMODATIONS: SME is committed to providing reasonable accommodations to individuals with disabilities so they may fully participate. Please call SME Customer Service at +1 (800) 733-4763 or +1 (313) 271-1500 ext. 4500 at least two weeks prior to the conference to arrange special accommodations. Please call the hotel directly at +1 (703) 416-4100 to inquire about special parking.