

Wednesday Morning, November 2, 2005

Manufacturing Science and Technology

Room 207 - Session MS+MN+NS-WeM

Advanced Manufacturing for Nano-scale Devices & Systems

Moderators: L. Larson, SEMATECH, A. Testoni, Varian Semiconductor Equipment Associates

8:20am **MS+MN+NS-WeM1 Government Directions in Nanomanufacturing, J.S. Murday**, Naval Research Laboratory **INVITED**

As the U.S. National Nanotechnology Initiative heads into its second five year, there is increasing attention to the transfer of science discovery into innovative technology. The new NNI Strategic Plan identifies manufacturing of nanoscale materials, structures, devices, and systems as one of seven program areas for emphasis over the next five years. Both the Chemical and Semiconductor Industries have identified critical manufacturing issues at the nanoscale. This presentation will provide an assessment of the present state-of-art, the challenges facing nanomanufacturing, and the government efforts to address those challenges.

9:00am **MS+MN+NS-WeM3 Next Generation Semiconductor Devices based on Carbon Nanotubes, T. Rueckes**, Nantero, Inc. **INVITED**

Nantero is developing carbon nanotube-based nonvolatile Random Access Memory (NRAM@super TM@, a high density, high speed, low power universal memory. The target markets in aggregate exceed \$100B in revenue per year. To support the development of NRAM@super TM@ Nantero has enabled a unique nanoelectronics platform that for the first time allows the use of carbon nanotubes in DUV production CMOS fabs. Single-walled carbon nanotubes have a combination of properties that make them highly valuable for use in electronics applications, such as higher electrical conductivity than copper, higher thermal conductivity than diamond, higher strength than steel, and molecular-scale size (diameter of 10Å, wall thickness of 1 carbon atom) combined with high chemical and thermal stability. However, there were substantial barriers to using this material in a mass production process: nanotubes could not be positioned reliably on wafers, they were available only with substantial particulates and contaminants and device properties were hard to control. Nantero has developed solutions to all of these problems which now allow carbon nanotubes to be used in production CMOS processes on established tool sets in existing semiconductor fabs. Nantero's carbon nanotube-enabled NRAM@super TM@ can be used as an embedded memory within logic products such as microprocessors, ASICs, programmable logic or as a standalone memory that can replace multichip packages in cell phones and enable instant-on computers.

10:20am **MS+MN+NS-WeM7 Assembly Pathway to Nanotechnology: Meso to Micro to Nano, J.R. Von Ehr**, Zyvex Corporation **INVITED**

Zyvex is the first molecular nanotechnology company, with a vision of developing adaptable, affordable, molecularly precise manufacturing. This talk will show the progression from macroscopic manipulation, to meso-scale (millimeter), to micro-scale, and ultimately to nano-scale. Zyvex has several years of experience in building and selling nanomanipulation tools, as well as a number of microassembled MEMS products under development, including a miniature mass spectrometer. New work to be discussed is an approach to Atomically Precise Manufacturing, using UHV STM-mediated depassivation of silicon followed by repetitive cycles of Atomic Layer Deposition/Epitaxy to build 3D structures with atomic precision.

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