Directed Assembly of Nanoelements for the Nanomanufacturing of Devices

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Abstract

The future of the electronics industry depends on developing new nanoscale technologies that will be energy efficient with high performance, scalable with gain and operational reliability at room temperature that are preferably compatible with CMOS process and architecture. Proposed nanoelectronic devices using technologies beyond currently-deployed are many; mechanical or molecular switches, spin logic, phase logic, molecular devices, cross-bar devices, etc. Manufacturing of these involves very diverse fabrication and assembly techniques that may involve top-down, bottom or both. High-throughput hierarchical directed assembly and nanoscale components and interconnect reliability will also be essential in going beyond silicon. Fundamental understanding and novel technology in high rate, high volume integration and assembly of robust tools and processes are addressed. Nanotemplates and tools are used to accelerate the creation of highly anticipated commercial products and will enable the creation of an entirely new generation of applications. This requires understanding what is essential for a rapid multi-step, high volume/high rate processes, as well as for accelerated-life testing of nanoelements and defect-tolerance. Another important nanomanufacturing issue is nanoscale defect mitigation and removal and defect tolerant materials, structures and processes. The NSF Center for High-rate Nanomanufacturing develops processes and tools to enable massive directed assembly (of nanotubes, nanoparticles, etc.) at high-rate and high volume. Two applications are used to verify the developed technology; a nanotubes based mechanical switch based non-volatile memory devices and sensors.

Biography

Ahmed A. Busnaina, Ph.D. is the William Lincoln Smith Chair Professor and Director of NSF Nanoscale Science and Engineering Center for High-rate Nanomanufacturing and the NSF Center for Nano and Microcontamination Control at Northeastern University, Boston, MA. He specializes in Nanoscale defects removal, mitigation and characterization, chemical and particulate contamination in semiconductor processes and in the fabrication of micro and nanoscale structures. He authored more than 300 papers in journals, proceedings and conferences. He serves on the editorial advisory board of the Semiconductor International Magazine, the Journal of Particulate Science and Technology and the Journal of Environmental Sciences. He is a fellow of the American Society of Mechanical Engineers, and the Adhesion Society, a Fulbright Senior Scholar in addition to numerous listings in Who's Who (in the World, in America, in science and engineering, etc.).