

## **Directed Assembly of Nanoelements for the Nanomanufacturing Devices and Sensors**

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The transfer of nano-science accomplishments into technology is severely hindered by a lack of understanding of barriers to nanoscale manufacturing. The NSF Center for High-rate Nanomanufacturing (CHN) is developing tools and processes to conduct fast massive directed assembly of nanoscale elements by controlling the forces required to assemble, detach, and transfer nanoelements at high rates and over large areas. The center has developed templates with nanofeatures to direct the assembly of carbon nanotubes and nanoparticles (down to 10 nm) into nanoscale trenches in a short time (in seconds) and over a large area (measured in inches). The center has demonstrated that nanotemplates can be used to pattern conducting polymers and that the patterned polymer can be transferred onto a second polymer substrate. The center has many applications where the technology has been demonstrated. For example, the nonvolatile nanotube memory device switches, the actuating elements (SWNTs) are assembled down to a size that will enable a one SWNT per switch on a wafer level. A new biosensor chip (0.1 mm x 0.1 mm) attached to a catheter could detect multiple biomarkers simultaneously and can be in vitro and in vivo (as part of an intravenous catheter). The center has developed the fundamental science and engineering platform necessary to manufacture a wide array of applications ranging from electronics, energy, and materials to biotechnology

### **Biography:**

Ahmed A. Busnaina, Ph.D. is the William Lincoln Smith Chair Professor and Director of National Science Foundation's Nanoscale Science and Engineering Center (NSEC) for High-rate Nanomanufacturing and the NSF Center for Nano and Microcontamination Control at Northeastern University, Boston, MA. He is internationally recognized for his work on nano and micro scale defects (particulate and chemical) mitigation and removal in semiconductor fabrication. He also involved in the fabrication of nanoscale wires, structures and interconnects. He specializes in directed assembly of nanoelements and in the fabrication of micro and nanoscale structures. He served as a consultant on micro contamination and particle adhesion issues to the semiconductor industry. He authored more than 350 papers in journals, proceedings and conferences. He is on the editorial advisory board of Semiconductor International, the Journal of Particulate Science and Technology. He is a fellow of the American Society of Mechanical Engineers, and the Adhesion Society, a Fulbright Senior Scholar and listed in Who's Who in the World, in America, in science and engineering.

