



**Spring 2017 Colloquium Series**

**Tuesday, April 4, 2017**

**1:30-2:00 pm – Meet and Greet –BB340**

**2:00-3:00 – Seminar Talk – GC Metals Hall**



Dr. Ahmed A. Busnaina, William Lincoln Smith Professor, Distinguished University Professor and Director  
The NSF Nanoscale Science and Engineering Center for High-rate Nanomanufacturing, Northeastern University

***Printing of Nano and Microscale Sensors and Electronics***

**Abstract:**

Over the last decade, there has been a paradigm shift in manufacturing of low-end electronic devices and other nanomaterials based-devices away from vacuum-based processes and toward printing technologies. Inkjet, screen-printing and gravure are three printing technologies that are commercially used for printing electronics, flexible displays, and RFID tags. However, the smallest features that can be printed using inkjets today is about 20 microns, although this is still sufficient for many applications, its scale leaves it far behind today's silicon electronics. The next generation of printed devices requires printing features at today's silicon electronics line width, which is 1000 times smaller (about 20 nanometers). Many researchers have shown techniques that can print down to sub 100 nm using jets but using jets has severe rate limitations even if thousands of jets are used. In here, we have developed a new technology that uses directed assembly based printing at the nanoscale to make products that fully take advantage of the superior properties of nanomaterials. This printing technology can print metals, insulators and semiconductors (including III-V and II-VI), organic and inorganic materials into micro and nanoscale structures and circuits (down to 20 nanometers) on flexible and rigid substrates. In this presentation, we show the applications of this technology in electronics, sensors and materials.

**Bio:** Ahmed A. Busnaina, Ph.D. is the William Lincoln Smith Chair Professor, University Distinguished Professor, and founding Director of National Science Foundation's Nanoscale Science and Engineering Center for High-rate Nanomanufacturing and the NSF Center for Nano and Microcontamination Control at Northeastern University, Boston, MA. Prior to joining Northeastern University in 2000, he was a professor at Clarkson University from 1983-2000. Dr. Busnaina is internationally recognized for his work on nano and micro scale defects mitigation and removal in semiconductor fabrication. He specializes in nanoscale printing of 2D and 3D structures for devices and sensors. He developed many techniques for the directed assembly of nanomaterials for the manufacturing of nanoscale structures for energy, electronics, biomedical and materials applications. His research support exceeds \$50 million. He authored more than 600 papers in journals, proceedings and conferences. He is an associate editor of the Journal of Nanoparticle Research. He also serves on many advisory boards including Samsung Electronics; International Technology Roadmap for Semiconductors, Electronic Materials Letters, 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 and a Fulbright Senior Scholar.