

## MATERIALS SCIENCE AND ENGINEERING (MS&E) SEMINAR SERIES

### Friday October 25, 2019 at 3:00pm in room ESB 207

#### Printing of Nano and Microscale Electronics and Sensors on Flexible and Rigid Substrates

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[www.nano.neu.edu](http://www.nano.neu.edu), [www.northeastern.edu/cssm/](http://www.northeastern.edu/cssm/)

A new disruptive technology will be presented that will enable the fabrication of nanoelectronics at a cost of 10-100 times less than conventional fabrication while allowing device designers the use of any organic or inorganic semiconducting, conductive or insulating material on flexible or rigid substrates. This will also include leveraging nanomaterials such as two-dimensional (2D) materials, quantum dots, nanotubes, etc. Printed electronics can significantly lower electronics and sensor costs by 10-100 times. However, most currently printed systems are at 20 micron line width and larger and utilizing mostly organic semiconductors. The new technology is enabled by directed assembly-based nanoscale printing at ambient temperature and pressure that prints 1000 faster and 1000 smaller (down to 20nm) structures than ink-jet based printing. The technology enables a nanoscale printing platform, enabling heterogeneous integration of interconnected circuit layers (like CMOS) of printed electronics and sensors at ambient temperature and pressure.

The directed assembly-based printing processes were specifically created to be scalable, sustainable and designed to enable precise and repeatable control of assembly of various nanoelements at high-rate. These efforts have resulted in over 80 patent applications (25 granted to date). CHN has created processes to print arrays of nanoparticles, conducting polymers, polymer blends, 2D materials<sup>Error!</sup> and SWNTs into various structures including 3D architectures at multiple length scales. Printed devices include transistors, inverters, diodes, chemical and biosensors, and interconnects using a variety of nanomaterials including 2D materials. Some of the printed applications include Nano LEDs, Printing QDs for display, flexible electronics, micro wearable biosensors for detecting lactate and glucose in Sweat, chemical sensors, etc. We unveiled the world's first Nanoscale fully-automated offset printing system (NanoOPS) prototype with built-in alignment and registration in 2014. This system is designed to print devices and products with minimum features down to 20 nm or smaller.

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