

# “BNC Distinguished Seminar”

September 16th, 2015 @ 11:00am

MRGN, ROOM 121

**Jim Watkins**

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## **Title: Electronic and Optical Devices via Additive Driven Self-Assembly and Nanoimprint Lithography: Towards Solution-Based Nanomanufacturing**

**Bio:** Jim Watkins is Professor of Polymer Science and Engineering and Director of the Center for Hierarchical Manufacturing, a National Science Foundation Nanoscale Science and Engineering Center (NSEC) at the University of Massachusetts, Amherst. Professor Watkins received his B.S. and M.S. degrees in Chemical Engineering from the Johns Hopkins University and his Ph.D. in Polymer Science and Engineering from the University of Massachusetts. He joined the Chemical Engineering faculty at UMass in 1996 and the Polymer Science and Engineering faculty in 2005. He is the recipient of a Camille Dreyfus Teacher-Scholar Award and a David and Lucile Packard Foundation Fellowship for Science and Engineering and is a Fellow of the American Physical Society.

**Abstract:** Roll-to-roll (R2R) and solution-based technologies offer the potential for continuous and cost-efficient production of materials and devices but their applications in nanomanufacturing have remained extremely challenging. We outline a strategy for nanoscale device fabrication that includes nanoparticle driven self-assembly to produce well-ordered polymer/nanoparticle hybrid materials with domain sizes ranging from less than 10 nm to more than 125 nm that can serve as active device layers and R2R nanoimprint lithography for device scale patterning at length scales greater than 50 nm. We also employ highly filled nanoparticle/polymer hybrids for applications that require tailored dielectric constant or refractive index. Finally, we have developed a new process that allows direct printing of 2-D and 3-D patterned crystalline metal oxide films and composites with feature sizes of less than 100 nm. These approaches are attractive alternatives to conventional subtractive processing using Si wafer-based platforms and can enable large area production of fully printed devices. Each of these methods can be scaled in our newly constructed R2R process and demonstration facility. Applications in flexible electronics, light and energy management, photonics, and sensors and will be discussed.