

**Recent Advances at the NSF Nanosystems Engineering Research Center for  
Nanomanufacturing Systems for Mobile Computing and Mobile Energy  
Technologies (NASCENT)**

*NSF Grant No. EEC-1160494*

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NASCENT's vision is to create and validate a scalable and cost-effective nanomanufacturing infrastructure to enable future nanotech factories for deployment of promising nanoscience concepts to address societal needs. NASCENT's 10-year deliverable is to create a NASCENT nanodevices manufacturability fabrication facility (NASCENT *nm*-FAB) comprised of roll-to-roll (R2R) and flex wafer-scale (WS) nanomanufacturing systems (including processes, metrology and yield management) for nanoscale photonic, electronic, magnetic and optoelectronic devices. Each of these systems is composed of unit processes (enabling technologies), including for example R2R 2D material transfer, high speed process and functional metrology, bulk crystalline exfoliation and multiscale modeling. In this talk I will highlight NASCENT's recent successes in achieving this vision by creation of:

- Nanoimprinted structures with precisions of sub 3 nm.
- Directed self-assembly of aligned and selectively etched block copolymers to sub 5nm registration
- R2R gravure printing of flexible electronics
- Multi-scale simulations for design and optimization of R2R dry transfer of graphene
- High speed optical scatterometry for nanometer scale resolution for metrology
- Prototype nano-enabled wearable flexible electronic devices
- Tech transfer to industrial partners and spin-off of start-up companies.

I will also discuss how NASCENT and its facilities enables productive collaborations with industry and other academic institutions on a variety of nanomanufacturing challenges.