

HOPE COLLEGE CHEMISTRY SEMINAR

Mary Elizabeth Anderson
Pennsylvania State University

Benchtop Chemical Patterning of Nanostructures: from Nanowires to Surfaces to Circuits...

Friday, November 6, 2009 4:00 PM, Schaap 1000

Abstract

As technology continues to advance toward smaller device sizes, the need for novel patterning methods on the nanoscale is growing. This is the regime of the chemist. In the field of nanofabrication, the combination of benchtop chemical processes (“bottom-up”) with conventional lithographic techniques (“top-down”) has potential for patterning surfaces with nanometer-scale resolution. The fusion of these technologies also addresses another important aspect of this field—the parallel creation of hierarchical structures that interface components on the 1–100 nm range with micrometer-scale structures and ultimately the outside world. The research to be presented has focused on integrating chemical methods, such as self-assembled monolayers (SAMs) and solution-phase solid-state inorganic synthesis, with traditional fabrication techniques, such as photolithography and metal deposition.

SAMs are formed when organic molecules spontaneously chemisorb on a surface and form an ordered monolayer film. Chemical and physical properties of these films can be easily controlled by modifying component molecules. Two methods combining these SAMs with photolithography will be described. These permit the fabrication of aligned metal microstructures with precisely defined nanometer-scale spacing and the generation of chemical patterns with tailored functionality. Another merging of techniques combines conventional metal deposition with solution based metallurgy in a beaker. The polyol process is a low temperature solution-based technique utilizing metal salts as starting materials. This “bottom-up” solid-state chemistry has been applied toward the patterning of metal surfaces and nanowires, integrating derivative multi-metal compounds of technological relevance.

Biography

Dr. Beth Anderson was born and raised in Alabama. She attended a liberal arts undergraduate school, Samford University in Birmingham, AL, for her B.S. degree in Chemistry with a minor in Biology. Her introduction to research was through two summer NSF-funded Research Experience for Undergraduate (REU) fellowships at University of Florida and Pennsylvania State University. She obtained her Ph.D. in Chemistry under the direction of Prof. Paul S. Weiss (Chemistry) and Prof. Mark W. Horn (Engineering Science) at Pennsylvania State University. Her doctoral research was interdisciplinary with projects focused in the areas of surface, material, and engineering sciences; combining chemical self-assembly with conventional lithography. After graduate school, she was a Postdoctoral Faculty Fellow at Boston University co-teaching general chemistry, while conducting research using surface plasmon resonance spectroscopy with Prof. Rosina M. Georgiadis. Currently, she is a postdoctoral research associate with Prof. Raymond E. Schaak in Chemistry at Pennsylvania State University working to integrate inorganic solid-state synthesis techniques with nanofabrication methods.