Physics Colloquium

Etching Zero Dimensional Structures with a Scanning Tunneling Microscope: Putting the Microscopist in the Pilot's Seat

Dr. Andrew Stollenwerk

Assistant Professor of Physics
Physics Department
University of Northern Iowa

September 30, 2009
4:00 p.m.
114 Begeman Hall

Nanocrystals are ordered clusters of atoms that are typically no more than 10 nm in all three dimensions. At this scale, quantum confinement in these structures results in discrete electronic and optical properties, similar to individual atoms or molecules. The ability to tune these properties by controlling the size and composition of nanocrystals makes then useful from a practical stand point in devices such as light emitting diodes, solar cells, and solid state lasers. In order to design more efficient devices, the fundamental properties of individual nanocrystals must be better understood. Due to its atomic resolution, scanning tunneling microscopy (STM) has proven to be an ideal technique to study nanocrystals. Currently, nanocrystal samples suitable for STM are fabricated using self assembly techniques that employ epitaxial deposition or colloidal solutions. Both techniques offer limitations in that the shape and ordering of the nanocrystals are determined by the surface dynamics involved in the growth process. A more advantageous method would give us direct control over the shape, size, and ordering of the nanocrystals to better understand their fundamental properties. Dichalcogenide crystals such as TiSe2 and TaS2, contain molecular layers held together by van der Waal forces. This weak, interlayer, electrostatic binding makes it possible for single molecular layers to be stripped by the electric field between the STM tip and the sample. The ability to selectively etch these materials could give us the capability of creating nanocrystals of varying shape, size and ordering, without the limitations of current growth processes.

Everyone Welcome! Refreshments Provided.