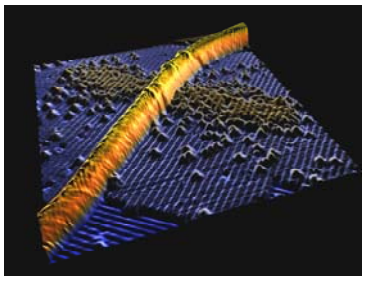
NANOHOUR

Wednesday, February 21, 2007
3:00 PM
Beckman Institute - Room 3269

Scanning Tunneling Microscopy of Carbon Nanotubes Interfaced with Slicon

Peter Albrecht - Graduate student in Electrical and Computer Engineering



The extraordinary electronic properties of single-walled carbon nanotubes (SWNTs) motivate their integration with silicon-based integrated circuit technology. To support such efforts, a room-temperature ultrahigh vacuum (UHV) scanning tunneling microscope (STM) is used for the imaging, electrical characterization, and mechanical manipulation of SWNTs interfaced with Si(100) surfaces.

The dry contact transfer (DCT) approach developed in our lab enables the ultraclean deposition of isolated SWNTs in UHV. The atomic-scale cleanliness of the resulting interface permits the controlled manipulation of SWNTs with the STM tip. Moreover, we can tune the electronic band alignments between SWNTs and hydrogen-passivated Si(100) surfaces according to the type of impurity (dopant) intentionally incorporated into the substrate. Nanoscale desorption of hydrogen at the SWNT/Si(100) interface locally enhances the nanotube-surface coupling.

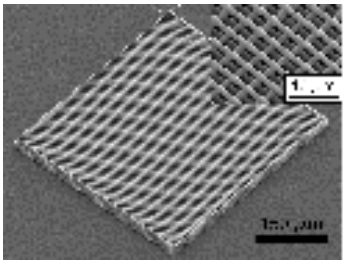
Finally, our results will be compared with existing first-principles theoretical predictions for the SWNT/Si(100) system.

AND

Sol-Gel Inks for Direct-Write Assembly of 3D Micro-periodic Structures

Eric B. Duoss - Department of Materials Science and Engineering

Motivated by the intricate process of spiders spinning webs, we have pioneered an innovative approach to the fabrication of highly ordered, planar and 3D micro-periodic structures, known as direct ink writing (DIW). In this method, a micro-capillary nozzle is mounted to a 3-axis micro-positioning robotic stage that is controlled via a computer-aided design (CAD) program. Paramount to our approach is the creation of inks that flow through these fine deposition nozzles as continuous filaments, and then rapidly solidify to maintain their shape even as they span gaps in the underlying layer(s). Using titania-based sol-gel inks, face-centered tetragonal woodpile structures with feature sizes of ~1 μm have been patterned and directly converted to anatase and rutile by thermal annealing. The resultant structures have been explored as potential photonic crystals due to the high refractive index of titania ($n_{anatase}$ ~ 2.5, n_{rutile} ~ 2.7) and its transparency in the near infrared spectral regime. The annealed woodpile structures exhibit a partial photonic bandgap. Ongoing efforts are focused on extending the DIW approach to other sol-gel based materials systems, including doped titania, barium titanate, and zirconia inks.



Coffee and cookies will be served. **http://nanohour.beckman.uiuc.edu**