UNIVERSITY OF CONNECTICUT

INSTITUTE OF MATERIALS SCIENCE

POLYMER PROGRAM SEMINAR

"Chemically Tailored Carbon-based Nanoelectronic Materials and Devices"

Prof. Mark C. Hesam
Northwestern University

Friday, November 20, 2009
11 AM, IMS Room 20

Abstract

Carbon-based nanoelectronic materials have attracted significant attention due to their potential to enable and/or improve applications such as transistors, transparent conductors, solar cells, and biosensors [1]. This talk will delineate chemical strategies for enhancing the electronic and optical properties of these promising nanomaterials. For example, we have recently developed a scalable technique for sorting single-walled carbon nanotubes (SWNTs) by their physical and electronic structure using density gradient ultracentrifugation (DGU) [2,3]. The resulting monodisperse SWNTs possess unprecedented uniformity in their electronic and optical properties, thus enabling the fabrication of high performance thin film field-effect transistors [4,5] and transparent conductors [6]. The DGU technique also enables multi-walled carbon nanotubes to be sorted by the number of walls, which facilitates the preparation of high purity solutions of double-walled carbon nanotubes (DWNTs). Monodisperse DWNT samples yield enhanced performance in transparent conductors and help elucidate the fundamental photophysics of DWNTs [7]. As a final example, this talk will discuss the preparation and characterization of highly ordered self-assembled monolayers on graphene. In particular, self-assembled monolayers of perylene-3,4,9,10-tetracarboxylic-dianhydride (PTCDA) can be formed on graphene surfaces via gas-phase deposition in ultra-high vacuum environments at room temperature [8]. Molecular-scale resolution scanning tunneling microscopy images reveal long-range order in the PTCDA monolayers, while scanning tunneling spectroscopy measurements yield distinct electronic features associated with the PTCDA that are not observed on pristine graphene. Ultimately, organic functionalization allows the chemical properties of graphene to be tailored for subsequent materials deposition in addition to presenting opportunities for graphene-based molecular electronic and sensing devices.

[1] M. C. Hersam, *Nature Nanotechnology*, **3**, 387 (2008).

[2] M. S. Arnold, et al., *Nature Nanotechnology*, **1**, 60 (2006).

[3] A. A. Green, et al., *Nano Research*, **2**, 69 (2009).
[4] M. Engel, et al., *ACS Nano*, **2**, 2445 (2008).
[5] L. Nougaret, et al., *Applied Physics Letters*, **94**, 243505 (2009).
[6] A. A. Green and M. C. Hersam, *Nano Letters*, **8**, 1417 (2008).
[7] A. A. Green and M. C. Hersam, *Nature Nanotechnology*, **4**, 64 (2009).
[8] Q. H. Wang and M. C. Hersam, *Nature Chemistry*, **1**, 206 (2009).

**Coffee will be served at 10:45AM outside the seminar room.*
**For further information, please contact YH Chudy at 860.486.3582 or ychudy@ims.uconn.edu*

Polymer Program, Institute of Materials Science, University of Connecticut, Storrs, CT 06269-3136   www.ims.uconn.edu/polymer