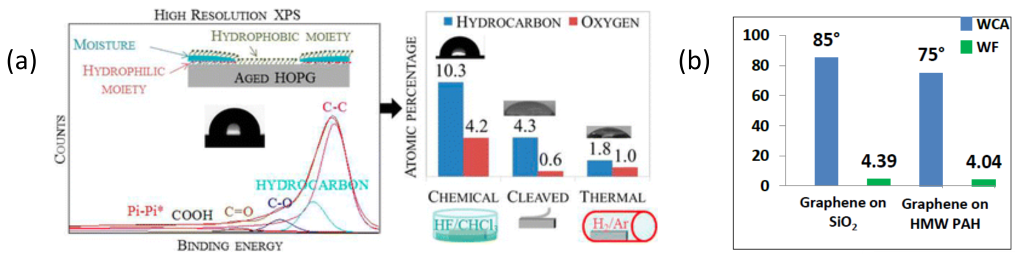
Nanohour

Wednesday, April 1, 2015, 3:00 pm
Beckman Institute – Room 4269

Nanoscopic, Microscopic and Spectroscopic Investigations of Wettability of Graphene – Influence of Surface Functionality, Defects, and Doping

Ali Ashraf, Mechanical Science and Engineering
Graduate student with Professor SungWoo Nam

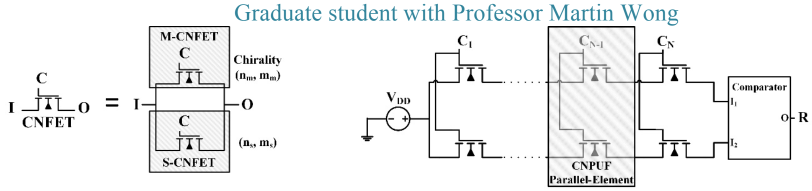


(a) Spectroscopic investigation of multilayer graphene wettability [1] (b) Doping induced wettability change of graphene (WF- Work Function, WCA- Water Contact Angle)

Fundamental understanding of surface energy of graphene is the key to its success as a functional material. However, due to unavoidable defect formation and adsorption from ambient atmosphere during fabrication process, wettability investigation of single and multi-layer graphene using conventional means is not reliable. We performed combined nanoscopic, microscopic and spectroscopic investigations of wettability of graphene to elucidate the relationships between surface defects, functionality, doping and wettability of graphene. Based on different underlying substrates' polarity/charge density and their interactions (electrostatic and van der Waals) with graphene surface, water contact angle (WCA), investigated by environmental scanning electron microscope (E-SEM), varied from 70˚ to 85˚. In addition, we explored several key surface cleaning techniques (i.e., thermal annealing, Ar plasma treatment, chemical cleaning with chloroform and HF) on multilayer graphene samples contaminated by air-borne contamination. We observed that the WCA for multilayer graphene ranges from ~5° to ~80° based on the surface functional groups and defects generated after surface treatment/cleaning methods. These studies of graphene wettability were correlated with various characterization techniques. We believe our investigation builds a framework to find a correlation between WCA of graphene with surface functional groups, underlying substrate, and defects that can help design advanced graphene-based devices in the future

CNPUF: A Carbon Nanotube-based Physically Unclonable Function for Secure Low-Energy Hardware Design

Leslie Hwang, Electrical and Computer Engineering
Graduate student with Professor Martin Wong



Physically Unclonable Functions (PUFs) are used to provide identification, authentication and secret key generation based on unique and unpredictable physical characteristics. Carbon Nanotube Field Effect Transistors (CNFETs) were shown to have excellent electrical and unique physical characteristics and are promising candidates to replace silicon transistors in future Very Large Scale Integration (VLSI) designs. This talk introduces Carbon Nanotube PUF (CNPUF), the first PUF design that takes advantage of unique intrinsic CNFET characteristics and inevitable metallic carbon nanotubes. CNPUF is implemented with small number of transistors while achieving higher reliability against environmental variations and increased resistance against modeling attacks. Furthermore, CNPUF has a considerable power and energy reduction in comparison to previous ultra-low power PUF designs.

Coffee and cookies will be served
http://nanohour.beckman.illinois.edu/Nanohour/Nanohour.html