NST2-004

Raman Spectroscopy Studies of Graphene Nanoribbons and Chemical Doping in Graphene

Sunmin Ryu

Department of Applied Chemistry, Kyung Hee University

Atom-thick graphene membrane and nano-sized graphene objects (NGOs) hold substantial potential for applications in future molecular-scale integrated electronics, transparent conducting membranes, nanocomposites, etc. To realize this potential, chemical properties of graphene need to be understood and diagnostic methods for various NGOs are also required. To meet these needs, chemical properties of graphene and optical diagnostics of graphene nanoribbons (GNRs) have been explored by Raman spectroscopy, AFM and STM scanning probes. The first part of the talk will illustrate the role of underlying silicon dioxide substrates and ambient gases in the ubiquitous hole doping of graphene. An STM study reveals that thermal annealing generates out-of-plane deformation of nanometer-scale wavelength and distortion in sp^2 bonding on an atomic scale. Graphene deformed by annealing is found to be chemically active enough to bind molecular oxygen, which leads to a strong hole-doping. The talk will also introduce Raman spectroscopy studies of GNRs which are known to have nonzero electronic bandgap due to confinement effect. GNRs of width ranging from 15 nm to 100 nm have been prepared by e-beam lithographic patterning of mechanically exfoliated graphene followed by oxygen plasma etching. Raman spectra of narrow GNRs can be characterized by upshifted G band and strong disorder-related D band originating from scattering at ribbon edges. Detailed analysis of the G, D, and 2D bands of GNRs proves that Raman spectroscopy is still a reliable tool in characterizing GNRs despite their nanometer width.

Keywords: nano-sized graphene objects (NGOs), graphene nanoribbons (GNRs)