MAR11-2010-002279

Abstract for an Invited Paper
for the MAR11 Meeting of
the American Physical Society

Properties of Dilute Fluorinated Graphene

XIA HONG, The Pennsylvania State University

I will discuss our recent studies on dilute fluorinated graphene (DFG). Fluorine adatoms are covalently added to a graphene sheet using a controlled and reversible approach to create a dilute coverage on the order of $10^{12}/\mathrm{cm}^2$, as determined by scanning tunneling microscopy studies. These adatoms are atomically sharp defects, interact strongly with the electronic states of graphene and drastically modify the transport properties of pristine graphene. This unusual 2D system exhibits several remarkable properties. Mid-gap state scattering dominates conduction at high temperature, the magnitude of which is determined by the adatom density and is correlated with Raman spectra. The temperature-dependent conductivity of the DFG sample follows weak localization at high carrier density and variable-range hopping at low carrier density. The transition is strongly correlated with the fluorine adatom density. In the variable-range hopping regime, DFG samples exhibit very large, negative magnetoresistance, which shows unusual staircase-like field dependence at low temperature. In the weak localization regime, we observe anomalous phase breaking behavior. I will discuss possible origins of these observations in the context of magnetism and localization. (In collaboration with S.-H. Cheng, C. Herding, and J. Zhu.)