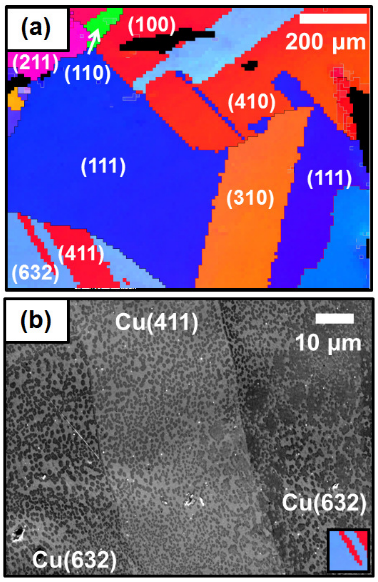
NANOHOUR

Wednesday, October 19, 2011 3:00 pm
Beckman Institute - Room 3269

Copper Substrate Effects on the Growth and Functionalization of Graphene

Joshua D. Wood, Electrical and Computer Engineering

Graduate Student with Professor Joseph Lyding and Professor Eric Pop



Chemical vapor deposition (CVD) of graphene on Cu employs polycrystalline Cu surfaces with diverse facets, grain boundaries (GBs), annealing twins, and rough sites. Using scanning electron microscopy (SEM), electron-backscatter diffraction (EBSD), and Raman spectroscopy on graphene and Cu, we determine that (111) containing facets produce pristine monolayer graphene with higher growth rate than (100) containing facets, especially Cu(100). Further, we find that Cu crystallography affects graphene growth more than facet roughness. At high temperature, the graphene defect number appears Cu facet invariant. We also functionalize graphene by exposing graphene on Cu to XeF_2, rendering the film insulating by fluorination. This process terminates in covalent C-F bonding, a C_4F stoichiometry, and opens a bandgap in the previously metallic graphene. Before that point, it appears that the fluorine atoms attach to the graphene lattice based on the underlying Cu crystallography. Thus, one could engineer the fluorine decoration and tailor a bandgap in the fluorinated material.

Investigating dislocation/grain boundary interactions using electron microscopy

Josh Kacher, Materials Science and Engineering

Graduate Student with Professor Ian M. Robertson

The mechanical properties of metals are largely controlled by the interaction of dislocations with defects, with grain boundaries being one of the most important of these defects. As such, a fundamental understanding of the mechanisms dictating dislocation/grain boundary interactions is essential to understanding and developing predictive capabilities of the mechanical response of metals to deformation. Transmission electron microscopy (TEM) provides insight into these interactions, as the interactions themselves can be observed in real time through in situ deformation experiments. More recently developed diffraction contrast electron tomography capabilities further provide information as the three-dimensional dislocation state becomes accessible. The combination of in situ experiments with tomographic reconstructions, along with traditional Burgers vector analysis, provides a more complete understanding of the nature and evolution of dislocation interactions with grain boundaries. This will be shown for grain boundary/dislocation interactions in stainless steel samples.

Coffee and cookies will be served

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