

Abstract Submitted
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A single-step growth process of graphane using hydrogen plasma and observation of an induced bandgap. M.L. TEAGUE, D.A. BOYD, W.-S. TENG, C.-C. HSU, N.-C. YEH, Dept. of Physics, Caltech, Pasadena, CA 91125, M. GHARIB, Dept. of Aeronautics, Caltech, Pasadena, CA 91125 — There has been considerable interest in reliably opening up a bandgap in graphene for electronic applications. One promising method is the hydrogenation of graphene into graphane. We present Raman spectroscopy, scanning tunneling microscopy/spectroscopy (STM/STS) and x-ray photoemission spectroscopy (XPS) studies of hydrogenated multilayer graphene on Cu as a function of hydrogen exposure time (t). Our growth process for hydrogenated graphene involved *in-situ* exposure of PECVD-grown graphene on Cu to hydrogen plasma. Raman measurements revealed an increase in intensity of a pronounced and narrow D-band with t when compared to pristine graphene. FTIR studies revealed the presence of C-H bonds on the surface of our samples post hydrogenation. STM topographic studies revealed a nanoscale Moiré pattern resulting from the hydrogenated graphene. For $t = 120$ s, STS studies revealed an average gap of $\Delta \sim (0.2750.050)$ eV, which increased to average value of $\Delta \sim (0.3150.050)$ eV for $t = 600$ s. Topographic and spectroscopic studies showed approximate hydrogen coverage of 20%, 50% and 80% for $t = 30$ s, 60s and 120s, respectively. XPS studies of the C-1s state revealed an energy shift from the C-C peak (284.6 nm) towards a C-H peak (285.8 nm), consistent with the formation of carbon-hydrogen bonds. Our results have demonstrated the existence of a bandgap opening in graphene, induced by the adsorption of atomic hydrogen onto graphene.

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