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Fluorination of CVD graphene: the role of wrinkles, folds, multi-layer islands and grain boundaries BEI WANG, JUNJIE WANG, J. ZHU, Department of Physics, Penn State University — Chemical functionalization, such as fluorination, can modify the gapless band structure of graphene and turn it into an insulator. Fluorinated graphene (FG) can potentially be integrated into graphene electronics and serve as ultrathin gate dielectrics or tunnel barriers. Here we present our effort in synthesizing and understanding the properties of FG. Graphene sheets synthesized by chemical vapor deposition (CVD) are fluorinated using CF_4 plasma under varying conditions. The resulting FG is systematically examined using a wide range of spectroscopic and microscopic tools including XPS, Raman, FTIR, electrical transport and conductive AFM. We obtain high F:C ratio of 0.1-1. Our results show that 1. Morphological features of CVD graphene (wrinkles, folds, multi-layer islands) are less fluorinated and charge transport in FG occurs through the conductive network formed by these features. 2. Lattice defects and grain boundaries play a significant role in the chemical reactivity of CVD graphene. XPS studies indicate the formation and evolution of CF_x (x=1,2,3) bonds, as well as oxygen-passivated defect sites in FG. These studies highlight current challenges in realizing electronics-grade FG and point to the possible pathways forward.

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