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Large area, Few Layer Graphene Films on Insulating Substrates

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Graphene has exceptional electronic, thermal and mechanical properties. For the realization of graphene-related applications, it is necessary to develop reliable and low cost fabrication methods of graphene-based structures, ideally on any substrates. In this talk I will present our method of fabricating large area ($\sim$cm^2) films of single- to few-layer graphene and transferring the films to arbitrary substrates. The graphene films are synthesized by ambient pressure Chemical Vapor Deposition, consist of regions of 1 to $\sim$10 graphene layers and have an average thickness of 2-3 nm. Despite their ultra-thin nature, the films thus produced are continuous over the entire area. Regions of single- or bi-layer graphene with lateral sizes of up to 25 μm were observed. High Resolution Transmission Electron Microscopy (HRTEM) and electron diffraction revealed that they are crystalline over the entire area and their Raman features were compared to those of graphene derived from mechanical exfoliation of Highly Oriented Pyrolytic Graphite (HOPG). Transistor devices made from these graphene show similar characteristics to ones made from graphitized SiC. Scanning tunneling microscopy imaging reveals interesting Morié patterns and helpful insights for the growth of the graphene films on the Ni substrate. The method presented in this work can potentially be scaled to industrial production of graphene films, for applications such as ultra-thin conductive and transparent electrodes, or devices and interconnect for integrated circuits.