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Synthesis of Few-layer Graphene Film on a Ni Substrate by Using Filtered Vacuum Arc Source Method

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Graphene has generated significant interest in the recent years as a functional material for electronics, sensing, and energy applications due to its unique electrical, optical, and mechanical properties. Much of the considerable interest in graphene stems from results obtained for samples mechanically exfoliated from graphite. Practical applications, however, require reliable and well-controlled methods for fabrication of large area graphene films. Recently high quality graphene layers were fabricated using chemical vapor deposition (CVD) on nickel and copper with methane as the source of the carbon atoms. Here, we report a simple and efficient method to synthesize graphene layers using solid carbon source. Few-layer graphene films are grown using filtered vacuum arc source (FVAS) technique by evaporation of carbon atom on Ni catalytic metal and subsequent annealing of the samples at 800°C. In our system, carbon atoms diffuse into the Ni metal layer at elevated temperatures followed by their segregation as graphene on the free surface during the cooling down step as the solubility of carbon in the metal decrease. For a given annealing condition and cooling rate, the number of graphene layers is easily controlled by changing the thickness of the initially evaporated amorphous carbon film. Based on the Raman analysis, the quality of graphene is comparable to other synthesis methods found in the literature, such as CVD and chemical methods.

Keywords: Graphene, Filtered vacuum arc source, CVD