Graphene thin film deposition using ultraviolet pulsed Nd:YAG laser

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Abstract

Graphene has received increasing attention for last one decade due to its extraordinary properties like extremely high charge carrier mobility [1] and its huge potential application in electronics [2]. One of the key challenges in graphene research is to grow high-quality and large-area graphene. The graphene was first experimentally obtained by mechanical exfoliation of graphite in 2004 [3]. In this talk, I will present our recent result on graphene thin film deposition using ultraviolet pulsed Nd:YAG laser with the photon energy of 3.5eV (355 nm) similar to the bond energy of HOPG . The use of UV Nd: YAG as a possible alternative to excimer laser would facilitate rapid deployment of the optical technology within the graphene fabrication. It will be shown that the effect of different substrate and substrate temperature play an important role on graphene formation under optimized condition. Finally, we will discuss on characterization of graphene using Raman spectroscopy, atomic force microscopy, field emission scanning electron microscope, and two point probe method. From the Raman spectra of graphene samples, it was observed that substrates affect the Raman features of graphene film. It was also found that increasing substrate temperature, the number of graphene layers are controlling well on Ni/Si substrate. At substrate temperature of 750 °C, the ratio of intensities (I_{2D}/I_G) was calculated from the Raman spectra of the graphene samples to be 0.15 which confirms the multilayer graphene formation; while for graphene film grown at 800 °C, I_{2D}/I_G ratio was 0.27 indicating formation few layer graphene. Moreover, the measurement of electrical resistance by two probe method shows the increment of its value with the reduction of the number of graphene layers. The development of this new material through PLD opens new exiting possibilities. This new material has a number of unique properties which make it interesting for both fundamental science and future applications.

Keywords: *Graphene, Pulsed Laser Deposition, Raman* Spectroscopy, AFM, SEM,

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