A wafer scale AB stacked Bilayer graphene film on dilute Cu(Ni) foil by atmospheric pressure CVD

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Abstract (Century Gothic 11)

Graphene has attracted wide interest due to its promising potential applications in electronics and photonics[1–3]. However, many of these applications are restricted by zero band gap of graphene[4,5]. Nonetheless, a considerable band gap of up to 250 meV can be opened up in Bernal (AB) stacked bilayer graphene by applying a perpendicular electric field between the two superimposed layers[5–7]. Hence, graphene synthesis has been focused on growing high-quality and large-area AB-stacked bilayer graphene. Chemical vapour deposition (CVD) is a favourable synthesis technique for graphene since it can grow high-quality and large-area or wafer-scale graphene, which is important for electronic devices[8,9]. In addition, atmospheric-pressure CVD is technologically more accessible for graphene growth. The metallic substrate like Cu which mostly used for CVD grown graphene is found to be favouring to grow monolayer graphene because of limitation of C arbsorption in Cu, while Cu substrate engineered with Ni is found to grow multilayer graphene because of significant arbsorption of C in Ni and hence if it well controlled it can grow AB stacked graphene.

In this study we focuse on the AP-CVD synthesis and characterization of high-quality and wafer-scale (scale of an entire foil) AB-stacked bilayer graphene film obtained on a dilute Cu(0.61 at% Ni) foil and compared the growth to the results of AP-CVD growth under identical conditions on pure Cu foil. Atomic force microscopy (AFM) average step height analysis showed thickness of bilayer graphene, scanning electron microscopy (SEM) micrographs showed uniform and continuous graphene layers and the Raman optical microscopy images and spectroscopy data supported by selected area electron diffraction (SAED) data showed high-quality and continuous (wafer-scale) AB-stacked bilayer graphene for graphene film obtained on a dilute Cu(0.5 at% Ni) foil.

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Figures

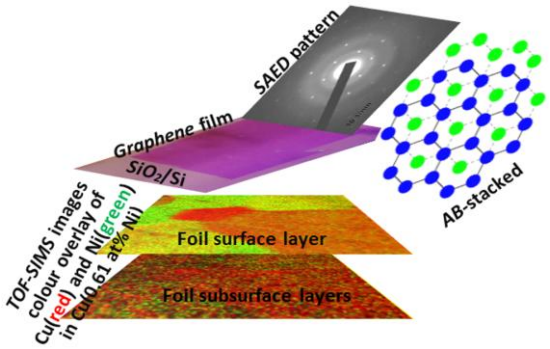

Figure 1: Shows the summarized data of wafer scale AB stacked graphene that was transferred on Si/SiO_2 and analysed by AFM, TEM and ToF SIMS techniques and also showing the schematil of atom arrangements in the AB stacked graphene