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Large-scale Lithium-intercalated Multilayer Graphene Production

For more than 70 years, Graphite Intercalated Compounds (GICs) have been extensively studied, wherein LiC6 was discovered as a lead material for high-capacity electrical energy storage. With the recent surge of compact electronic devices in commercial production, we present a novel fabrication technique for ultra-thin LiC6 devices. Here we present a new transfer method, termed “bifacial float transfer”, which enables large-scale multilayer graphene transfer from both sides of a nickel growth catalyst [1]. Bifacial float transfer has the potential to reduce graphene production costs by transferring chemically vapor deposited (CVD) graphene films from both sides of their native nickel substrate, with one graphene film transferred to a polymer and the other graphene film transferred to another target substrate. In traditional transfer methods, the graphene on the “non-preferred” side, that is, the bottom of the substrate, is removed with oxygen plasma before removal of the metal catalyst in etchant solution. Although this treatment prevents undesired aggregation of the graphene films, it fails to utilize both sides of CVD-grown graphene. In this talk, we compare the quality of graphene transferred from both sides onto target glass and polymer substrates. The results of optical microscopy, confocal Raman spectroscopy, atomic force microscopy, and electronic transport measurements suggest that the quality of the multilayer graphene on the “non-preferred” side does not differ significantly from that of the “preferred” side. This method will allow more efficient and cost-effective use of graphene by doubling the usable graphene per area of growth substrate, and by eliminating the need for intermediate sacrificial transfer substrates such as poly(methyl methacrylate). By modifying the air-liquid interface, we also attempt similar polymer-free transfer of progressively thinner multilayer graphene films. The fabricated samples are then lithiated using the in-situ short-circuit direct contact method [2]. The ultra-thin LiC6 exhibits metallic behavior at room temperature with low sheet resistance and improved optical transparency in the visible spectrum [3]. We present preliminary results on the fabrication and characterization of these large-scale, stable LiC6 films.

References

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