Functionalized Single-Sheet Graphene

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Poster (2:20 PM)

Individual layers of graphite, termed graphene, are composed of sp^2 aromatic carbon and are the basis of fullerene and carbon nanotube structures. Graphene sheets are expected to have tensile modulus and ultimate strength values similar to that of single wall carbon nanotubes (SWCNT). Recent studies of graphene produced by a scotch-tape method have been shown to possess interesting electrical properties [1]. Graphene sheets, much like SWCNTs, serve as fillers for the enhancement of mechanical and electrical properties in composite materials [2]. A recent study performed in our laboratories has demonstrated the formation of individual graphene sheets by oxidation and thermal expansion of graphite [3]. The graphene sheets produced by this method are found to have residual functional groups from the oxidation step, largely in the form of hydroxyl groups. We have also examined the expansion mechanism and the degree of exfoliation and determined the material consists of more than 80% single sheets [4].

In this study, we seek to take advantage of the existing functional groups to attach reactive pendant groups to the surface of the graphene sheets. The reactive pendant groups will be further utilized to attach polymers with reactive end groups. Polymer functionalized graphene sheets are expected to exhibit better dispersion and bonding in a polymer matrix for composite applications. Several chemical functionalization routes are investigated, including isocyanates, alkyl chlorosilanes, and epichlorohydrin. We have determined that the one-pot synthesis with epichlorohydrin to attach reactive epoxy groups to be the simplest and most effective method we have investigated.

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