Nanoscale Assembly & Chemical Modification of Graphene Based Nanomaterials: Graphene Oxide Liquid Crystals and Other Relevant Nanostuctures

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Abstract
Graphene based materials, such as carbon nanotubes and graphene, attract enormous research attention for their outstanding material properties along with molecular scale size dimension. Real-world applications of the graphene based materials in many different fields inevitably requires the subtle controllability of their structures and properties. In this presentation, our recent research works associated to 'nanoscale assembly and chemical modification of graphene based nanomaterials' will be presented [1, 2]. Carbon nanotubes and graphene can be efficiently assembled into various different nanoscale structures, including three-dimensional structures, by means of self-assembly and other relevant principles. The resultant carbon assembled structures with extremely large surface area and high electro-conductivity are potentially useful for catalysis, energy storage, and so on. Aqueous dispersion of graphene oxide shows colloidal liquid crystalline phase, whose spontaneous molecular ordering is useful for display, carbon fiber spinning, filtration membrane, and so on [3, 4]. Subsequently, substitutional doping of the graphene assembled structures with boron or nitrogen was achieved via pre- or post-synthetic treatment. The resultant chemically modified graphene based nanostructures with tunable workfunction, modulated charge carrier density and remarkably enhanced surface activity could be employed for organic solar cells, nanocomposites, and so on [5]. Significantly nitrogen-dopant specific unzipping of carbon nanotubes could offer superior electrode materials for ultrafast supercapacitors and alternating electric current filters [6].

References

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