High Concentration Surfactant-Polymer Stabilized Few-layer Graphene Sheets

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Abstract

The discovery of free standing graphene just over a decade ago [1] has attracted so much attention due to its novel properties and potential application in energy storage devices, composites, sensors, solar and fuel cells, optics, medicine etc. Despite the potentially highly valuable properties exhibited by graphene, lack of feasible production methods has hindered wide scale application in industry. Several different methods exist for graphene production and each presents its own challenges. Micromechanical cleavage is the method used to produce pure single layer graphene sheets at lab scale but is not suitable for large scale production. Graphene grown on metal substrates, via methods such as chemical vapor deposition (CVD), require transfer of graphene to target substrates for various application, thus limiting the general material applicability. Chemical exfoliation of graphene oxide (GO) introduces hydroxyl and epoxide compounds on the graphene surface, which disrupt the electronic structure of graphene, such that GO itself is essentially an insulator. Furthermore, reduction only partially reduces GO back to graphene. Therefore, reduced graphene oxide fails to exhibit the same properties as virgin graphene. Sonication methods require long periods of processing for the production of low concentrated graphene suspensions and normally introduces defects to the graphene structure. Graphene can, however, be exfoliated from graphite via shear exfoliation [2]. Here we show potential for a simple and effective method for non-chemical production of high quality single and few-layer graphene sheets in colloidal suspension, that in principle can easily be scaled up for large scale production. We show the production of high concentration graphene suspensions at short processing time. The graphene so produced was characterized by UV-visible spectrometry, atomic force microscopy (AFM) and Raman spectroscopy.

References

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