

Green exfoliation of graphene nanosheets based on freezing induced volumetric expansion of carbonated water

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Abstract

Regardless of considerable advancements made on mass production of chemically exfoliated graphene nanosheets the quality, processing time, productivity, cost and environmental friendliness remain key challenges for their commercialization. Here, we report a green, economical and fast exfoliation approach for the synthesis of highly crystalline graphene sheets by means of carbonated water assisted exfoliation based on its freezing – expansion property. The obtained graphene sheets were characterized by X-ray diffraction (XRD), Raman spectroscopy, transmission electron microscopy (TEM), scanning electron microscopy (SEM) and UV-visible spectroscopy. The above mentioned characterization tools marked the synthesis of highly crystalline and defect-free mono to few layer graphene sheets. The synergistic effects of both sonication and freezing-expansion property of carbonated water have realized the exfoliation of graphite into graphene nanosheets in actual practice.

Our findings suggest that the present approach not only contributes a novel strategy, but also paves the way for large scale application of graphene in aqueous mediums such as water based green coatings.

Keywords: Graphite flakes, Graphene, exfoliation, liquid phase exfoliation

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