

Development of multi-layer graphene by an environmentally friendly process using assisted physical sonication

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The traditional approach for generating bulk graphene powders involves a multistep, strong oxidation reaction which generates graphene oxide materials. The graphene oxide exhibits a damaged graphitic structure and behaves as an insulator. Further, high temperature or strong reduction reactions are required in order to partially restore the graphitic structure, for use in conductive polymer composites or in electrochemical applications. The repaired graphene structure is however not of the same quality as the high quality graphene flakes directly exfoliated by scotch tape methodology [1, 2]. Recently, the use of organic solvents to disperse multi-layer graphene flakes directly has been shown successful [3]. However, there are outstanding environmental and cost concerns which surround the use of this exfoliation methodology.

In this report, we investigate the use of a large molecule biopolymer, which possesses strong dispersion and emulsification characteristics, to assist in the direct exfoliation of graphite through physical sonication in water. The biopolymer materials are environmentally friendly, readily available and do not exhibit bioaccumulation or cause health concerns like many small molecule surfactants. The material is characterized to verify that the graphene flakes maintain a low defect ratio and high conductivity. The investigation will also consider attempts to enhance the purity of the graphene produced, removing any biopolymer residue.

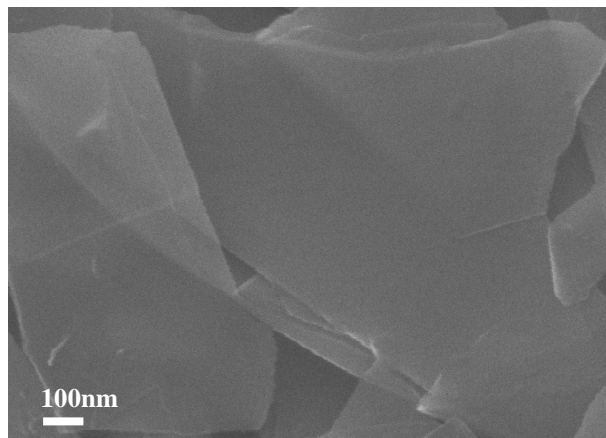


Figure 1: SEM image of graphene flakes captured from directly exfoliate graphite.

References

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3. Khan, U. et al., *High-concentration solvent exfoliation of graphene*, *Small*, Apr. 2010. **6**(7): p. 864–71.