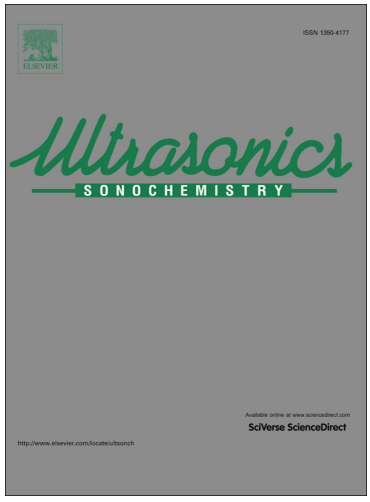

Graphene nanosheets preparation using magnetic nanoparticle assisted liquid phase exfoliation of graphite: The coupled effect of ultrasound and wedging nanoparticles

Alireza Hadi, Jafar Zahirifar, Javad Karimi-Sabet, Abolfazl Dastbaz

PII: S1350-4177(18)30248-7
DOI: https://doi.org/10.1016/j.ultsonch.2018.02.028
Reference: ULTSON 4089

To appear in: *Ultrasonics Sonochemistry*

Received Date: 27 November 2017
Revised Date: 7 January 2018
Accepted Date: 15 February 2018

Please cite this article as: A. Hadi, J. Zahirifar, J. Karimi-Sabet, A. Dastbaz, Graphene nanosheets preparation using magnetic nanoparticle assisted liquid phase exfoliation of graphite: The coupled effect of ultrasound and wedging nanoparticles, *Ultrasonics Sonochemistry* (2018), doi: https://doi.org/10.1016/j.ultsonch.2018.02.028

Graphene nanosheets preparation using magnetic nanoparticle assisted liquid phase exfoliation of graphite: The coupled effect of ultrasound and wedging nanoparticles

Alireza Hadi[1], Jafar Zahirifar[1], Javad Karimi-Sabet[2*†], Abolfazl Dastbaz[1]

[1]Department of Chemical Engineering, Faculty of Engineering, University of Tehran, Tehran, Iran

[2]Material and Nuclear Fuel Research School (MNFRS), Nuclear Science and Technology Research Institute, Tehran, Iran.

Abstract:

This study aims to investigate a novel technique to improve the yield of liquid phase exfoliation of graphite to graphene sheets. The method is based on the utilization of magnetic Fe_3O_4 nanoparticles as "particle wedge" to facilitate delamination of graphitic layers. Strong shear forces resulted from the collision of Fe_3O_4 particles with graphite particles, and intense ultrasonic waves lead to enhanced exfoliation of graphite. High quality of graphene sheets along with the ease of Fe_3O_4 particle separation from graphene solution which arises from the magnetic nature of Fe_3O_4 nanoparticles are the unique features of this approach. Initial graphite flakes and produced graphene sheets were characterized by various methods including field emission scanning electron microscopy (FE-SEM), transmission electron microscopy (TEM), Raman spectroscopy, atomic force microscopy (AFM), Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), and Zeta potential analysis. Moreover, the effect of process factors comprising initial graphite concentration, Fe_3O_4 nanoparticles concentration, sonication time,

† (*) Corresponding author. Email: j_karimi@alum.sharif.edu , jvkarimi@aeoi.org.ir