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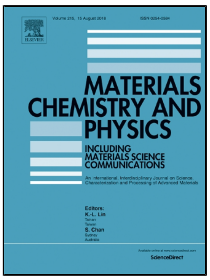

Graphene nanosheets obtained through graphite powder exfoliation in pulsed underwater electrical discharge

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ABSTRACT

Graphene nanosheets were produced by graphite exfoliation through underwater electrical discharge, also known as plasma underwater. Graphite particles were dispersed in different solvents with different ratios between polar and dispersive surface tension components (pure water and an aqueous solution of isopropyl alcohol (IPA) at different concentrations (1:1 and 7:3 IPA:Water)) under constant stirring and low voltage pulses (about 1.5kV). Even under relative low voltage, the production of graphene was observed in all solvents with the most of the graphene sheets containing less than 10 monolayers. Results show that further affinity between the surface tensions of the graphite and the solvents influenced in the characteristic of the graphene obtained. The 7:3 IPA/water solution has a similar ratio between polar and dispersive surface tension components to the graphite and the mixture. Exfoliation product obtained with this mixture presented an intense peak at ~284.3 eV, which is corresponding to sp2 binding, characteristic of the graphene. However, in this solution, it was observed further break of C-C bonds and a significant reduction of its surface area. Smaller graphene flakes sizes present more C-O contents due to the carboxyl groups be more likely to form at graphene edges than at defect sites within the basal plane.

Keywords: pulsed underwater electrical discharge; graphene, exfoliation, solvents.

1 Introduction

Recently, graphene and graphene-related materials have attracted attention due to their outstanding properties and their potential application in energy storage devices, catalysis, sensors, and polymeric