SYNTHESIS AND STRUCTURAL CHARACTERIZATION OF THERMAL REDUCED GRAPHENE OXIDE PRODUCTS

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Graphene is a two dimensional (2D) material with sp^2 hybridized carbon atoms configured in a honeycomb-like structure. Unique thermal, electrical, optical, physical and mechanical properties make it highly promising energetic material for various applications in electronics or electrochemical power sources such as fuel or solar cells and supercapacitors. [1] Today thermal reduction of graphene oxide (GO) is one of the potential synthesis methods to obtain graphene in a simple, low-cost, high yield and time-saving way. However, high volume of CO_2, CO and H_2O is released due to the deoxygenation of functional groups in GO lattice. The vigorous process of deoxygenation generates topological defects and C vacancies in the final product and causes poor electrical conductivity of graphene prepared this way. Also, high temperature of exfoliation leads to the fragmentation of graphene structure. [2] To overcome these drawbacks, efficiency recovery of conjugated π-electron system could be achieved by using lower temperature of reduction and suitable source of elemental carbon. According to the literature, reaction between malonic acid (MA) and phosphorus pentoxide gives carbon suboxide (C_3O_2) that decomposes into carbon atoms at low temperatures. [3] By addition of these compounds in reduction of GO lower defects concentration and better structural properties of thermal reduced graphene can be achieved.

In this work, we present a new approach of thermal reduction of GO in the presence of additives. Three GO samples were prepared using different oxidizing agents and exfoliated by adding various amounts of MA and P_2O_5 .The thermal annealing under Ar gas atmosphere was performed for 30 min at different temperatures: 100 ºC, 150 ºC, 250 ºC and 500 ºC. Reduced GO products were analyzed by Fourier Transform infrared (FTIR) and Raman spectroscopy, scanning electrone microscopy (SEM) and X-ray diffraction (XRD) analysis. Furthermore, measurements of electrical conductivity have also been carried out.

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