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Synthesis, characterization and reduction of graphene oxide for its application in photovoltaic solar cells

D. K .Becerra Paniagua[1], **M. Sotelo Lerma**[2] and **H. Zhao Hu**[1]
[1]Universidad Nacional Autónoma de México, México
[2]Universidad de Sonora, México

In this paper, the graphene oxide (GO) was prepared by variations of the Tour using natural graphite powder as starting material. The GO was synthesis procedure is described as follows: for oxidation stage, a mixture of concentred sulfuric acid and boric acid (H_2SO_4/H_3BO_3, 10-30 ml) was added to a mixture of graphite powder (0.1-0.3 g) and potassium permanganate ($KMnO_4$, 0.6-0.8 g), producing a slight exotherm. The reaction was stirred for 30-90 min to 20-30 °C and then was heated to 40-55°C. For exfoliation stage, deionized (DI) water (20-30 ml) was added to the suspension and then was heated to 80-90°C and stirred for 15-45 min. The reaction was then finished by adding hydrogen peroxide (H_2O_2 50%, 10-30 ml). The resulting product has a brown/yellowish color and was separated by centrifugation from the solution. The resulting GO was washed 3-5 times with diluted HCl (20%, 50-100 ml) and DI water (150-200 ml); for each wash, the mixture was centrifuged (6000 rpm for 10-20 min) and the supernatant decanted away. The solid obtained was dried overnight to 50-60°C, obtaining 30-40 mg. For reduction stage, GO was suspended in DI water and sonicated for 1-2 h, yielding an aqueous GO dispersion (10-20 mg/ 100 ml). This dispersion was treated with ascorbic acid (1-2 mM) and stirred for 1-2 h to 70-80°C under reflux. The resulting product has a dark color and was separated by centrifugation from the solution. The solid obtained was dried overnight to 50-60°C, obtaining 5-10 mg of product. To study the chemical composition, presence of functional groups, exfoliation level, number of layers, oxidation degree, and the samples were characterized by different techniques such as UV-Visible, FT-IR, SEM, TEM and XPS. The designed synthesis is to looking for an alternative approach for large scale production of GO.

dkbp@ier.unam.mx