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Microwave-assisted rapid synthesis of Graphene-ZnO nanocomposite

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Graphene, one-atom-thick two-dimensional sheet of sp^2-bonded carbon atoms arranged in honeycomb network, has attracted whole world due to its remarkable electrical, optical, mechanical and thermal properties [1]. Apart from different synthesis techniques; mono or bilayer graphene has been successfully produced recently from microwave-assist exfoliated graphite (EG) [2]. In addition, graphene combined with metal oxide nanostructure such as ZnO, not only resists agglomeration of graphene layers but also enhances its properties; and shown enhanced photocatalytic reduction, electrocatalytic activity and higher efficiency in solar cells [3]. Herein, we present a rapid and energy saving synthesis approach for graphene (G)-ZnO nanocomposite by microwave system within 300sec. Initially, natural flake graphite (NFG) has been exfoliated through microwave irradiation and used as carbon precursor. Microwave-assisted reaction of Zinc acetate dehydrate in aqueous solution of EG with hydrazine hydrate, results the formation of G-ZnO nanocomposite.

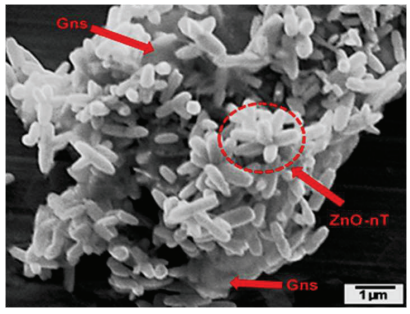

Figure 1: SEM image of G-ZnO nanocomposite

Figure 1 shows microstructure of G-ZnO nanocomposite consists of randomly crumpled thin sheets of graphene closely associated with each other; and ZnO nanotubes grown over graphene and resemble like flowers. Further, G-ZnO nanocomposite was characterized by Raman spectroscopy to identify ZnO phase and number of graphene layers. Raman spectra confirm the formation of G-ZnO nanocomposite. The 2D peak at 2682 cm^{-1} is well fitted with six Lorentz curves with R^2 accuracy of 0.97533 as shown in Figure 2. This clearly indicates formation of trilayer graphene system [4]. In addition, X-ray spectroscopy (XPS) has been tested for compositional analysis. XPS confirms the formation of nanocomposite with C, O and Zn elements (Figure 3).

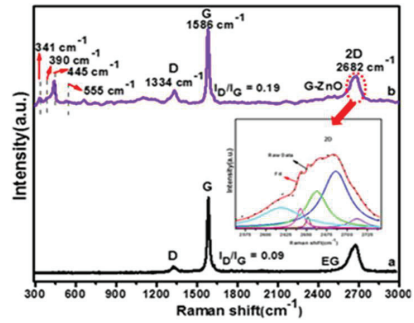

Figure 2: Raman spectra of G-ZnO nanocomposite Inset: 2D peak with six well fitted Lorentz curves

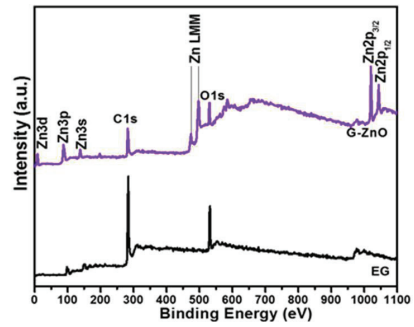

Figure 3: XPS survey of G-ZnO nanocomposite

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