Synthesis of Reduced Graphene Oxide/Nickel (rGO/NiO) Nanocomposite via Electron Beam

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Introduction
Electron Beam is a flow of electrons with energy that has been used mainly for sterilization and to cross-link polymers. However, little is known about graphene based /metal nanocomposites generated by electron beam metal nanoparticles on graphene-based surfaces produces new materials with wide application in optics, electronics and catalysis [1]. The aims of this work are to syntheze and characterize reduced graphene oxide/nickel oxide (rGO/NiO) via electron beam to generate conductive materials.

Method, Results and discussion
Dispersed graphene oxide was mixed with nickel in the complex form in water-isopropanol (1:1) solution. The mix was submitted to a dose of radiation varying between 150 and 400 KGy. The nanocomposite rGO/NiO characterization was performed by thermogravimetry analysis (TGA), X-ray diffraction (XDR), cyclic voltammetry (CV) and scanning transmission electron microscope coupled to the energy dispersive X-ray spectrometry (TEM/EDS). The TGA curve showed that the incorporation amount of Ni was 20% (w/w) and the presence of Ni was confirmed by TEM/EDS and nanoparticle size was 20 nm. The nanocomposite crystalline structure was confirmed by XRD as well as the number of layers of rGO, which are four. From the XDR pattern of the rGO/NiO, a peak corresponding to the rGO at $2\theta=9.10°$. These results indicate the incorporation of Ni nanoparticles to the rGO. The electrochemical characterization of rGO/NiO was performed by CV. From the voltammetric profile, current peaks were observed at 0,45 V (vs.Ag/AgCl) and correspond to 0,75 A/mol/cm^2 in ascorbic acid media and pH = 5.0. According to the data obtained, it was possible to observe that the rGO/NiO showed a higher current density compared to graphene oxide at the same conditions.

Conclusions
The analysis demonstrated that it is possible to apply electron beam in the synthesis of rGO/NiO and as confirmed by the characterization results. It is noteworthy that the incorporation of NiO occurred at the same time the reduction of graphene oxide. The voltammetric results showed that the presence of rGO/NiO facilitated the transfer of charge during the electrooxidation of ascorbic acid. This study allowed the generation of a conductive nanocomposite that can be widely used in the electrochemical area.

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Reference

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