Graphene Oxide/Polyaniline/Tungsten Oxide Nanowires: A new nanocomposite for energy storage devices

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Abstract

We report the synthesis, characterization and application in energy field of **GO/PAni/WO_3** nanocompostie.

Introduction

Graphene based materials, conducting polymers and transition metal oxides are materials with several applications, highlighting the sensors and energy storage capacity. The combination of these nanostructures may show an improvement in their properties, through the synergic effect. Due to the long life cycle and quick charge/discharge process, electrochemical capacitors were regarded as "green" energy storage devices,[1] however it needs to improve performance. In this sense, different nanostructured materials may increase ionic conductivity and the ion transport,[2] showing better results for the capacity properties. Thus we report the synthesis and characterization of a novel nanocomposite based on one and two dimensional materials and the application as supercapacitors.

Results and Discution

The methodology is summarized as: i) graphene oxide dispersions (**GO**) were synthesized through modified Hummers method,[3] in which the oxidized graphite was dispersed in water resulting in an aqueous and stable solution, **GO**, ii) the tungsten oxide nanowires (**WO_3NW**) were synthesized by a hydrothermal reaction using the Na_2WO_4 as a precursor material,[4] iii) nanocomposites were prepared by adding different proportions of GO dispersions and **WO_3NR** was added in the polyaniline (**PAni**) synthesis, using hydrochloric acid and ammonium persulfate to obtain the polymer in its conducting structure. The new materials were deposited in FTO, a conducting substrate, using the drop-dry methodology. All samples were characterized by: Raman spectroscopy, scanning electron microscopy, and especially by electrochemical methods such as cyclic voltammetry, charge/discharged and electrochemical impedance spectroscopy. Figure 01 shows the cyclic voltammograms of the obtained materials, which clearly present the peaks for the redox process of the conducting polymer.[5]

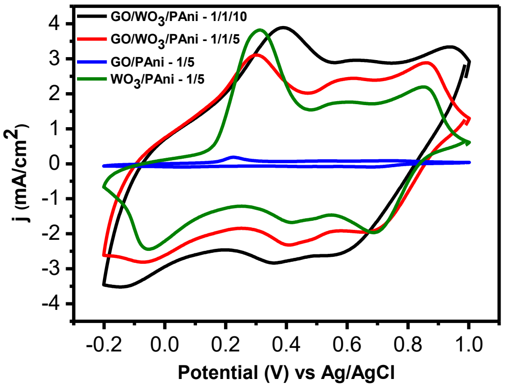

Figure 1. Cyclic voltammograms of the obtained materials in H_2SO_4 (0.5 mol L^{-1})

It can be seen that **GO/WO_3/PAni -1/1/10** nanocomposite has a higher current density, indicating that more capacitive material. This is evidenced by the charge-discharge analysis, from which we obtain the capacitance value of 234 $F.g^{-1}$ for **GO/WO_3/PAni–1/1/10**, 121 $F.g^{-1}$, 86 $F.g^{-1}$, and 179 $F.g^{-1}$ for **GO/WO_3/PAni–1/1/5, GO/WO_3–1/5** and **WO_3/PAni–1/5** respectively. Moreover, the **GO/WO_3/PAni** shows a higher stability (charge/discharge) compared to the other materials.

Conclusions

Results confirm the success in the synthesis of **GO/ WO_3/PAni** nanocomposite. Besides, our nanocomposite is show a good specific capacitance attached with a highly stable when compared to the neat materials used in this project.

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