Novel synthetic route to graphene/tungsten oxide nanocomposite

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Abstract

We report a green route to produce graphene /tungsten oxide (rGO/WO_3) nanocomposite.

Introduction

Graphene is a 2D material that stands out due to its exceptional properties, which makes it promising in many applications[1]. In this sense, we highlight tungsten oxide, a promising material in applications such as capacitors, sensors, optical displays and energy storage. Usually, these nanocomposites are obtained through techniques that require polluting reagents, high temperature and/or expensive equipment. Targeting to solve this problem, the aim of this work is to produce the **rGO/WO_3** nanocomposite through a simple and green route based on the hydrogen as the reducing agent of both materials involved.

Results e Discussion

Experimental procedure is summarized as: (i) GO was obtained through a modified Hummers Method[4], in which the oxidized graphite was dispersed in water resulting in an aqueous and stable solution (GO); (ii) peroxitungstic acid was obtained from sodium tungstate and hydrogen peroxide reaction, resulting in a solution of peroxitungstic acid (**$H_2W_2O_{11}$**); (iii) the prepared solutions were mixed to hydrochloride acid 3 mol.L^{-1} and the addition of magnesium foils in it, resulted in the production of hydrogen and high temperature. This condition caused the reduction of both materials and produced the **rGO/WO_3** nanocomposite. The nanocomposite was characterized by Raman spectroscopy, scanning electron microscopy, x-ray diffraction and electrochemical methods.

Figure 1 shows the Raman spectra of the nanocomposite along with neat **WO_3 and rGO** for comparison. Spectrum of **WO_3** presents three peaks at 690 cm^{-1}, 788 cm^{-1} and 979 cm^{-1}, commonly associated to O-W-O and W-O stretching modes[2]. **rGO** spectrum shows the three characteristic peaks of carbonaceous materials: D (1352 cm^{-1}), G (1594 cm^{-1}) and a well-defined 2D (2700 cm^{-1})[3].

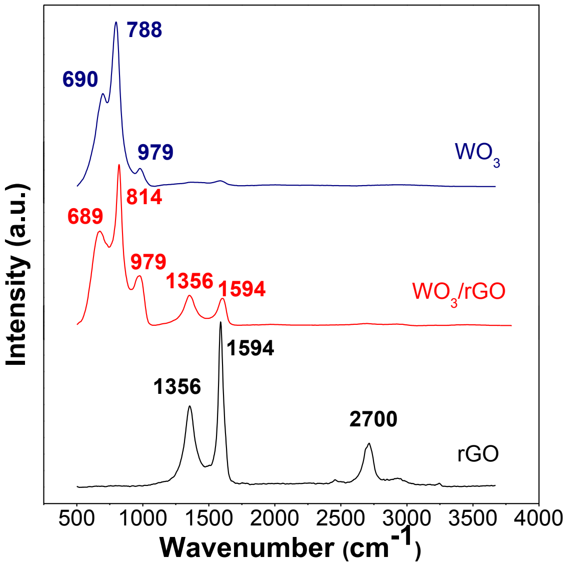

Figure 1. Raman spectra of WO_3, rGO and rGO/WO_3.

The nanocomposite spectrum presents peaks from both materials, attesting the success of this synthetic route. Thus, this nanocomposite has presented great potential in the applications such as capacitors and electrochemical sensors, experiments are being conducted in order to testify this.

Conclusion

Results confirmed the efficiency of a novel method to obtain **rGO/WO_3** nanocomposites. Besides, the obtained material presents potential to be employed as capacitor and sensor.

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