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Analysis on the effect of ZnO on Carbon nanotube by spray pyrolysis method

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Abstract

Background: ZnO/CNT nanocomposites were prepared using Zinc acetate source materials and with the assistance of copper plate, glycine and sugar solution. The combined behavior between these two materials may give rise to the production of advanced materials with a wide range of applications in electronics and optoelectronics.

Methods: The ZnO-CNT nanostructures are successfully prepared by simple perfume spray pyrolysis method on copper substrate. The possible growth mechanism of ZnO-CNT nanocrystals formation by this method has been tried to explore the sensor and optical properties has been demonstrated.

Results: The as-synthesized ZnO-CNT nanostructures were characterized using the scanning electron microscopy (SEM), transmission electron microscopy (TEM) and X-ray diffraction (XRD) pattern measured with Cu Kα radiation. Studies of the morphologies of the ZnO-coated CNTs revealed no significant change in the internal structures single walled graphite sheets and the diameters of the CNTs, but the ZnO appeared to form a layer of thinfilm single crystalline particles attaching to the surface of the nanotubes. The photoluminescence (PL) measurements excited by the 380 nm were done at room temperature. CNTs are easy to be entangled and agglomerate due to their long length and low diffusive mobility in base fluids.

Conclusion: The lower mobility was found to occur for the ZnO/CNT composite where a linear sensitivity behavior was measured and it reaches high at the temperature of 200 °C. The samples luminescence is dominated by well-structured ultraviolet band emission and almost no deep level emission was observed, revealing a high optical quality of the produced structures.

Keywords: ZnO-CNT, Photoluminescence studies, Morphological studies and sensor studies

Background

The carbon nanotubes (CNTs) have also strained much attention since their unique fundamental physical structures, eminent mechanical and electronic properties which leading to potential high-technology applications (Odaci et al. 2008; Wei et al. 2008; Iyakutti et al. 2009). The ZnO is one of the most important functional metal oxides for their versatile practical applications, ranging from photodetector (Jun et al. 2009), transparent electrode (Oh et al. 2005), spintronic devices (Gupta et al. 2008), surface acoustic wave devices (Krishnamoorthy and Iliadis 2008), and thin film gas sensors(Tang et al. 2006), attributed to their outstanding properties such as wide direct optical band gap, large exciton binding energy, excellent chemical and thermal stability, and excellent piezoelectric properties(Gupta et al. 2009). When the ZnO metal oxide is combined with CNT, it is marvelous that, the novel extraordinary properties of ZnO-CNT composite is appear.

In recent years, nano structured materials such as ZnO-CNT nano composites have also been incorporated into electrochemical sensors for biological and pharmaceutical analyses (Suchea et al. 2006). While they have many properties similar to other types of materials, they offer unique advantages including enhanced electron transfer, large edge plane/basal plane ratios and rapid kinetics of the electrode processes (Banks et al. 2006). Nanocomposites of a variety of shapes, sizes and compositions are changing modern bioanalytical measurement (Moradi et al. 2013).

Ching-Feng Li, Chia-Yen Hsu, Yuan-Yao Li et al. reported that, an 80 nm-thick ZnO film was prepared via the sol–gel method at 500 °C using zinc acetate, 2-methoxyethanol, and mono ethanolamine as precursors. Characterization of the film showed that it was composed of 20–30 nm sintered

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