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Optical and microstructural characteristics of CuO thin films by sol gel process and introducing in non-enzymatic glucose biosensor applications

Jessica Lillo-Ramiro [a], Jorge M. Guerrero-Villalba [a], María de L. Mota-González [a,b], Francisco S. Aguirre- Tostado [c], Gerardo Gutiérrez-Heredia [d], Israel Mejía-Silva [e], Amanda Carrillo- Castillo [a,*]

[a] Instituto de Ingeniería y Tecnología, Universidad Autónoma de Ciudad Juárez. Cd. Juárez, Chihuahua, CP, 32310, Mexico
[b] CONACYT- Universidad Autónoma de Ciudad Juárez. Cd. Juárez, Chihuahua, CP, 32310, Mexico
[c] Centro de Investigación en Materiales Avanzados, S. C., Unidad Monterrey, Apodaca, Nuevo León, C.P. 66628, Mexico
[d] Universidad de Sonora, Hermosillo, Sonora, C.P. 83000, Mexico
[e] Centro de Ingeniería y Desarrollo Industrial, Querétaro, Querétaro, C.P 76125, Mexico

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ABSTRACT

In this work, we reported the synthesis of copper oxide (CuO) thin films by sol-gel process assisted by spin coating technique at room temperature. Chemical characterization of CuO precursor solution was determined by Fourier Transformed Infrared Spectroscopy (FTIR) and thermal stability by Thermogravimetric/ Differential Scanning Calorimetry Analysis (TGA/DSC). The influence of variation parameters for the thin films were studied: speed deposition, number of layers and annealing effect on the deposited films. The optical properties of CuO thin films were analyzed using a spectrophotometer (UV–vis-NIR) in a range of 300−1100 nm. The calculated band gap for CuO this films was between 3.35 eV–3.89 eV for as deposited thin films and 2.4 eV–3.6 eV for annealed films. Homogeneous deposited films with monoclinic structure were determined using scanning electron microscopy (SEM) and X-Ray Diffraction respectively. The compositions and homogeneous elemental distributions were analyzed by energy dispersive spectroscopy (EDAX). From the profilometer measurement, the thicknesses of the CuO thin films prepared were found to be ~1/2−1 μm, depending of speed deposition. Finally, CuO solution precursor and thin films were implemented in a glucose test which showed the formation of gluconic acid by FTIR, indicating the glucose oxidation due to CuO interaction.

1. Introduction

Recent efforts to develop semiconductor oxide materials have increased the interest of the science community. Cupric oxide (CuO) is a widely used semiconductor due to its electrical and optical characteristics. This oxide is a p-type semiconductor with high mobility 0.06 - 5.40 cm^2/ Vs [1,2] and a 3.32 eV–3.65 eV band gap. It is also having a monoclinic crystal structure. Moreover, it exhibits electrochemical activity and it is easy to integrate with other materials [3,4]. Also, it is non-toxic at low concentrations and is greatly

* Corresponding author.
E-mail address: amanda.carrillo@uacj.mx (A.C. Castillo).

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