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A New Piezo-Amperometric Sensing Method Based on Comb-like Nanostructured Zinc Oxide Thin Films for the Efficient Detection of Na_2SO_4

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Abstract

A chemical vapor deposition (CVD) was employed to deposit ZnO thin films on two different substrates, glass (quartz) and silicon. The characterization of structural properties of the comb-like nanostructure ZnO thin films were carried out through X-ray diffraction (XRD), atomic force microscopy (AFM) and scanning electron microscopy (SEM). Nanostructured thin film sensor has been fabricated to detect the Na_2SO_2 aqueous solution concentrations. The obtained films are strongly c-axis oriented along (100) direction and have other low intensity towards the directions (101), (200) and (211), indicating polycrystalline characteristics. The film exhibits high dense comb-like nanostructured distribution which has been indicated in the SEM images, AFM images depicted the film porosity, the film deposited on the glass substrate has more pinholes and porosity than that deposited on the silicon substrate. A new sensing method has been established depending on the piezoelectrical properties of the ZnO material and the electrochemical interaction with the salt. Furthermore, the Na_2SO_4 sensing properties of the ZnO thin film were investigated for various salt concentrations (100, 200, 300 and 400) mg/L. The nanostructured ZnO thin film exhibits higher response, very fast rise time and acceptable recovery time upon working at room temperature. The relative response of ZnO film linearly behaves with the salt concentrations biomedical sensor was obtained. In this work, the results of detailed

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