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Morphological and Sensing Properties of the ZnO-Zn2SnO4 Ternary Phase Nanorod Arrays

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Abstract

In this paper, the morphological and sensing properties of the Sn-doped ZnO-Zn2SnO4 nanorods obtained by the hydrothermal method are presented. The developed methodology exhibits high levels of efficiency and cost-effectiveness, making it particularly suitable for implementation in the field of nanoelectronics and biomedical applications. Scanning electron microscopy was used to analyze the morphology of the Sn-doped ZnO-Zn2SnO4 nanostructures showing nanorod arrays formation. Energy dispersive X-ray spectroscopy was involved to determine the chemical composition and shows uniform distribution of Sn. Structural analysis by X-ray diffraction shows high crystallinity of Sn-doped ZnO-Zn2SnO4 samples with (0002) main orientation and formation of a ternary phase Zn2SnO4. These nanostructures obtained by the hydrothermal method were tested as sensor materials for ethanol and carbon dioxide. A high response of about 130% to 100 ppm ethanol vapor with a very fast response time of 1s at an operating temperature of 250 °C was observed. This factor is very important for the detection of harmful or explosive gases. Sn-doping in ZnO and the formation of Zn2SnO4 is considered to be the key factor that changes the morphological and sensing properties for application use in miniaturized photodetectors, light emitting diodes, laser light source, and gas sensors.

Keywords: zinc oxide, nanorods, hydrothermal method, scanning electron microscopy, zinc doping

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