

## Design and Fabrication of ZSO Nanocomposite Thin Film Based NO<sub>2</sub> Gas Sensor

**Authors :** Bal Chandra Yadav, Rakesh K. Sonker, Anjali Sharma, Punit Tyagi, Vinay Gupta, Monika Tomar

**Abstract :** In the present study, ZnO doped SnO<sub>2</sub> thin films of various compositions were deposited on the surface of a corning substrate by dropping the two sols containing the precursors for composite (ZSO) with subsequent heat treatment. The sensor materials used for selective detection of nitrogen dioxide (NO<sub>2</sub>) were designed from the correlation between the sensor composition and gas response. The available NO<sub>2</sub> sensors are operative at very high temperature (150-800 °C) with low sensing response (2-100) even in higher concentrations. Efforts are continuing towards the development of NO<sub>2</sub> gas sensor aiming with an enhanced response along with a reduction in operating temperature by incorporating some catalysts or dopants. Thus in this work, a novel sensor structure based on ZSO nanocomposite has been fabricated using chemical route for the detection of NO<sub>2</sub> gas. The structural, surface morphological and optical properties of prepared films have been studied by using X-ray diffraction (XRD), Atomic force microscopy (AFM), Transmission electron microscope (TEM) and UV-visible spectroscopy respectively. The effect of thickness variation from 230 nm to 644 nm of ZSO composite thin film has been studied and the ZSO thin film of thickness ~ 460 nm was found to exhibit the maximum gas sensing response ~ 2.1×10<sup>3</sup> towards 20 ppm NO<sub>2</sub> gas at an operating temperature of 90 °C. The average response and recovery times of the sensor were observed to be 3.51 and 6.91 min respectively. Selectivity of the sensor was checked with the cross-exposure of vapour CO, acetone, IPA, CH<sub>4</sub>, NH<sub>3</sub> and CO<sub>2</sub> gases. It was found that besides the higher sensing response towards NO<sub>2</sub> gas, the prepared ZSO thin film was also highly selective towards NO<sub>2</sub> gas.

**Keywords :** ZSO nanocomposite thin film, ZnO tetrapod structure, NO<sub>2</sub> gas sensor, sol-gel method

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