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Design and Fabrication of ZSO nanocomposite thin film based NO_2 gas sensor

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ZnO doped SnO_2 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_2) were designed from the correlation between the sensor composition and gas response. The available NO_2 sensors are operative at a very high temperature (150-800°C) with low sensing response (2-100) even in higher concentrations. Efforts are continuing towards the development of NO_2 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 the chemical route for the detection of NO_2 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 230nm to 644nm of ZSO composite thin film has been studied and the ZSO thin film of thickness ~460nm was found to exhibit the maximum gas sensing response ~2.1×103 towards 20ppm NO_2 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, CH4, NH3, and CO_2 gases. It was found that besides the higher sensing response towards NO_2 gas, the prepared ZSO thin film was also highly selective towards NO_2 gas.

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