World Academy of Science, Engineering and Technology
International Journal of Electronics and Communication Engineering
Vol:11, No:05, 2017

Design and Fabrication of ZSO Nanocomposite Thin Film Based NO2 Gas Sensor

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Abstract : In the present study, ZnO doped SnO2 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 (NO2) were designed from the correlation between the sensor composition and gas response. The available NO2 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 NO2 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 NO2 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 ~ 2.1×103 towards 20 ppm NO2 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 CO2 gases. It was found that besides the higher sensing response towards NO2 gas, the prepared ZSO thin film was also highly selective towards NO2 gas.

Keywords : ZSO nanocomposite thin film, ZnO tetrapod structure, NO2 gas sensor, sol-gel method
Conference Title : ICSAMN 2017 : International Conference on Sensors, Actuators, Micro- and Nanosystems
Conference Location : Tokyo, Japan
Conference Dates : May 28-29, 2017