Abstract

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Development of Nano SnO2 and SnO2:V2O5 Thin films for Selective Gas Sensor devices

Pure and doped SnO2 with V2O5 nanopowders were synthesized via sol–gel method using different V2O5 ratios. Novel thin films of SnO2: V2O5 were thermally vacuum deposited from the nanopowders and utilized for gas sensor devices to detect volatile organic compounds hazardous gases. The morphological and crystalline structure, textural properties, functional groups, optical properties and thermal behavior were investigated by FESEM, XRD, HRTEM, surface area BET, FTIR and UV–Visible spectroscopy, respectively, for both the nanopowders, and thin films. From XRD patterns, the average calculated crystallite sizes decreased from 7.8 nm to 4.5 nm as the V2O5 concentration was varied from 0 to 10%. FESEM and HRTEM show that all the synthesized nanomaterials composed of mesoporous networks of aggregated nanoparticles that almost spherical. Thus, V2O5 doped SnO2 nanopowders synthesized by sol–gel method exhibited the structural and textural features required to be used as an active area for gas sensor devices. The effect of various doping weight amounts (1, 5 and 10 wt%) of V2O5 as the dopant element enhanced the gas response time and sensitivity. The electrical behavior of the sensors was determined by measuring the resistance of two deposited platinum