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Morphological, structural, and gas-sensing characterization of tin-doped indium oxide nanoparticles

Abstract

Tin-doped indium oxide (ITO) nanoparticles with stable cubic phases were synthesized using a sol–gel combustion method that includes gelation and combustion in organic fuel. The influence of SnO_2 on the phase and morphology of the In_2O_3 nanoparticles were studied by X-ray diffraction, scanning electron microscopy, and high resolution transmission electron microscopy (TEM), along with selected area electron diffraction. ITO nanoparticles with 11–20 nm crystallite size and 69–46 m^2□g specific surface area were obtained. The lattice constant was nearly 10.12 Å, with orientation along the (222), (400), and (110) planes for all proportions of the doped SnO, indicating a stable cubic phase with high conductivity. The TEM micrograph of the ITO nanoparticles and powder revealed spherical morphology. The microstructure of the cured In_2O_3:Sn with Sn concentrations of 5, 10, 20, and 50 wt% demonstrated that the ITO nanoparticles clustered more densely with the increase in Sn concentration. The gas-sensing ability of the synthesized powders was demonstrated through the sensing of ethanol vapor at 200 °C.

Keywords; Sol–gel combustion, Sn-doped indium oxide, Structural, Electrical