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Effect of precursor concentration on structural, optical, electrical and gas sensing properties of nanostructured tin oxide thin films

Nanocrystalline SnO2 thin films were deposited onto glass substrates by spray pyrolysis. The effects of concentration of tin salt, on structural, electrical and optical properties of the SnO2 thin films have been investigated in order to optimize the gas sensing performance. Films were characterized by XRD, FESEM, TEM and UV-visible spectroscopy techniques. SnO2 thin films obtained under optimized conditions were found to be nanocrystalline in nature with tetragonal structure which is observed from XRD and TEM. The optical band gap of these films was found to be decreased from 3.54 to 3.82 eV with increase in SnCl4 precursor concentration. The sensing properties of the SnO2 thin films for H2S with operating temperature and gas concentration have been investigated.

Summary

The effect of the precursor concentration on the gas sensing characteristics of SnO2 films prepared by spray pyrolysis was studied. The films are polycrystalline with tetragonal crystal structure showing crystal reorientation effect as well as enhancement in grain size confirmed from TEM and XRD. The direct optical band gap (Eg) has decreased from 3.54 to 3.82 eV with increase in SnCl4 precursor concentration. The spray deposited SnO2 films were sensitive to H2S with 152.4, 102, 963 and 615.2 response at 150 oC upon exposure to 100 ppm of H2S gas for samples S1, S2, S3 and S4 respectively. The sensor response was quick (~ 8 s) and the recovery was fast (~ 30 s).

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