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Volume of precursor solution effect on the properties of SnO_2 thin films prepared by nebulized spray pyrolysis technique(Article)

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Abstract

Undoped SnO_2 thin films have been deposited on amorphous glass substrates with different precursor solution volume (10, 15, 20 and 25 ml) using simple and cost-effective nebulized spray pyrolysis technique. The influence of precursor solution on structural, optical, photoluminescence and electrical properties had been studied. The X-ray diffraction spectra prove the polycrystalline nature of SnO_2 with tetragonal structure. All the films show a preferred growth orientation along (110) diffraction plane. The average transmittance of SnO_2 thin films varied between 82 and 75% in the visible as well as IR region. The band gap energy decreases from 3.74 to 3.64 eV corresponding to direct transitions with the precursor solution volume had increased from 10 to 20 ml and then increased as 3.72 eV for 25 ml. SEM pictures demonstrated polyhedrons like grains. EDX confirmed the existence of Sn and O elements in all the prepared SnO_2 thin films. Photoluminescence spectra at room temperature revealed that the four emission bands in all the samples such as sharp dominant peak at 361 nm with shoulder peak at 377 nm (UV region), a broad and low intensity peak at 492 nm (blue region) and 519 nm (green region). The electrical parameters were examined by Hall effect measurements, which demonstrated that the film prepared at 20 ml precursor solution volume possess minimum resistivity 2.76×10^{-3} Ω-cm with activation energy 0.10 eV and maximum figure of merit 1.54×10^{-2} $(\Omega/sq)^{-1}$.

Author keywords

Activation energy | Band gap | Crystallite size | Nebulized spray pyrolysis | Tin oxide

Indexed keywords

Engineering controlled terms: Activation energy | Amorphous films | Amorphous materials | Cost effectiveness | Crystallite size | Energy gap | Film preparation | Photoluminescence | Solution mining | Spray pyrolysis | Substrates | Tin oxides

Engineering uncontrolled terms: Different precursors | Electrical parameter | Hall effect measurement | Nebulized spray pyrolysis | Photoluminescence spectrum | Precursor solutions | Tetragonal structure | X-ray diffraction spectrum

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