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Influence of Substrate Temperature on Physical Properties of Nebulized Spray Deposited SnSe Thin Films(Article)

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Abstract

Tin-based binary chalcogenide semiconductors SnSe and SnS have created increased interest in the production of earth-abundant and eco-friendly thin film solar cells. Thin films of SnSe were prepared on glass substrates at different temperatures via a nebulized spray pyrolysis technique using Stannous chlroride dihydrate and Se powder. Deposited films were characterized by structural, morphological, compositional, optical, and electrical properties. X-ray diffraction studies confirm the films are of polycrystalline orthorhombic crystal structure irrespective of substrate temperature. Scanning electron microscopy studies revealed uniform deposition with nanometer range grain size. Stoichiometric films of SnSe were observed from energy dispersive analysis by X-ray studies. UV-vis spectroscopy confirmed the formation of good adherence thin films with an average transmittance of ~70% in the visible region. Optical band gap was in the range of 1.14-1.24. The lower absorption and high transmittance in the visible region observed at lower substrate temperature represented the good optical quality of the crystals with low absorption or scattering losses. The lower electrical resistivity value of 4.84 Ωcm showed that the films are semiconducting. The structural, optical, morphological, and electrical conductivity studies of tin selenide thin films confirmed that the optimum substrate temperatures for depositing SnSe thin films by this NSP technique is 300°.

Indexed keywords

Engineering controlled terms: Crystal structure | Deposition | Electric conductivity | Energy gap | Entertainment industry | IV-VI semiconductors | Layered semiconductors | Scanning electron microscopy | Selenium compounds | Semiconducting selenium compounds | Semiconducting tin compounds | Spray pyrolysis | Substrates | Thin film solar cells | Tin compounds | Ultraviolet visible spectroscopy

Engineering uncontrolled terms: Chalcogenide semiconductors | Electrical conductivity | Energy dispersive analysis | Good optical quality | Nebulized spray pyrolysis | Orthorhombic crystal structures | Substrate temperature | X-ray diffraction studies

Engineering main heading: Thin films

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