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Influence of tin precursor concentration on physical properties of nebulized spray deposited tin disulfide thin films(Article)(Open Access)

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Abstract

Tin disulfide thin films were prepared with different molarities of tin species (M_{Sn}) at the optimized substrate temperature using the Nebulized Spray pyrolysis technique to obtain better crystallinity with mono phase thin films. The concentration of Tin IV chloride Penta hydrate precursor is varied from 0.05:0.4 to 0.25:0.4 ($SnCl_4.5H_2O$: thiourea) to achieve correct stoichiometry and to tune the concentration of Tin ions in the SnS_2 thin films. These films were well adherent, uniform, and shiny. Lower concentrations of Tin yields highly textured SnS_2 thin films with (001) crystallite orientation. On increasing the concentration, the multi-phases (SnS and Sn_2S_3) were found to be present along with SnS_2 material. The platelet-like grains were observed from SEM analysis in these SnS_2 films. Multiple interference effects were predominant in all these thin films in the wavelength region of 600–1100 nm. The direct optical band gap of tin disulfide thin films had decreased from 3.2 eV to 2.75 eV with an increase in M_{Sn} from 0.05 to 0.2 M, respectively, and further increased to 3.0 eV for 0.25 M concentration. Using Hall Effect measurement, the type of semiconductor is found to be of n-type. A minimum resistivity value of 2.19×10^3 Ω cm was obtained for the film grown at M_{Sn} = 0.2 M.

Author keywords

nebulized spray pyrolysis | Precursor concentration | thin films | tin disufhide

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