Preparation and characterization of sns thin films for solar cell application

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Thin films of tin sulfide (SnS) were prepared by thermal evaporation technique on glass substrates, in the rangeof substrate temperature 50-300C and their physical propertieswere studied with appropriate techniques. The obtained results were discussed in view of testing the suitability of SnS film as an absorber for the fabrication of low-cost and non toxic solar cell.

For substrate temperature, Ts=300°C, the films showed only the SnS phase with a strong (111) preferred orientation. The films deposited at Ts< 300°C deviated from stoichiometry andadditional phases such as SnS2, Sn2S3 were found to be present.

The structural parameters such as crystallite size, strain anddislocation density were estimated from XRD pattern. Studiesshowed that the crystallite size increased from 18 nm to 42 nm with increase of Ts. The surface morphology of the films was examined using scanning electron microscopy (SEM) and atomic force microscopy (AFM). The average grain size and surface roughness were found to increase with increase in the substrate temperature.

The films grown at 300C have shown blunted grains with an average size of 265 nm and roughness of 6.8 nm. Optical transmission spectra were recorded in the wavelength range 400-1200 nm, and the data were used to calculate absorption coefficient and optical bandgap. The single-phase film grown at 300°C has shown a directoptical band gap of ~1.36 eV, with an absorption coefficient of $10^5 cm^{-1}$above the fundamental absorption edge.

The conclusion can be made that these polycrystalline, single-phase and highly absorbing SnS thin films are suitable for the fabrication of junction solar cells.

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