

Influence of Annealing Condition on Ultrasonically Sprayed ZnS Thin Films

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ZnS thin films were grown by ultrasonic spray pyrolysis (USP) technique on soda–lime glass substrates at different annealing conditions such as temperature ambience. Structural, morphological, and optical properties of these films were characterized by using X-ray diffraction (XRD), scanning electron microscopy (SEM), and ultraviolet-visible (UV-Vis) spectrophotometry, respectively. Structural parameters such as strain ϵ , crystalline size D , and dislocation density δ for all thin films were calculated using XRD analysis. The XRD pattern of ZnS films annealed in N₂ ambient at 550°C indicated a nearly amorphous structure. The film, annealed at 500 and 550°C in H₂S:Ar ambient, suggests the presence of four peaks at 26.73, 28.26, 47.35, and 56.14 deg due to (100), (002), (110), and (112) planes of wurtzite ZnS, respectively. SEM images of ZnS in N₂ ambient seem to be homogenously dispersed while ZnS thin films annealed at 500 and 550°C in H₂S:Ar (1:9) consist of homogenously nano-sized grains. UV-Vis spectroscopy measurements indicate that the transmittance and energy band gap of ZnS thin films annealed at different ambient are changed due to the different crystallinity and the roughness. The energy band gap of the ZnS with various ambient found to be 3.64, 3.55, and 3.63 eV for H₂S:Ar at 500°C, H₂S:Ar at 550°C, and N₂ at 500°C, respectively.

Keywords: ZnS, ultrasonic spray pyrolysis, annealing.

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