

Effect of Thickness on Structural and Electrical Properties of CuAlS₂ Thin Films Grown by Two Stage Vacuum Thermal Evaporation Technique

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Abstract : This work studies the effect of thickness on structural and electrical properties of CuAlS₂ thin films grown by two stage vacuum thermal evaporation technique. CuAlS₂ thin films of thicknesses 50nm, 100nm and 200nm were deposited on suitably cleaned corning 7059 glass substrate at room temperature (RT). In the first stage Cu-Al precursors were grown at room temperature by thermal evaporation and in the second stage Cu-Al precursors were converted to CuAlS₂ thin films by sulfurisation under sulfur atmosphere at the temperature of 673K. The structural properties of the films were examined by X-ray diffraction (XRD) technique while electrical properties of the specimens were studied using four point probe method. The XRD studies revealed that the films are of crystalline in nature having tetragonal structure. The variations of the micro-structural parameters, such as crystallite size (D), dislocation density (ρ), and micro-strain (ϵ), with film thickness were investigated. The results showed that the crystallite sizes increase as the thickness of the film increases. The dislocation density and micro-strain decreases as the thickness increases. The resistivity (ρ) of CuAlS₂ film is found to decrease with increase in film thickness, which is related to the increase of carrier concentration with film thickness. Thus thicker films exhibit the lowest resistivity and high carrier concentration, implying these are the most conductive films. Low electrical resistivity and high carrier concentration are widely used as the essential components in various optoelectronic devices such as light-emitting diode and photovoltaic cells.

Keywords : CuAlS₂, evaporation, sulfurisation, thickness, resistivity, crystalline

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