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# Characterization of $Cu_2SnS_3$ thin films prepared by sulfurization of co-evaporated Cu–SnS precursor layers

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## ABSTRACT

Monoclinic $Cu_2SnS_3$ thin films were prepared by sulfurizing Cu–SnS precursor layers deposited by a co-evaporation method on soda-lime glass substrates. The morphological, optical and electrical properties of the $Cu_2SnS_3$ thin films were investigated by scanning electron microscopy, spectral transmittance, and Hall effect measurements. All $Cu_2SnS_3$ thin films prepared in this study exhibited p-type conductivity and a direct band gap of 0.86–0.87 eV with a high absorption coefficient ($\alpha$>$10^4$ $cm^{-1}$). However, carrier concentrations and electrical resistivities varied noticeably, depending on their metallic composition ratios and sulfurization temperatures. The thin film with a metallic composition ratio [Cu]/[Sn]=1.66 had a carrier concentration, resistivity, and mobility of $3.12\times10^{17}$ $cm^{-3}$, 6.37 Ω·cm, and 3.14 $cm^2/V\cdot s$, respectively. The temperature dependence of electrical resistivity, carrier concentration, and Hall mobility of this thin film was also obtained from liquid nitrogen temperature to room temperature to examine charge transport properties.

Keywords: Copper tin sulfide; Hall effect, Optical absorption, Raman spectroscopy