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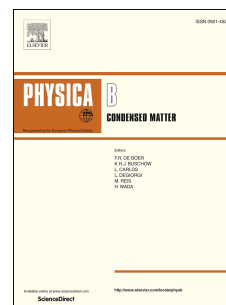
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Effect of Zn/Sn molar ratio on the microstructural and optical properties of $\text{Cu}_2\text{Zn}_{1-x}\text{Sn}_x\text{S}_4$ thin films prepared by spray pyrolysis technique

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Abstract

Quaternary kesterite $\text{Cu}_2\text{ZnSnS}_4$ (CZTS) compound is one of the most promising semiconductor materials consisting of abundant and eco-friendly elements for absorption layer in thin film solar cells. The effect of Zn/Sn ratio on $\text{Cu}_2\text{Zn}_{1-x}\text{Sn}_x\text{S}_4$ ($0 \leq x \leq 1$) thin films were studied by deposited by varying molar volumes in the precursor solution of zinc and tin was carried out in proportion of (1-x) and x respectively onto soda lime glass substrates kept at 573 K by using chemical spray pyrolysis technique. The GIXRD pattern revealed that the films having composites of $\text{Cu}_2\text{ZnSnS}_4$, Cu_2SnS_3 , Sn_2S_3 , CuS and ZnS phases. The crystallinity and grain size were found to increase by increasing the x value and the preferential orientation along (103), (112), (108) and (111) direction corresponding to CZTS, Cu_2SnS_3 , CuS, and ZnS phases respectively. Micro-Raman spectra exposed a prominent peak at 332 cm^{-1} corresponding to the CZTS phase. Atomic force microscopy was employed to study the grain size and roughness of the deposited thin films. The optical band gap was found to lie between 1.45 and 2.25 eV and average optical absorption coefficient was found

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