

Effect of Annealing Temperature on Earth Abundant $\text{Cu}_2\text{ZnSnS}_4$ Thin Film for Photovoltaic Application Synthesized by Low Cost Sol-Gel Spin Coating

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Abstract

Copper Zinc Tin Sulfide ($\text{Cu}_2\text{ZnSnS}_4$ or CZTS) thin film have been deposited on Soda lime glass substrates by a spin coater and annealed in air with different temperature varied from 300 – 500 °C. The effect of annealing temperature on structural, optical, electrical, morphological and compositional properties has been studied. The XRD study depicts that sharpness of the peak increases with annealing temperature. The major peaks are observed at 28.74°, 33.2°, 47.7° and 56.6° with (112), (200), (220) and (312) plane. Optical studies show relatively high absorption co-efficient within 10^4 - 10^5 cm^{-1} . The band gap energy (E_g) varies from 1.42 to 1.49 eV for CZTS thin film. Hall measurements show p type conductivity. Further, SEM analysis revealed the surface texture of CZTS film. The EDX measurement for CZTS thin films confirms the formation of CZTS which is Cu rich and Zn poor.