

Study the Properties of Solution Processable CZTS Thin Films Induced by Annealing Treatment: Study of Annealing Time

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Received May 13, 2020

Revised May 13, 2020

Accepted May 21, 2020

$\text{Cu}_2\text{ZnSnS}_4$ is suitable for high-performance thin-film solar cell because of its high absorbance coefficient, presence of non-toxic elements, excellent optoelectronic properties, and a near-perfect direct band gap. The effect of thermal annealing time (1–4 hour) on the optical, morphological, and structural properties of $\text{Cu}_2\text{ZnSnS}_4$ coated through a simple solution processable method has been studied in the present work. All the CZTS films are crystalline in nature with kesterite structure as shown by X-ray diffraction studies. Crystallite size, strain, and dislocation density were calculated. However, no notable changes in these parameters were obtained by varying the annealing time in the above range. Field emission scanning electron microscopy images show good quality compact films with particle size in the order of 10–5 nm. Absorption spectroscopy results show an optical band gap of 1.46 eV. Raman spectroscopy was used to check binary or ternary phases present. It shows that the impurity phase decreases and the pure $\text{Cu}_2\text{ZnSnS}_4$ phase was obtained by increasing the annealing time to 3 and 4 hours.

Keywords: $\text{Cu}_2\text{ZnSnS}_4$, thermal annealing, optical, characterization, Raman spectroscopy.

Full text of the paper will appear in journal SEMICONDUCTORS.