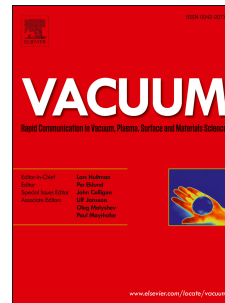


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# Impact of post-deposition annealing in $\text{Cu}_2\text{SnS}_3$ thin film solar cells prepared by Doctor Blade Method

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## ABSTRACT

In this work, post-deposition annealing is done at three different temperatures on  $\text{Cu}_2\text{SnS}_3$  (CTS) thin film solar cells prepared by doctor blade technique. Structural and electrical characteristics are determined from scanning electron microscopy (SEM), energy-dispersive X-ray fluorescence spectroscopy (ED-XRF), X-ray diffraction (XRD), Hall Effect and I-V characteristics studies to enlighten the mechanisms by which solar cells performance varies. The highest efficiency gain is obtained 1.14%. It is concluded that the optimum post-deposition annealing temperature for CTS is 400 °C for 30 min in the sulfur atmosphere.

**Keywords:** Doctor Blade; Annealing; Surface structures; Electrical Properties;

## 1. Introduction

Copper indium gallium selenide (CIGS) and cadmium telluride (CdTe) are the examples of primarily used thin film solar cells now a day. Other quaternary compounds, like  $\text{Cu}_2\text{ZnSnS}_4$  (CZTS) and  $\text{Cu}_2\text{ZnSnSe}_4$  (CZTSe), have considered as promising “next generation” materials for solar cell due to the near-optimum band-gap energy ( $E_g$ ) and large absorption coefficient ( $>10^4 \text{ cm}^{-1}$ ) [1]. Recently, other ternary p-type semiconductor like  $\text{Cu}_2\text{SnS}_3$  (CTS) has received attention among the researchers as a promising element for the application in thin film solar cells (TFSCs) due to suitable band-gap (0.96–1.77 eV), adequately high absorption coefficient ( $10^4 \text{ cm}^{-1}$ ), and environmentally friendly components with the theoretical power conversion efficiency of 30% [2]. Unlike CZTS, CTS is able to control the secondary phases during its deposition [3].

The formation of CTS thin film mainly varies with the deposition technique, annealing temperature, and environment. The parameters like crystal structure, optical band-gap, electrical characteristics etc., widely affect the

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