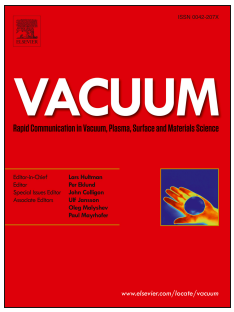
Accepted Manuscript



Impact of post-deposition annealing in Cu_2SnS_3 thin film solar cells prepared by doctor blade method

Arindam Basak, Himangshu Deka, Anup Mondal, Udai P. Singh

PII: S0042-207X(17)31861-4

DOI: 10.1016/j.vacuum.2018.07.049

Reference: VAC 8140

To appear in: *Vacuum*

Received Date: 15 December 2017

Revised Date: 24 July 2018

Accepted Date: 29 July 2018

Please cite this article as: Basak A, Deka H, Mondal A, Singh UP, Impact of post-deposition annealing in Cu_2SnS_3 thin film solar cells prepared by doctor blade method, *Vacuum* (2018), doi: 10.1016/j.vacuum.2018.07.049.

Impact of post-deposition annealing in Cu_2SnS_3 thin film solar cells prepared by Doctor Blade Method

Arindam Basak[a, c], Himangshu Deka[c], Anup Mondal[a, b], Udai P. Singh [c, *]

[a]Centre of Excellence for Green Energy and Sensor Systems, Indian Institute of Engineering Science and Technology, Shibpur, Howrah, West Bengal.

[b]Department of Chemistry, Indian Institute of Engineering Science and Technology,Shibpur, Howrah, West Bengal.

[c]Thin film Photovoltaic Lab, School of Electronics Engineering, KIIT (Deemed to be University), Bhubaneswar-751024, Odisha.

[*]singhup@kiit.ac.in

ABSTRACT

In this work, post-deposition annealing is done at three different temperatures on Cu_2SnS_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 Cu_2ZnSnS_4 (CZTS) and $Cu_2ZnSnSe_4$ (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 cm^{-1}) [1].Recently, other ternary p-type semiconductor like Cu_2SnS_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 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