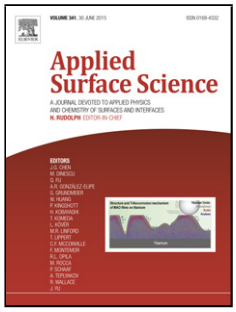

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PII: S0169-4332(17)31329-6
DOI: http://dx.doi.org/doi:10.1016/j.apsusc.2017.05.027
Reference: APSUSC 35962

To appear in: *APSUSC*

Received date: 9-11-2016
Revised date: 29-4-2017
Accepted date: 3-5-2017

Please cite this article as: Abdelbaki Cherouana, Rebiha Labbani, Study of CZTS and CZTSSe solar cells for buffer layers selection, Applied Surface Sciencehttp://dx.doi.org/10.1016/j.apsusc.2017.05.027

Study of CZTS and CZTSSe Solar Cells for Buffer Layers Selection

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Highlights

- Simulation of non toxic thin film solar cells is proposed.
- CdS/CZTS, CdS/CZTSSe, ZnS/CZTS and ZnS/CZTSSe were simulated using SCAPS program.
- Efficiency of the cell was affected by the buffer characteristics.
- Optimization of absorber layer parameters improved the performances of the cell.

Abstract

The output characteristics, of a thin film solar cell, are affected by several parameters related to the hetero-structure that is taken into account. In this paper, nontoxic thin film solar cells were studied. CdS/CZTS, CdS/CZTSSe, ZnS/CZTS and ZnS/CZTSSe hetero-junctions were numerically simulated using the Solar Cell Capacitance Simulator (SCAPS). According to the simulation results, we found that CdS buffer was suitable for the CZTSSe absorber and an efficiency of 9.02 % was obtained. The ZnS buffer was selected for CZTS absorber and an efficiency of 8.02 % has been reached. By optimizing the absorber film parameters (thickness and carrier density), we obtained conversion efficiencies as high as 9.47 % and 10.00 % for CdS/CZTSSe and ZnS/CZTS based solar cells respectively.

Keywords: CZTS; ; ; ; , CZTSSe, Solar cells, Simulation, SCAPS.

1. Introduction

The manufacturing of thin film photovoltaic devices is an area which has greatly increased in the last decade [1]. Several materials (such as CdTe, CIS, CIGS) have been employed by researchers to obtain low cost and high efficiency solar cells [2]. However, some of these materials are expensive or toxic [3]. Consequently, the researchers were motivated to introduce new environmentally and friendly materials [1]. Quaternary semiconductors with kestrite mineral structure are promising candidates for achieving the requirement of low cost and eco-friendly thin film solar cells [4]. The Copper Zinc Tin Chalcogenide is a quaternary semiconductor of group I-II-IV-VI. It was first elaborated in 1966 and afterwards, its photovoltaic effect was confirmed in 1988 [5, 6]. Actually, this material is attracting serious attention for photovoltaic applications.