

Accepted Manuscript

Title: Optimizing two and four-terminal CuGaSe₂/CuInGaSe₂ tandem solar cells for achieving high efficiencies

Authors: Santiago Torres-Jaramillo, Arturo Morales-Acevedo, Roberto Bernal-Correa, Alvaro Pulzara-Mora



PII: S0030-4026(18)31274-9
DOI: <https://doi.org/10.1016/j.ijleo.2018.08.124>
Reference: IJLEO 61421

To appear in:

Received date: 26-6-2018
Accepted date: 26-8-2018

Please cite this article as: Torres-Jaramillo S, Morales-Acevedo A, Bernal-Correa R, Pulzara-Mora A, Optimizing two and four-terminal CuGaSe₂/CuInGaSe₂ tandem solar cells for achieving high efficiencies, *Optik* (2018), <https://doi.org/10.1016/j.ijleo.2018.08.124>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

OPTIMIZING TWO AND FOUR-TERMINAL $\text{CuGaSe}_2/\text{CuInGaSe}_2$ TANDEM SOLAR CELLS FOR ACHIEVING HIGH EFFICIENCIES

Santiago Torres-Jaramillo¹, Arturo Morales-Acevedo^{2,*}, Roberto Bernal-Correa³
and Alvaro Pulzara-Mora¹

¹ Laboratorio de Nanoestructuras Semiconductoras, Universidad Nacional de Colombia, Sede Manizales, Colombia

² Sección de Electrónica y Estado Sólido, Centro de Investigación y Estudios Avanzados del IPN, CINVESTAV, México D.F., México

³ Unidad de Formación y Docencia, Universidad Nacional de Colombia, Sede Orinoquia, kilómetro 9 vía Tame-Arauca, Arauca Colombia

*Author for correspondence: amorales@solar.cinvestav.mx

Abstract

Solar cells based on CuInGaSe_2 (CIGS) have attained the highest record efficiency (22.9%) among thin film solar cells. CIGS is formed by the appropriate mixing of CuInSe_2 (CIS) which has a bandgap around 1 eV and CuGaSe_2 (CGS) which has a bandgap around 1.7 eV. These bandgaps are close to the optimal values for two-junction tandem solar cells. Therefore, CGS on CIGS or CGS on CIS tandem cells should be attractive and viable to achieve high efficiency and cost-effective thin film solar cells. In this work, a simple unified analytical model is used to design two-terminal and four-terminal CGS/CIGS tandem solar cells, establishing a realistic value for the expected efficiency in each case. Short circuit current density (J_{sc}), open circuit voltage (V_{oc}), fill factor (FF) and efficiency, are determined as a function of the CGS and CIGS acceptor impurity concentrations, back surface recombination velocities, minority carrier diffusion lengths, and absorber layer thickness. It is shown that realistic efficiencies over 30% can be achieved under one sun AM1.5 spectrum for both of the terminal configurations, but the optimum composition for the CIGS sub-cell should be different depending on the respective tandem cell configuration.

Keywords: *Tandem solar cell, CGS, CIGS, Thin film solar cell.*

Download English Version:

<https://daneshyari.com/en/article/8960622>

Download Persian Version:

<https://daneshyari.com/article/8960622>

[Daneshyari.com](https://daneshyari.com)