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PII: S0040-6090(18)30056-7
DOI: https://doi.org/10.1016/j.tsf.2018.01.040
Reference: TSF 36439

To appear in: *Thin Solid Films*

Received date: 13 June 2017
Revised date: 16 January 2018
Accepted date: 21 January 2018

Please cite this article as: Stephen Glynn, Ingrid Repins, James Burst, Carolyn Beall, Karen Bowers, Lorelle Mansfield , Selective excitation of window and buffer layers in chalcopyrite devices and modules. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Tsf(2017), https://doi.org/10.1016/j.tsf.2018.01.040

Selective Excitation of Window and Buffer Layers in Chalcopyrite Devices and Modules

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Abstract — Window and buffer layers in chalcopyrite devices are well known to affect junctions, conduction, and photo-absorption properties of the device. Some of these layers, particularly "buffers," which are deposited directly on top of the absorber, exhibit metastable effects upon exposure to light. Thus, to understand device performance and/or metastability, it is sometimes desirable to selectively excite different layers in the device stack. Absorption characteristics of various window and buffer layers used in chalcopyrite devices are measured. These characteristics are compared with emission spectra of common and available light sources that might be used to optically excite such layers. Effects of the window and buffer absorption on device quantum efficiency and metastability are discussed. For the case of bath-deposited Zn(O,S) buffers, we conclude that this layer is not optically excited in research devices or modules. This provides a complimentary mechanism to the chemical differences that may cause long time constants (compared to devices with CdS buffers) associated with reaching a stable "light-soaked" state.

Keywords: Copper indium gallium diselenide, CIGS, buffer layers, CdS, zinc oxysulfide, selective excitation, metastability, solar cells

1. Introduction