



Simulation with ZnS Buffer Layer for Cd-free Chalcopyrite Photovoltaic Devices

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N-type semiconductor compounds with a bandgap between 2.0 and 3.6 eV and a low absorption coefficient have been applied as a buffer for CIGS solar cells. The most important features of the buffer layer are to protect the junction against chemical reactions and mechanical damage. Since high efficient cells can be produced with CdS, it has been the most commonly investigated buffer material. But CdS is a toxic material despite its high efficiency. One of the major purpose of photovoltaic technology is the reduction of environmental pollutants and to increase the safety of the production process. The recent trend for the buffer layer is to replace it with semiconductors with a wide band gap that “Cd-free”. As an alternative to CdS, variety of materials provide promising results. Materials such as In_2S_3 , ZnS, Zn(O,S) and $\text{Zn}_x\text{Mg}_{1-x}\text{O}$ are various alternative materials that can be used as a buffer layer. This study shows that ZnS buffer material can be used as an alternative to CdS by using SCAPS solar simulator program. With the I–V characteristics open circuit voltage (V_{oc}), short circuit current density (J_{sc}), fill factor (FF) and efficiency (η) of the cells was calculated. According to the simulation results, photovoltaic conversion efficiency was found to be % 12.08 when using CdS buffer layer and % 11.29 when using ZnS buffer layer. ZnS has a promising potential to replace CdS. The parameters of this work will be used as a reference in future solar cell production.

Keywords: *Photovoltaic (PV), CIGS, buffer layer, ZnS*

