Fabrication of Copper Indium Diselenide Thin Film Solar Cells Using a Direct Solution Processing Method

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Copper Indium Diselenide (CIS) thin film solar cells have received significant attention in recent years due to their successful use in the fabrication of ~15-20% efficient thin film solar cells and their potential for scalable device production. Presented here is the fabrication and characterization of several different CIS solar cell designs each with a Copper Indium Diselenide p-type absorber layer and a Cadmium Sulfide (CdS) n-type window layer. Some devices contained an additional zinc oxide (ZnO) n-type window layer in an effort to reduce leakage current and improve diode quality. Solution-based fabrication of the CIS thin film absorber layer is achieved through a variation of the method originally presented in Mitzi et. al. *Chem. Mater.* 18, 3 (2005), which represents a potentially significant decrease in processing costs for creating this type of structure. Solar cells and isolated films utilizing various CIS, CdS, and ZnO layer thicknesses and deposition parameters have been examined through the fabrication of thin film transistors (TFTs) as well as by energy dispersive x-ray spectroscopy (EDX), scanning electron microscopy (SEM), stylus profilometry, and x-ray diffraction (XRD). Finally, current-voltage curves under standard AM1.5 (100 mW/cm^2) illumination using a solar simulator have been taken and an optimized fabrication procedure for maximum power conversion efficiency is presented.

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