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MoO 3/Au BACK CONTACT FOR ELECTRODEPOSITED CdS/CdTe SOLAR CELLS

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CdS/CdTe based solar cell is one of leading photovoltaic (PV) device structures that can be found in the territory of second generation solar cells. Among the existing fabrication methods of CdS/CdTe solar cells, electrodeposition (ED) is a promising technique due to its low cost, simplicity, scalability and manufacturability. However, to fabricate stable solar cells with good power conversion efficiency, the role of back contacts on CdS/CdTe is crucial to improve the device performances and need further investigations to establish a stable back contact. In this study, the effect of back contact material on the PV properties of CdS/CdTe solar cells was investigated using three different back contact combinations namely; Au, Cu/Au, MoO 3 /Au. Prior to the fabrication of back contacts, CdS and CdTe thin layers were electrodeposited on glass/FTO one after the other to form the stack of glass/FTO/CdS/CdTe. Then the samples were annealed in air atmosphere in the presence of CdCl 2 and chemically etched using HNO 3 :H 3 PO 4. Subsequently different back contact combinations were thermally evaporated on chemically etched CdTe layers. Fabricated devices were evaluated by current density-voltage (J-V) characteristics under AM 1.5 illumination. According to the obtained results, device with MoO 3 /Au back contact showed about 40 % efficiency improvement, by increasing fill factor and open circuit voltage, in comparison with the device with Au back contact. This suggests that MoO 3 is an effective hole blocking layer that can be introduced for CdS/CdTe back contacts. Device with Cu/Au back contact further improved the efficiency to 5.6 %, with open circuit voltage (Voc) of 0.57 V, short circuit current (Jsc) of 23.8 mA cm -2 and fill factor of 0.41, which is highest among the three types of devices studied. In this study, MoO 3 /Au layer is found to be a promising alternative back contact for CdS/CdTe solar cells.

Keywords: Back contacts; Electrodeposition; Cadmium sulfide; Cadmium telluride; Solar cells