

Sulphurisation of sequentially electrodeposited Cu-In alloy for the preparation of semiconductor thin films

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ABSTRACT

Copper indium disulphide thin films were fabricated by sulphurisation of Cu-In alloy prepared by a sequential electrodeposition method. Thin film layers of copper and indium were sequentially electrodeposited on a well-cleaned Ti substrate and on Ti/Cu thin film respectively. The Ti/Cu/In films were then heated at 130⁰C for 4 hours in air to form Cu-In alloy. Sulphurisation of Cu-In alloy was carried out at 550⁰C for 30 minutes in 100% H₂S gas with a constant flow rate. XRD measurement revealed that the chalcopyrite structure of single phase CuInS₂ can be obtained by adopting a proper In concentration in Cu-In alloy. The photoresponse of the CuInS₂ films in polysulphide showed the n-type behavior of the films. A p-type ZnSe thin film was deposited on CuInS₂ by electrodeposition to produce Ti/CuInS₂/ZnSe heterostructure. XRD measurement also revealed that the ZnSe films were amorphous. Spectral response of Ti/CuInS₂/ZnSe structure in a PEC cell containing sodium acetate showed the photoactivity of both interfaces n-CuInS₂/p-ZnSe and p-ZnSe/electrolyte. This study reveals that the thin film solar cell structure Ti/CuInS₂/ZnSe/metal may be developed to an efficient solar cell device. The solar cell parameters that we have observed so far are $V_{oc}=330\text{mV}$ and $I_{sc}=2\text{mA/cm}^2$.

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