3.6 Investigation of growth parameters of $CuInTe_2$ thin films by electrodeposition technique

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ABSTRACT

Copper indium di-telluride ($CuInTe_2$) is a promising semiconductor material for photovoltaic applications because of its suitable optoelectronic properties. Among the various deposition techniques available for the preparation of $CuInTe_2$ thin films, method of electrodeposition is an attractive technique because of its simplicity, low cost and possibility of making large area thin films. In this investigation, potentiostatic electrodeposition of $CuInTe_2$ thin films on fluorine doped tin oxide (FTO) was studied using a three electrode electrochemical cell containing an aqueous solution of CuCl, $InCl_2$ and TeO_2. pH of the solutions was adjusted by adding ultra pure HCl. The counter electrode was a graphite rod and reference electrode was Ag/AgCl. Electrolytic solutions were prepared with deionised water and 99.995 % pure chemicals. Prior to the film deposition FTO substrates were degreased in acetone and rinsed with deionised water followed by 2 min ultra-sonication. Cyclic voltammograms were used to investigate the growth parameters; deposition potential, concentration, proportion of CuCl, $InCl_2$ and TeO_2, pH, temperature and stirring speed of the bath. In order to grow the photoactive $CuInTe_2$ thin films, set of samples were prepared by slightly changing the deposition potential using the growth parameters obtained from cyclic voltammetric curves. Photoactive performance (V_{oc} and I_{sc}) of the films were characterized using I-V measurements in PEC containing aqueous solution of $Na_2S_2O_3$. Highest photoactivity is given when the film deposited at -600 mV Vs Ag/AgCl for 20 min in the electrolyte containing aqueous solution of 1 mM CuCl, 20 mM $InCl_2$ and 2 mM TeO_2. Deposition temperature, pH and stirring speed of the bath were room temperature, 1.5 and 125 rpm respectively. Annealing temperature and time were 400^0C and 20 minutes respectively.

The preliminary results of this study suggest the possibility of growing photoactive p-$CuInTe_2$ thin films by single step electrodepostion technique.