Preparation and Characterisation of Copper Iodide (CuI) Thin Films by Sequential Chemical Bath Deposition (S-CBD) method

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Abstract

Copper iodide thin films have been used as buffer layer in $CuInX_2$ (X=S, Se and Te) based solar cells. Copper iodide (CuI) is a water insoluble solid with three crystalline phases α, β and γ. The high temperature (above 392 ^{O}C), α-phase of cubic structure is a mixed conductor, where the charge carrier is predominantly Cu^{2+} ions. The hexagonal β-phase is also an ionic conductor .The low-temperature γ-phase (below 350 ^{O}C) again of cubic structure is a p-type semiconductor of band gap 3.1 eV, whose conductivity depends on the presence of iodine in stoichiometric excess.

Recently, copper iodide has used to construct fully solid-state dye-sensitized photovoltaic cell. The utility of this material for the above purpose depends on optical transparency and hole conductivity of CuI. γ-CuI is also a convenient material for studying cathodic dye-sensitization.

In the present investigation, copper iodide thin films were prepared on glass substrates from aqueous medium from copper sulphate as a Cu and potassium iodide as iodide source, respectively using sequentially chemical bath deposition (S-CBD) method. S-CBD method is based on the immersion of the substrate in separately placed cationic and anionic precursor solutions. The Influence of preparative parameters on the deposition of the films has been studied. The deposition conditions are optimized to get good quality copper iodide thin films at room temperature. The films were characterized for their structural, optical and electrical properties by means of X-ray diffraction (XRD), optical transmission; electrical resistivity and thermoemf measurement techniques. The XRD diffraction pattern of CuI thin film shows a cubic crystal structure with particle size 36.79 nm. The electrical resistivity of copper iodide film was of the order of 10^6 Ωcm. From thermoemf measurement, CuI is a p-type semiconductor material. The film (thickness ~ 0.022 μm) shows high optical transmission (> 90%) with in the wavelength range of 350-850 nm.

Acknowledgement:

Authors are thankful to the UGC, New Delhi (India) for the financial support through departmental research scheme UGC-DRS (SAP): (1999-2004).