

Oral Presentations

Modifying PEC characteristics of CuS thin film electrodes prepared by electrodeposition: effect of cooling rate and coverage with electroactive composite materials

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Abstract

Binary compound semiconductors of CuS were grown on FTO/glass substrates by electrodeposition method. The prepared films were then covered with tetra(-4-pyridyl)porphyrinatomanganese(II/III) sulfate ($Mn^{II}MTPyP$ & $Mn^{III}TPyP$) embedded into a polyethylene polymer matrix. The covered films were annealed under nitrogen and used for a photoelectrochemical study in aqueous electrolyte solutions for the first time. Effects of pre-annealing temperature (150, 250 and 350 °C), cooling rate, annealing time, and using different aqueous electrolytic systems, of the covered thin film electrodes, on their photoluminescence spectra, electronic absorption spectra, dark J-V plots, photo J-V plots, conversion efficiency and value of short-circuit current, have been studied. The modified electrode surfaces were more stable to degradation in the dark and under illumination than the unmodified ones. Furthermore, the modified electrodes showed higher light-to-electricity conversion efficiency than the unmodified ones. Based on this study, it is strongly recommended to pre-anneal CuS films and cover them with MnP/PE matrices before using them in PEC processes.

Keywords: CuS, thin film, electrodeposition, annealing, cooling rate, PEC, efficiency, stability.