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论文

CuInSe₂薄膜的电化学沉积及其形成机理

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摘要:

采用电化学沉积法制备了太阳能电池用CuInSe₂薄膜。利用循环伏安法(CV)、X射线能谱(EDS)和X射线衍射技术(XRD)研究了电沉积过程中CuInSe₂的形成机理, 并研究了制备工艺对膜层成分、形貌和物相结构的影响。研究结果表明, 铟进入固相是通过In³⁺受Cu₃Se₂诱导作用欠电势还原或者In³⁺与H₂Se反应这两种途径实现; 先沉积的Cu₃Se₂与新生成的铟或铟硒化合物反应最后生成CuInSe₂。在阴极电位为-0.58~-0.9 V(vs. SCE)时出现了不随电位变化的极限还原电流, 在该电位范围内进行电沉积获得了化学计量组成稳定可控且相对致密平整的CuInSe₂薄膜。电沉积的CuInSe₂薄膜经真空退火处理后结晶质量得到明显改善。

关键词: CuInSe₂; 太阳能电池; 电化学沉积; 形成机理; 诱导作用; 退火处理

Electrodeposition of CuInSe₂ and Its Formation Mechanism

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Abstract:

In this paper, CuInSe₂ thin films were prepared by electrodeposition. The formation mechanism of CuInSe₂ was primarily analyzed by cyclic voltammetry(CV), energy dispersive X-ray spectroscopy(EDS) and X-ray diffraction(XRD). The influence of deposition conditions on film stoichiometry, morphology and structure was also investigated. It was shown that the insertion of In into solid phase may proceed underpotential deposition mechanism involving two different routes: In³⁺ reduction by induced effect of Cu₃Se₂, and/or reaction with H₂Se. The newly generated In and indium selenides may be assimilated into the formation CuInSe₂ by reaction with copper selenides. A limiting current was observed at potentials between -0.58—-0.9 V vs. the saturated calomel electrode(SCE) at which smooth and dense CuInSe₂ thin films with controllable stoichiometry were obtained. Crystallinity of electrodeposited films was improved largely after annealing.

Keywords: CuInSe₂; Solar cell; Electrodeposition; Formation mechanism; Induced effect; Annealing

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