Effect of argon gas on photoelectrochemical characteristics of film electrodes prepared by thermal vacuum evaporation from synthesized copper zinc tin selenide

Abstract

Copper Zinc Tin Selenide (CZTSe) compound was synthesized from its constituent elements in an evacuated quartz ampoule. The synthesized compound was used as source to deposit film electrodes by vacuum evaporation method under different argon gas flow rates. The argon gas flow rate affected film surface morphology and chemical composition. The film prepared under higher argon gas flow rate of 15 cm3/min or higher exhibited photoelectrochemically p-type behavior due to the SnSe compound. When using argon flow rate of 10 cm3/min or lower, the film exhibited mixed p- and n-type behaviors due to mixed CZTSe and ZnSe phases. The deposited films exhibited high absorption coefficient value (> 4.0 x 104 cm-1) in the wavelength range of 400 and 800 nm, showing their applicability as visible light energy conversion materials. The results show the potential value of the technique described here, where film electrode main characteristics can be controlled by simply changing the argon gas flow rate.

Keyword: Argon gas condensation; Copper zinc tin selenide film; Photoactivity; Photoelectrochemical; Thermal evaporation.