Growth Characteristics of ZnS Buffer Layers by Chemical Bath Deposition

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ABSTRACT

In this study, chemical bath deposition (CBD) is employed to growth ZnS buffer layers. Traditional CBD process, as a single-stage process operated under thermodynamic equilibrium, the whole process is time consuming. Furthermore, there is inevitably some ZnS particles resided on the substrate owing to the homogeneous nucleation took place in the solution which will deteriorate the quality of the as-deposited ZnS then film. To alleviate this disadvantage, we apply a novel two-stage CBD process which divide the deposition into two regimes. At the first pot, the glass substrate was dipped in for 1 hour during which the adsorption of complex ions onto the substrate surface took place. After that, the substrate was put in a new bath for the surface reaction of zinc- and sulfur-containing complex ions to proceed. It shows that by applying a two-stage CBD process, a ZnS film with more compact and smooth surface structures could be derived as observed by FE-SEM and AFM. The optical transmittance is declined, as measured by UV-vis spectroscopy, however, the optical band-gap of the as deposited ZnS films were increased from ~ 3.4eV to ~ 3.9eV. XPS analysis confirms that the as-deposited CBD-ZnS films containing minor ZnO phase. The thiourea favors the formation of ZnO phase in this case, as the concentration of thiourea increased, the Zn2p3/2 peak of ZnS (1021.7 eV) blue shifts to 1022.4eV, which is the characteristic Zn2p3/2 peak of ZnO.

Keywords : ZnS、Chemical Bath Deposition(CBD)

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