Study of ALD-Zn(O,S) buffer layers for CZTS solar cells

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Cu2ZnSnS4 (CZTS) thin film solar cells is an attractive material because of its large absorption coefficient of 10^4 cm^{-1} and direct band gap of 1.5eV. The highest conversion efficiency of 12.6% has been achieved[1], but compared to CIGS solar cell, the conversion efficiency needs to increase double. Some reports[1,2] showed that the main reason for poor conversion efficiency of CZTS is the low V_{oc} and incongruent band alignment. In order to improve the V_{oc}, the buffer layer is necessarily considered in terms of conduction band alignment at the absorber-CdS interface.[3] Therefore, in this study, Zn(O,S) buffer layer using Atomic Layer Deposition(ALD) method was examined to replace CdS buffer layer using Chemical Bath Deposition(CBD).

In this work, the CZTS solar cell device structure consisted of a soda lime glass (SLG) substrate, a 600-nm-thick Mo layer as a back-contact layer, a CZTS absorber layer deposited via sputtering, a 50-nm-thick CdS or two-type Zn(O,S) buffer layers, a 50-nm-thick intrinsic ZnO layer deposited via sputtering, a 300-nm-thick Al-doped ZnO (AZO) layer as a transparent conducting oxide layer deposited via sputtering, and a 500-nm-thick Al collection grid deposited via thermal evaporation. The best cell with Zn(O,S) buffer layer had an efficiency of 4.86%.

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