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High Work Function of AZO Fhin Films as Insertion Layer between TCO and p-layer and Its Application of Solar Cells

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We report high work function Aluminum doped zinc oxide (AZO) films as insertion layer as a function of O2 flow rate between transparent conducting oxides (TCO) and hydrogenated amorphous silicon oxide (a-SiOx:H) layer to improve open circuit voltage (Voc) and fill factor (FF) for high efficiency thin film solar cell. However, amorphous silicon (a-Si:H) solar cells exhibit poor fill factors due to a Schottky barrier like impedance at the interface between a-SiOx:H windows and TCO. The impedance is caused by an increasing mismatch between the work function of TCO and that of p-type a-SiOx:H. In this study, we report on the silicon thin film solar cell by using as insertion layer of O2 reactive AZO films between TCO and p-type a-SiOx:H. Significant efficiency enhancement was demonstrated by using high work-function layers (4.95 eV at O2=2 sccm) for engineering the work function at the key interfaces to raise FF as well as Voc. Therefore, we can be obtained the conversion efficiency of 7 % at 13mA/cm2 of the current density (Jsc) and 63.35 % of FF.

Keywords: Oblique angle deposition, magnetron sputtering, AZO film, surface texture, amorphous silicon solar cell

ET-P018

Over 8% efficient nanocrystal-derived $Cu_2ZnSnSe_4$ solar cells with molybdenum nitride barrier films in back contact structure

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Numerous of researches are being conducted to improve the efficiency of $Cu_2ZnSnSe_4$ (CZTSe)-based photovoltaic devices, which is one of the most promising candidates for low cost and environment-friendly solar cells. In this work, we concentrate on the back contact of the devices. A proper thickness of $MoSe_2$ in back contact structure is believed to enhance adhesion and ohmic contact between Mo back contact and absorber layer. Nevertheless, too thick $MoSe_2$ layers that are grown during high-temperature selenization process can impede the current collection, thus resulting in low cell performance. By applying molybdenum nitride as a barrier in back contact structure, we were able to control the thickness of $MoSe_2$ layer, which resulted in lower series resistance and higher fill factor of CZTSe devices. The phase transformation of Mo-N binary system was systematically studied by changing N_2 concentration during the sputtering process. With a proper phase of Mo-N fabricated by using an adequate partial pressure of N_2, the efficiency of CZTSe solar cells as high as 8.31% was achieved while the average efficiency was improved by about 2% with respect to that of the referent cells where no barrier layer was employed.

Keywords: CZTSe, solar cell, molybdenum nitride, $MoSe_2$, barrier