

The effect of annealing steps of spin coated Sb_2S_3 film in planar structure solar cells

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The inorganic Sb_2S_3 thin-film solar cells have increasing attention due to their merit features, which are suitable for solar cell applications. The performance of solar devices is varied based on different conditions of film deposition. The annealing temperature is an important factor in the spin-coated Sb_2S_3 layers because it changes from amorphous to crystalline during the preparation. Therefore, the present work was done by a step-annealing process of Sb_2S_3 . Herein, Sb_2S_3 precursor was prepared by using 1 mmol of Sb_2S_3 and 1.5 mmol of thiourea in 1 ml of 2-methoxyethanol and it was spin-coated at 4000 rpm on com- TiO_2/FTO . Just after coating, the cells were annealed in two different conditions. For the first condition, the coated Sb_2S_3 was pre-heated inside the tube furnace at 160 °C for 1 minute, then again annealed at 280 °C for 10 minutes. In the second condition, the Sb_2S_3 was annealed in a single step at 280 °C for 10 minutes. All these annealing processes have proceeded under N_2 stream. In the cell with a two-step annealing, the desired phase was synthesized and photo-generated electron-hole pairs effectively converted. By improving the photovoltaic parameters, the power conversion efficiency (PCE) of 1.76% was achieved in a configuration of $\text{FTO}/\text{com-TiO}_2/\text{Sb}_2\text{S}_3/\text{P3HT}/\text{Ag}$.