Dependence of performance of Sb_2S_3 thin film solar cell on blocking TiO_2 layer

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The demand for low cost, high efficiency solar cells is the power of thin film solar cells. In recent years, antimony sulfide (Sb_2S_3) has much attraction as light harvesting material in solar cell applications. Sb_2S_3 solar cells are reported with a dense blocking layer and mesoscopic TiO_2 scaffold. But still, in both cases, the performance of Sb_2S_3 solar cells are unsatisfactory. However, planner Sb_2S_3 solar cells would be more competitive because it is simpler and has a higher open circuit voltage due to reduced charge carrier recombination. Herein, planner Sb_2S_3 solar cells have been successfully made using spin coated Sb_2S_3 as the absorber, dense blocking TiO_2 (bl-TiO_2) as the electron conductor and poly (3-hexathiophene) (P3HT) as the hole conductor. This study pinpointed the dependence of cell performance on the thickness of the blocking TiO_2 layer. The bl-TiO_2 was deposited by spin coating at rpm with a different number of spin coat cycles (1-5). The TiO_2 precursor solution was prepared by mixing of Titanium IsoPropoxide (TTIP), of butol-1-ol and of diethanolamine. The blocking properties and thickness variation of the bl-TiO_2 layers fabricated with a various number of spinning cycles were verified by cyclic voltammograms and UV-Vis spectra respectively. The optimization of the TiO_2 blocking layer to enhance the device performance was carried out on the planner device consisting of FTO/bl-TiO_2/Sb_2S_3/P3HT/Ag and the optimized device with of bl-TiO_2 exhibited the power conversion efficiency of at 1 sun illumination.

Keywords: Blocking TiO_2, Planner structure, Performance, Sb_2S_3, and Spin coat cycle

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