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THICKNESS CONTROLLED FABRICATION OF Sb_2S_3 PLANAR STRUCTURE ENHANCED LIGHT HARVESTING AND CHARGE COLLECTION EFFICIENCY

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Utilization of semiconductors as a light absorbing material has recently been receiving much attention. Among the range of investigated semiconductors, antimony sulfide (Sb_2S_3) is appealing as a promising light absorber due to its suitable bandgap (1.5 - 1.7 eV), one dimensional crystal structure and non-toxic constituents. Among a number of methods available, spin coating is known as the simplest technique to fabricate Sb_2S_3 thin films. In this investigation, the thickness of the Sb_2S_3 light harvesting layer was optimized by varying the spin coating conditions. Different Sb_2S_3 photoanodes were fabricated on the TiO_2 compact layer/FTO substrates by spinning the Sb_2S_3 precursor solution of antimony chloride and thiourea (2:3) in 2-methoxyethanol at 3000, 4000, 5000 and 6000 rpm for 30 s. The devices, fabricated with the configuration of FTO/compact TiO_2/Sb_2S_3/P3HT/Ag, showed an increase of solar cell performance with an increase of the spinning rate of the Sb_2S_3 precursor solution up to 5000 rpm. The thickness of Sb_2S_3 film, which was fabricated at 5000 rpm was ~ 265 nm, showed the highest power conversion efficiency of 4.01% with 619.2 mV as open circuit voltage, 14.05 mA cm^{-2} as short circuit current and 46.1% as a fill factor. The IPCE measurements were in good agreement with the *I-V* performance of the devices. Generally, the morphology of the films has no significant changes with the spinning speed. However, the thicknesses of Sb_2S_3 films were decreased by increasing spinning speed, which was examined by UV-Vis absorption spectra of Sb_2S_3 films. Therefore, the thickness of Sb_2S_3 film should be one of the critical factors that highly affects the performance of Sb_2S_3 solar cell devices. Herein, the performance of the Sb_2S_3 based solar cell was improved upon changing the thickness of Sb_2S_3 film based on spinning speed.

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