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IMPROVING THE PERFORMANCE OF Sb_2S_3 SOLAR CELLS BASED ON THE EFFECT OF CONCENTRATIONS OF SB_2S_3 PRECURSOR

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Abstract

In solid-state solar cells, binary structure Sb_2S_3 semiconductor material is much more attractive as a light-harvesting active layer due to its desirable properties in solar cell applications. Since the precursor solution of the active layer is one of the key parameters that would control the material properties and hence device performance, in this study, we investigated the effect of the precursor concentration of the Sb_2S_3 solution. The Sb_2S_3 complex precursor solutions were prepared by adding 1mmol of Sb_2Cl_3 and 1.5 mmol of thiourea in different volumes (0.5, 1, 1.5 ml) of solvent (2-methoxyethanol), which give the concentrations of 2, 1, and 0.67 M of Sb_2S_3 complex precursor solution. The devices were fabricated in the configuration of FTO/TiO_2/Sb_2S_3/P3HT/Ag. The physical and electrical properties of the devices were examined based on the influence of the precursor concentration of Sb_2S_3 solution by measurements of current density-voltage (J-V), External Quantum Efficiency (EQE), UV-Vis absorption spectroscopy, and Scanning Electron Microscopy (SEM). The power conversion efficiencies (PCE) of 0.75, 3.23, and 2.11% were obtained for 2, 1, and 0.67 M, respectively. The best device performance was achieved with 1 M of Sb_2S_3 solution, which was 53% and higher than low concentrated (0.67 M) Sb_2S_3 solution and 3 times higher than the higher concentration (2 M) of Sb_2S_3 solution indicating the significant role of the precursor concentration.

Keywords: *active element, concentration*, *Sb_2S_3*