S1-1.1

Tunable Properties of Vacuum-Evaporated $CH_3NH_3PbCl_{3-x}I_x$ Perovskite Layers

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Perovskite layers as a photo absorber material are widely used in single-junction and tandem solar cells. The characteristics of these solar cells have been greatly improved in recent years. This study prepared the $CH_3NH_3PbI_{3-x}Cl_x$ metal halide perovskite layers on glass substrates covered with a thin indium tin oxide film by vacuum thermal evaporation method. Inorganic lead iodide (PbI_2) and organic methylammonium chloride (CH_3NH_3Cl) were used as precursors. The layers were characterized by scanning electron microscope, x-ray diffraction, and *C–V* measurements. The transmission and absorption of the obtained layers were studied within the wavelength range of 400 to 1100 nm. It was found that the structural and optoelectronic properties of sequentially (layer-by-layer) evaporated (after annealing at the temperature of 100°C for 30 min) and co-evaporated (jointly) perovskite layers are similar. The perovskite layers had a tetragonal crystal structure. They densely, without pinholes and cracks covered the surface of the substrates. The layers show a favorable band gap of 1.57 eV. The low-temperature optical studies were carried out to reveal the temperature dependence of the band gap energy. The possibility of increasing the layers' thermal stability by adding 2.3 % cesium iodide to the PbI_2 precursor during the evaporation process. was also shown.