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Analysis and characterization of perovskite solar cells effected by film thickness of $CH_3NH_3PbI_{3-x}Cl_x$ Layer

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Introduction: At present, the photovoltaic market is dominated by solar cells made of crystalline silicon. However, even in light of the major decrease in the price of crystalline silicon, the high production and installation costs lead to long payback times in most regions, decreasing the economic feasibility of widespread use. As such, there has been a concerted effort to find a cheaper alternative to silicon solar cells.

Abstract: Recently, a new class of hybrid organic halide perovskite was introduced as light harvesting material, showing strong absorption in a broad region of the visible spectrum, good electron and hole conductivity, delivering also high open circuit voltages in photovoltaic devices. The perovskite absorber was initially used as the sensitizer to replace dye molecules in the dye-sensitized solar cell by using the liquid of iodide-based electrolyte. The solution-based device fabrication in solid-state perovskite solar cell (PSC) is very attractive advantage of manufacturing compared with other solar cell. PSCs are consist of $CH_3NH_3PbX_3$ loaded on a mesoporous TiO_2 layer in conjunction with the hole transporting material between the two electrodes.

The PSCs based on $CH_3NH_3PbX_3$ thin films processed by various methods show quite different device performances. High power conversion efficiency was observed from PSCs based on high quality deposited $CH_3NH_3PbX_3$ thin films. Moderate power conversion efficiency was observed from PSCs based on low quality solution-processed $CH_3NH_3PbI_3-_xCl_x$ layer.

In this study, we studied the correlations between the efficiencies of PSCs and the film thicknesses of $CH_3NH_3PbI_{3-x}Cl_x$ layers. We investigate the device performance of X-ray diffraction (XRD) patterns, atomic force microscopy (AFM) and scanning electron microscopy (SEM) images of $CH_3NH_3PbI_3$−xClx films. The incident photocurrent conversion efficiency was measured using a solar simulator (100 mW/cm^2).

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