

Morphology control of mixed halide perovskite solar cell by heat-treatment

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The mixed halide perovskite ($\text{CH}_3\text{NH}_3\text{PbI}_{3-x}\text{Cl}_x$) is used for perovskite solar cell with planar structure because it has good charge transport property and long carrier's diffusion length by doping effect with Cl-contents. Generally, the efficiency of perovskite planar structure solar cell is dependent on the thickness and morphology of perovskite thin-layer because the diffusion length of MAPbI_3 and $\text{MAPbI}_{3-x}\text{Cl}_x$ is ~ 100 nm and ~ 1000 nm. In order to make efficient planar mixed halide perovskite hybrid solar cell, the morphology and thickness of mixed halide perovskite thin film should be controlled to single crystalline pinhole-free morphology with < 1000 nm-thickness. When the mixed halide perovskite layer is deposited by one-step spin-coating process, it tends to form island morphology on dense TiO_2 thin layer/FTO (F doped tin oxide) substrate. Consequently, such morphology yield to low device efficiency due to severe recombination of charge carriers by direct contact of electron conductor and hole conductor. Here, we studied on the effect of heat-treatment to the morphology of mixed halide perovskite layer and consequently could form uniform mixed halide perovskite thin-films.