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Effects of Cs-doping in Formamidinium Lead Triiodide Perovskite films on improved phase stability and charge separation

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Herein, polycrystalline of cesium (Cs) doped in formamidinium lead triiodide ($HC(NH_2)_2PbI_3$ or $FAPbI_3$) films were successfully prepared by spin-casting from solutions. Changes in structural, optical and morphological properties of the obtained films upon varied Cs concentrations were systematically investigated. A phase stability and the grain sizes of the films are very strongly dependent on the amounts of Cs dopants. XRD results reveal that a phase transition from an unstable δ-phase to the stable α-phase of the perovskite films with an increase in the grain size up to ca. 1 μm was clearly observed when the film was doped with 0.1% at Cs. A decrease in the lattice parameters of the film due to the substitution of Cs^+ ions into FA^+ sites in the $FAPbI_3$ structure was quantified. An optical band gap of the films exhibits a blue shift from 1.52 eV for an undoped $FAPbI_3$ film to 1.56 eV for the film doped with 0.1% at due to a quantum-size effect. Effects of Cs doping in the $FAPbI_3$ films on the charge separation and charge transport behaviors as probed by surface photovoltage (SPV) spectroscopy will be presented and discussed.

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