Mixed-cation lead halide perovskite solar cells for phase stability

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Organic-Inorganic perovskite solar cells have drawn attention in the photovoltaic research due to suitable properties such as high absorptivity, long charge carrier diffusion length, small excition binding energy, convenient bandgap controllability and solution processability. Although perovskite solar cells have achieved high efficiency enough to replace silicon solar cells by using their properties, it has a problem that poor long-term stability to commercialize. For instance, cubic phase of formamidinium lead iodide ($FAPbI_3$) and Cesium lead iodide ($CsPbI_3$), the photoactive black perovskite α-phase, only crystallizes at high temperature. However, the materials are transformed to non-perovskite hexagonal and orthorhombic σ-phase each at room temperature. Here, we propose tolerance factor tuning through solid-state alloying to improved stability and obtain high crystallization using mixed-cation $FA_XCs_{1-X}PbI_3$ perovskite materials.