Additive-induced Crystallization of Inorganic Perovskite Films for Efficient Solar Cells

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In recent years, hybrid perovskite solar cells (PSCs) have received extensive attention because of their high power conversion efficiency (PCE), yet their thermal stability is still not ideal. Meanwhile, all-inorganic PSCs have excellent thermal stability, but their device efficiency is relatively low. Here we report the use of non-toxic additive-induced crystallization to improve film quality to enhance the efficiency of all-inorganic PSCs. High-quality perovskite films with full surface coverage and uniform grain structure were prepared. Kinetic analysis of the crystallization process showed that the non-toxic additive increased the supersaturation of the perovskite precursor and induced rapid nucleation and crystallization. The optical band gap of the perovskite films was tuned by adjusting iodide content. CsPbBrI₂ with an appropriate bandgap was used as the light-absorbing material in PSCs that displayed high thermal stability. By optimizing the preparation process, an all-inorganic PSC with a planar structure delivered a PCE of 5.6%. The entire device fabrication process was performed in the ambient environment without humidity control. Thus, we developed a simple, controllable, and versatile approach to produce high-quality inorganic perovskite films for use in high-performance photovoltaic devices.

Keywords: all-inorganic; perovskite solar cells; nucleation; crystallization

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