Ultra-Fast Low-Temperature Crystallization of Solar Cell Graded Formamidinium-Cesium Mixed-Cation Lead Mixed-Halide Perovskites Using a Reproducible Microwave-Based Process

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The control of morphology and crystallinity of solution-processed perovskite thin-films for solar cells is the key for further enhancement of the devices power conversion efficiency and stability. Improving crystallinity and increasing grain size of perovskite films is a proven way to boost the devices' performance and operational robustness, nevertheless this has only been achieved with high temperature processes [1-2]. Here, we present an unprecedented low temperature (<80 ºC) and ultra-fast microwave (MW) annealing process to yield uniform, compact and crystalline $FA_{0.83}Cs_{0.17}Pb(I_{(1-x)}Br_x)_3$ perovskite films with full coverage and micrometer-scale grains. We demonstrate that the nominal composition $FA_{0.83}Cs_{0.17}PbI_{1.8}Br_{1.2}$ perovskite films annealed at 100 W MW power present the same band gap, similar morphology and crystallinity of conventionally annealed films, with the advantage of being produced at a lower temperature (below 80 °C vs 185 ºC) and during a very short period of time (~2.5 min vs 60 minutes). This results opens new avenues to fabricate band gap tunable perovskite films at low temperatures, which is of utmost importance for mechanically flexible perovskite cells and monolithic perovskite based tandem cells applications.

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