Coadditive and device engineering for high performance perovskite solar cells

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Abstract

Perovskite solar cells (PSCs) have shown a jump in power conversion efficiency (PCE) of 26% in just over a decade, have become one of the top choices for next generations of solar cells, and are now at the frontline competing against conventional Si solar cells.[1-3] We used heavily doped inorganic charge extraction layers in planar PSCs to achieve very rapid carrier extraction and eliminating local structural defects over large areas. This robust inorganic nature allowed us for the fabrication of PSCs showing hysteresis free I-V characteristics with high stablity.[4-5] Tin based perovskite solar cells (Sn-PSCs) has emerged as a viable solution for the fabrication of low toxic PSCs. However, the rapid crystallization process of tin halide perovskite compounds often results in severe electronic defects which limits the open circuit voltage (V_{OC}) of the overall PSC. To enhance the quality of perovskite film, additives engineering is a well-known process for both Pb and Sn-based PSCs to slow down the crystallization rate.[6] Here, we present a co-additive and compositional engineering for $FASnI_3$ based PSCs.[7-9] These positive aspects of this process made us able to boosts the power conversion efficiency over 15%.