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Enhanced Photoconversion Efficiency in $CH_3NH_3PbI_3$ Solar Cells with Cadmium Incorporation SUNETH WATTHAGE, ZHAONING SONG, NIRAJ SHRESTHA, ADAM PHILLIPS, GEETHIKA LIYANAGE, PAUL ROLAND, RANDY ELLINGSON, MICHAEL HEBEN, university of toledo — Non-radiative recombination is the primary energy loss in organic-inorganic metal halide perovskites solar cells, which significantly reduces the power conversion efficiency of the devices. To reduce the density of trap states that controls non-radiative recombination, it is important to prepare perovskite films consisting of large-sized grains with a high degree of crystallinity. Here, we show that the addition of small concentrations of Cd2+ in the methylammonium iodide precursor solution during the two-step sequential deposition can significantly improve the grain size and crystallinity of methylammonium lead iodide perovskite thin films. The grains are highly oriented in the <110>direction compare to films produced by the standard two-step deposition, indicating a change in the growth mechanism. Time resolved photoluminescence measurements indicated a dramatic increase in the carrier lifetime which can be attributed to a reduction in the active trap density. Highly reproducible photovoltaic devices were obtained from the Cd-modified perovskites with a 13.8 % device efficiency, while only 7.1 % PCE was obtained from the standard two-step process.

Suneth Watthage
university of toledo

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