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Facet-dependent photovoltaic efficiency and stability variations in mixed Sn-Pb perovskite solar cells

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Since the first breakthrough of perovskite solar cells by using a solid-state structure, the solar cell's power conversion efficiency has increased from 9.7% to >26%. These exciting improvements are mainly attributed to achieving a pinhole-free thin film at the beginning and an increased understanding of microstructures on perovskite thin films. In addition, the rapid PCE improvement has been accompanied by an increased understanding of microstructures on perovskite thin films. The photovoltaic performance of PSCs has been found to strongly correlate with their facet orientations. For example, the charge carrier lifetime, open-circuit voltage deficit and device hysteresis of PSCs are related to the structure and density in (111) crystal facets of perovskite. Besides, different crystal facets have different atomic arrangements and coordination, which lead to different atomic potential landscapes and, subsequently, to different electronic, physical, and chemical properties. Nevertheless, the deep understanding of perovskite thin films, especially the crystal facets of the thin film, still lags behind that of single-crystal samples or other inorganic thin films. In this work, we prepare the mixed tin-lead perovskite film with different orientations according to the facet engineering. We research the role of the different perovskite crystal facets in stability and optoelectronic properties.

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