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On the chemical origins of crystalline preferred orientations in hybrid organometallic lead halide perovskite thin films

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Solar cells based on organometallic lead halide perovskites have established themselves as a promising alternative to commercial thin film solar cells. The crystallographic versatility of the material allows the possibility of extensive chemical tuning, which manifests in the material as a spectra of properties that may be obtained. This entices research on hybrid perovskite structures combining different organic and inorganic groups into a crystalline framework. Preferential orientations of the crystalline hybrid perovskites (1) are reported and correlated to their morphological and chemical characteristics by grazing incidence wide angle x-ray scattering (GIWAXS). Remarkably, perovskite thin films prepared by the same methodologies displayed varying behaviors of preferred orientations, as their chemical composition was varied.

Moreover, the route and rate of crystallization (2) is known to radically influence crystalline preferred orientations as well, giving rise to information regarding kinetic and thermodynamic orientations. These results, for the first time propose the possibility of controlling crystallinity of spin-coated thin films by tuning the ingredients of and the treatment of the solution used for spin coating.

(1) Oesinghaus et al., Adv. Mater. Interfaces 2016, 3, 1600403

(2) Giesbrech et al., ACS Energy Lett. 2016, 1, 150-154

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