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An insight into atmospheric degradation processes by mapping local nanoheterogeneities within hybrid polycrystalline perovskite films

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Hybrid perovskites are an exciting and a highly versatile class of materials within the photovoltaic community. Their versatility emerges from their crystallographic structure which allows for functionalization of materials into hybrid species by partial/ complete compositional substitution at various lattice sites. Their manufacturing is economically attractive since perovskite materials have low activation energies for crystallization and they require low temperatures for formation. However, as a result they are known to be sensitive to structural and chemical degradation in ambient atmosphere, especially in the presence of humidity and oxygen. Within this study, we map local crystallographic characteristics of two exemplary perovskite systems: a stoichiometrically pure and a mixed hybrid perovskite thin film. The samples were, etched with a focussed ion beam and probed with the aid of a nanofocussed x-ray beam. Local heterogeneities emerging at the nanoscale were discovered, making it possible for the first time to map individual crystallites of solution-processed thin films and pinpoint local sites of degradation within the two prototypical materials.

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