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In Situ and Operando Scattering Studies on Perovskite Solar Cells

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The first application of hybrid organo-metal halide perovskites as sensitizer in hybrid solar cells marked the cornerstone for what has now become a broad field of extensive research. After overcoming initial challenges, power conversion efficiencies (PCE) of hybrid perovskite photovoltaics strongly increased to above the 25 % mark and now outperform many conventional inorganic thin film technologies for solar cell fabrication. The easy and versatile processing towards an improved stability and reproducibility further increases the massive interest in this type of material. The abundance of precursor materials in combination with the wet chemical processing are rendering hybrid organo-metal halide perovskites as candidates for a low-cost, mass-producition photovoltaic technology. Moreover, perovskite solar cells are lightweight, show mechanical flexibility, are well working at diffuse light conditions and proof to be suited for an in-door use.
Extensive studies have focused on improving the operational stability of perovskite solar cells, but few have surveyed the fundamental degradation mechanisms. One aspect overlooked in earlier works is the effect of the atmosphere on device performance during operation. Here we investigate the degradation mechanisms of perovskite solar cells operated under vacuum and under a nitrogen atmosphere using synchrotron radiation-based operando grazing-incidence X-ray scattering methods. [1]

[1] R.Guo, D.Han, W.Chen, L.Dai, K.Ji, Q.Xiong, S.Li, L.K.Reb, M.A.Scheel, S.Pratap, N.Li, S.Yin, T.Xiao, S.Liang, A.L.Oechsle, C.L.Weindl, M.Schwartzkopf, H.Ebert, P.Gao, K.Wang, M.Yuan, N.C.Greenham, S.D.Stranks, S.V.Roth, R.H.Friend, P.Müller-Buschbaum
Degradation mechanisms of perovskite solar cells under vacuum and one atmosphere of nitrogen
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