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The zero step for degrading perovskite solar cells: What atmosphere should we choose?

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The power conversion efficiency (PCE) of perovskite solar cells (PSCs) reached the champion value of 25.2 %, making this technique competitive with commercial silicon solar cells. Despite such advantages, the application of PSCs is currently limited by combining high performance and operational stability, because PCE of PSCs can degrade due to the presence of temperature, light, humidity, and oxygen. So far, the degradation research on PSCs is carried out without having an established standard protocol. Therefore, it is necessary to establish a standard protocol for the long-term degradation of PSCs. In this respect, we investigate degradation processes of PSCs under both, AM 1.5G and different atmosphere conditions with in-situ grazing incidence wide-angle X-ray scattering (GIWAXS) and grazing incidence small-angle X-ray scattering (GISAXS). With these approaches, we can follow the evolution of characteristic structures and of the inner morphology under the respective operational conditions. After understanding the degradation mechanisms upon different atmospheres (nitrogen and vacuum), we can suggest a reasonable atmosphere, which enters the protocol for the standard aging routine to guide future industrial development.

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