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Elucidating the Degradation Mechanism of Perovskite Solar Cells in Humid Air ZHAONING SONG, SUNETH WATTHAGE, GEETHIKA LIYANAGE, ADAM PHILLIPS, MICHAEL HEBEN, The University of Toledo — Solar cells based on organic-inorganic hybrid metal halide perovskites have rapidly progressed over the past few years. With >22% power conversion efficiencies, simple fabrication processes, and low manufacturing costs, there is a great potential to proceed towards commercialization. However, perovskite solar cells are currently limited by the instabilities in the materials and devices, especially due to reactions with water. To address this issue, it is important to know why the perovskite materials are unable to retain the excellent optoelectronic properties after exposure to moisture. Here, we investigate water induced device degradation by in-situ mapping the spatial and temporal evolution of laser beam induced current (LBIC) [1]. We show that the hydration of the perovskite phase leads to a significant drop in the external quantum efficiency. However, this process is reversible: drying the device can convert the hydrated phases back to an unhydrated perovskite and recover the desired optoelectronic properties. Understanding of the phase stability and device performance on a microscopic level gives insight toward improving the long-term stability. [1] Song et al., Adv Energy Mater, 1600846, 2016.

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