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Electrical measurement of real-time ion migration dynamics in 1-D perovskite[1] ZHENQI HUA, AZZA BEN, Florida State University, TIANHAN LIU, University of California, Los Angeles, HANWEI GAO, BIWU MA, PENG XIONG, Florida State University, DR. MA BIWU GROUP COLLABORATION
— Organic metal-halide perovskites have shown superior properties amenable to optoelectronic applications. The low-dimensional versions exhibit enhanced chemical stability due to their unique molecular structures. However, the charge transport properties, particularly their electronic stability with respect to ion migration, have yet to be systematically investigated. Here, we report on electrical measurements of real-time ion dynamics in the 1D hybrid metal-halide (R-MBA)PbI_3. The 4-terminal I-V curves exhibit a number of reproducible features indicative of common ion dynamics, including negative differential resistance, nonlinearity, and hysteresis that depend on the rate and direction of the current sweep. Measurements of the time-dependent voltage at constant current evidence an exponential dynamic of a time constant of ˜2 s for the ion migration current. Moreover, all the unusual features in the I-V's can be quantitatively modeled based on this single ion dynamic, which can be enhanced by photo illumination. Our observations are consistent with the photo-activation of mobile ions and field-assisted ion migration. They provide valuable insights into the hysteresis in perovskite solar cells and the general dynamics of ion migration.

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