Bidirectional Halide Ion Exchange in Paired Lead Halide Perovskite Films with Thermal Activation

MAPbBr\textsubscript{3} and MAPbI\textsubscript{3} films cast onto glass slides and physically paired together undergo halide exchange to form mixed halide films. The change in halide composition in these two~130 nm thick films occurs concurrently with Br\textsuperscript{−} diffusing toward the MAPbI\textsubscript{3} film and I\textsuperscript{−} diffusing toward the MAPbBr\textsubscript{3} film. The diffusion of these halide species, which is tracked through changes in the absorption, offers a direct measurement of thermally activated halide diffusion in perovskite films. The increase in the rate constant of halide diffusion with increasing temperature (from 8.3 \times 10^{-6} s\textsuperscript{-1} at 23 °C to 3.7 \times 10^{-4} s\textsuperscript{-1} at 140 °C) follows an Arrhenius relationship with activation energy of 51 kJ/mol. The thermally activated halide exchange shows the challenges of employing layers of different metalhalide perovskites in stable tandem solar cells.