

Preventing Photoinduced Halide Segregation in Mixed-Halide Perovskites

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Abstract:

Tandem solar cells with metal halide perovskite top cells have achieved power conversion efficiencies better than single-junction silicon solar cells. However, the success of these devices is constrained by the phenomenon of halide segregation, which afflicts the mixed iodide-bromide compositions [e.g. $\text{CH}_3\text{NH}_3(\text{Br}_{0.5}\text{I}_{0.5})_3$] used to achieve the necessary wide bandgaps. When exposed to above-bandgap illumination, these mixed-halide perovskites de-mix into iodide-rich and bromide-rich regions. This phase segregation is deleterious to the performance of mixed-halide perovskites in tandem cell applications.

In this seminar, I will give an overview of the multiplicity of proposed models of this phenomenon, none of which have been able to fully explain all reported observations of light-induced halide segregation. I will then discuss my time-dependent photoluminescence spectroscopy studies, conducted with the Herz & Johnston Groups at the University of Oxford, on how this ion migration is influenced by the atmospheric environment, trap states, temperature and incident light intensity.

I use our findings to elucidate the validity of the most commonly examined models describing the origins of halide segregation, and discuss their relevance to applications of mixed-halide perovskites in tandem and concentrator solar cells.