Perovskite stability and extracting meaning from ion migration

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Hybrid halide perovskites combine top-notch optoelectronic properties with solution-deposition. This unprecedented combination has led to the development of solar cells approaching power conversion efficiencies achieved by industry staples such as poly-Si. The road towards these achievements has been marked by a constant improvement of perovskite deposition techniques fuelled by our increasing understanding of the crystallization processes, yet stability is still a challenge. Here, the dual ionic-electronic conductor nature of the materials poses a particular challenge. On the one hand, ion vacancies catalyse degradation and make perovskites particularly susceptible to moisture. On the other hand, ion accumulation at interfaces blurs interface energetics, giving rise to 'hysteresis' and making data interpretation from electronic measurements complicated.

In this talk I will showcase some of our contributions in the degradation mechanism arena, how a popular strategy of incorporating layered perovskites as a 'hydrophobic' layer, in fact does not keep water out; and alternative approaches to minimise the issue. I will also introduce a technique we have recently developed to determine the built-in voltage in a functioning device via the application of rapid voltage pulses giving way to a more targeted approach to interfacial optimisation.