Controlling the Crystallisation Dynamics of Halide Perovskites: The Path to Improved Performance and Stability

Nakita K. Noel[1]

[1]*Clarendon Laboratory, Department of Physics, University of Oxford, Parks Road, Oxford, OX1 3PU*

Email: nakita.noel@physics.ox.ac.uk

Since the first demonstration of efficient halide perovskite solar cells, there has been sustained and growing research interest in this class of materials. With facile deposition processes and excellent optoelectronic properties, these materials have found applications not only in photovoltaics, but in a myriad of optoelectronic devices. While research into halide perovskites for light emission and X-ray detection is just beginning to surge, perovskites are most well known for their remarkable PV performance, achieving certified power conversion efficiencies over 26%. Despite their truly impressive device performance, these materials have not yet reached their true potential. The major obstacle to this is an incomplete understanding of crystallisation processes, as well as defects which exists on surfaces and at interfaces in perovskite thin-films. For solution-processing, arguably the most researched deposition modality, defect control may start with the ability to control precursor ink chemistry. For thermal vapour deposition on the other hand, the initial stages of growth and the quality of the perovskite material at the interface with charge transport layers must be precisely controlled. Here, I will discuss how on the one hand understanding ink chemistry and degradation processes can yield the ability to precisely control crystallisation kinetics and phase transformations; and on the other, an approach to improving the quality of vapour deposited perovskite thin-films. In general, these approaches can be used to fabricate halide perovskite films with improved optoelectronic quality, yielding devices with not only enhanced performance, but notable improvements in operational stability.