

Non-destructive in-situ slot-die coating x-ray and neutron scattering experiments on perovskite thin films for photovoltaic application

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Organic-inorganic metal halide perovskite solar cells (PSCs) offer a potentially cheap source for clean and low cost electrical energy. Improving stability^{1, 2} and minimodule power conversion efficiencies over 17% in 2018³ promise commercial devices possibly capable of competing with multi-crystalline silicon solar cells with current module efficiencies of around 22% in 2017³. This calls for developing large scale production techniques which are not yet available. The lab-to-fab process is not easily done since experience in perovskite layer deposition has long been limited on spin-coating which is a flexible but small area coating method easily applicable in lab scale production.⁴ However, among other techniques, slot-die coating offers the possibility of cheap and high-throughput large area perovskite deposition compatible to roll-to-roll fabrication.⁵⁻⁷ A homogeneous perovskite film with low defect concentration and high crystallinity is paramount for supreme device performance and therefore optimized printing parameters are key to high quality films.^{8, 9} In order to understand the printing, crystallization and drying process during deposition non-destructive in-situ X-ray and neutron scattering experiments (GISAXS/GIWAXS, GISANS) are proposed. This allows for detailed crystallization analytics and printing parameter optimization for the next step towards large area PSC fabrication.

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