Contribution ID: **257**

Type: **Talk**

Crystallization Dynamics of Perovskite Thin Films Studied by Real-time Grazing Incidence Diffraction

Monday, 17 September 2018 14:45 (15 minutes)

New materials for thin film applications, like photovoltaics and light emitting diodes, are often deposited from solution. One of these relatively new material classes is hybrid organic-halide perovskite. The performance of such perovskite thin films depends not only on their composition, but also their structural and morphological features.[1]
We applied in situ real-time grazing incidence wide angle X-ray scattering (GIWAXS) to determine the reaction rate, domain size and preferred orientation in several perovskite thin films during crystallization from solution. The relevant time scales for the crystallization range from the subsecond regime up to several minutes.
The perovskite thin films are prepared with the so-called two-step conversion method, which involves the deposition of an iso-propanol solution onto a lead halide precursor (PbX_2, X=I,Br,Cl) via drop casting. The solution contains a defined amount of either methylammonium halide (CH_3NH_3X) or formamidinium halide ($CH(NH_2)_2X$). We will discuss how different lead halide precursors in combination with different organic halide solutions can impact the quality and time scale of the structural and morphological development of the perovskite thin films.
[1] N. Arora et al. Science, 358, 768 (2017).

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Session Classification: Parallel session 5

Track Classification: P5 Thin films, 2D materials and surfaces