CPP 11: Hybrid and Perovskite Photovoltaics II

Time: Monday 16:15–17:00 Location: H38

CPP 11.1 Mon 16:15 H38

Structure and morphology investigations on slot-die coated perovskite nanocrystal films — •Thomas Baier[1], Altantulga Buyan-Arivjikh[1], Lixing Li[1], Xiaojing Ci[1], Matthias Schwartzkopf[2], Sarathlal Koyiloth Vayalil[2,3], and Peter Müller-Buschbaum[1] — [1]TUM School of Natural Sciences, Chair for Functional Materials, 85748 Garching, Germany — [2]Deutsches Elektronen-Synchrotron DESY, 22607 Hamburg, Germany — [3]Applied Sciences Cluster, University of Petroleum and Engergy Studies UPES, Dehradun, Uttarakhand 248007, India

Perovskite quantum nanocrystals hold great potential for contributing to the future renewable energy mix by serving as the active layer in solar cells. This potential arises from quantum confinement effects, which occur when crystal sizes are reduced below the Bohr radius. These nanocrystals achieve high power conversion efficiencies, excellent photoluminescence quantum yield (PLQY), narrow photoluminescence (PL) peaks, and enhanced stability compared to bulk perovskite. Additionally, the choice of X halides (I-, Br-, Cl-) and A-site cations (FA+, MA+, Cs+) within the ABX3 perovskite structure allows precise bandgap tuning. Cesium-formamidinium lead iodide perovskite nanocrystals have been prepared and slot-die coated. These perovskite nanocrystals as active layers are investigated using in-situ grazing incidence small- & wide-angle x-ray scattering (GISAXS & GIWAXS) to better understand the layers formation process.

CPP 11.2 Mon 16:30 H38

Tracking the Crystallization Pathway of Perovskite using Microscopy, Spectroscopy and Machine Learning — •Meike Kuhn[1], Milan Harth[2], Alessio Gagliardi[2], and Eva M. Herzig[1] — [1]Dynamik und Strukturbildung - Herzig Group, Universität Bayreuth, Universitätsstr. 30, 95447 Bayreuth, Germany — [2]Simulation of Nanosystems for Energy Conversion, Technische Universität München, Hans-Piloty-Str. 1, 85748 Garching b. München, Germany

The interest in perovskite materials has grown significantly in recent years due to their diverse applications, with the crystallization process playing a crucial role in determining the final properties of perovskite films. Time-resolved techniques, such as microscopy and spectroscopy, enable detailed analysis of the various stages of perovskite formation.

In this study, we investigated the crystallization of methylammonium lead iodide (MAPbI3) blade coated from dimethylformamide (DMF), using a combined microscopy and spectroscopy approach. This approach allowed us to observe morphological and optical changes during intermediate phase formation and perovskite conversion, influenced by the addition of various additives. By applying a machine learning model to the microscopy data, we developed a predictive framework capable of estimating spectroscopic signals, thus enabling insights into physical properties with time-resolved microscopy.

CPP 11.3 Mon 16:45 H38

Utilizing CsPbBr3 Nanocrystals as Nucleation Seeds for Scalable FAPbI3 Thin Films — •Altantulga Buyan-Arivjikh[1], Jascha Fricker[1], Thomas Baier[1], Xiaojing Ci[1], Lixing Li[1], Matthias Schwartzkopf[2], Sarathlal Koyiloth Vayalil[2], and Peter Müller-Buschbaum[1] — [1]TUM School of Natural Sciences, Chair for Functional Materials, 85748 Garching, Germany — [2]DESY, 22604 Hamburg, 22607, Germany

Lead-halide perovskites have gained a significant interest in the scientific community owing to their favorable optoelectronic properties combined with their ease of production and abundance of raw materials. In many cases, polycrystalline thin films are fabricated, where the crystallinity and morphology of the thin film are critical factors influencing the properties and performance of perovskites. In this work, we present a novel approach for improving the quality of FAPbI3 thin films by utilizing CsPbBr3 nanocrystals as nucleation seeds. In-situ optical spectroscopy experiments reveal a faster transition of FAPbI3 into the photactive phase in the seeded thin films as well as a reduced defect density. In-situ grazing incidence wide angle X-ray scattering (GIWAXS) measurements confirm the former and additionally show that the seed crystals improve the thin film texture by inducing a preferred crystallite orientation.