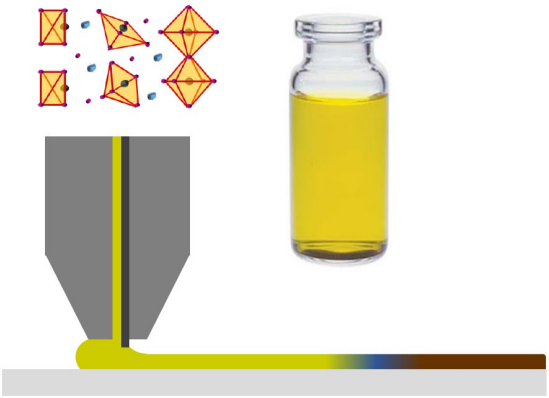
Doktorarbeit / PhD thesis

Defect and energy level tuning of printed hybrid perovskite films for photovoltaic applications



At the Chair of Functional Materials at the Technical University of Munich, we investigate the physical basis of material properties using state-of-the-art scattering methods (neutron, X-ray and light scattering) and spectroscopic techniques. The general goal of our research is to infer functional properties from knowledge of microscopic structure and dynamics.
We are looking for a PhD student to work on the project "Amphiphilic self-assembly of completely noninvasive orthogonal switchable block copolymers". The salary is 1/2 TVL E13 for 3 years.
Information about the chair can be found at:
https://www.groups.ph.tum.de/en/functmat/about-us/

Topic: Main goal of this project is to tailor the energy levels and defects in printed hybrid perovskite films based on a fundamental understanding of these defects. Hybrid perovskites typically form polycrystalline thin-films and various detrimental defects can unavoidably manifest during the rapid crystallization process of the films during the printing, resulting in a higher defect density compared to their monocrystalline counterparts. These defects tend to accumulate at the interfaces and grain boundaries, and cause a non-radiative recombination of photo-generated charge carriers, thus significantly hinder the effective transmission and extraction of photo-generated charge carriers. To obtain sufficient and effective photo-generated charge carriers, most investigations have emphasized so far on the grain size and crystallinity optimization during the perovskite thin-film deposition progress like printing. In the present project, we will use a different strategy. We will make use of the distinct differences in the growth orientation of different grains in a polycrystalline perovskite film, which gives rise to anisotropy of charge carrier lifetimes and trap densities distributions. Based on pre-grown seeds from colloidal precursors in the solution used for the printing, the printed polycrystalline hybrid perovskite films will be tailored in its grain sizes, crystal orientation and defect density. Advanced x-ray and neutron scattering will provide the structure information on the meso- and crystal-scale. This knowledge will be combined with information about the chemical composition, band edge position, and work function as probed by a collaborating partner.

For further information, please contact Prof. Peter Müller-Buschbaum (muellerb@ph.tum.de).
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