In situ GIWAXS analysis of $MAPbI_3$ formation using the software tool INSIGHT

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In situ observation of thin-film formation by e.g. x-ray scattering is more frequently used as detectors improve and become more affordable and high brilliant (synchrotron) sources become more broadly available. This gives rise to powerful in situ observation possibilities, e.g. in the field of thin-film solar cell research. Especially the morphology evolution of the thin-film during e.g. formation or degradation is of interest when aiming for high-quality films for industrial scale production.

Here we report on the formation of hybrid perovskite methylammonium iodide ($MAPbI_3$) from lead iodide and methylammonium iodide by thermal annealing as observed in situ. We applied in situ grazing-incidence wide-angle x-ray scattering (GIWAXS) to analyze phase and texture information in real time.

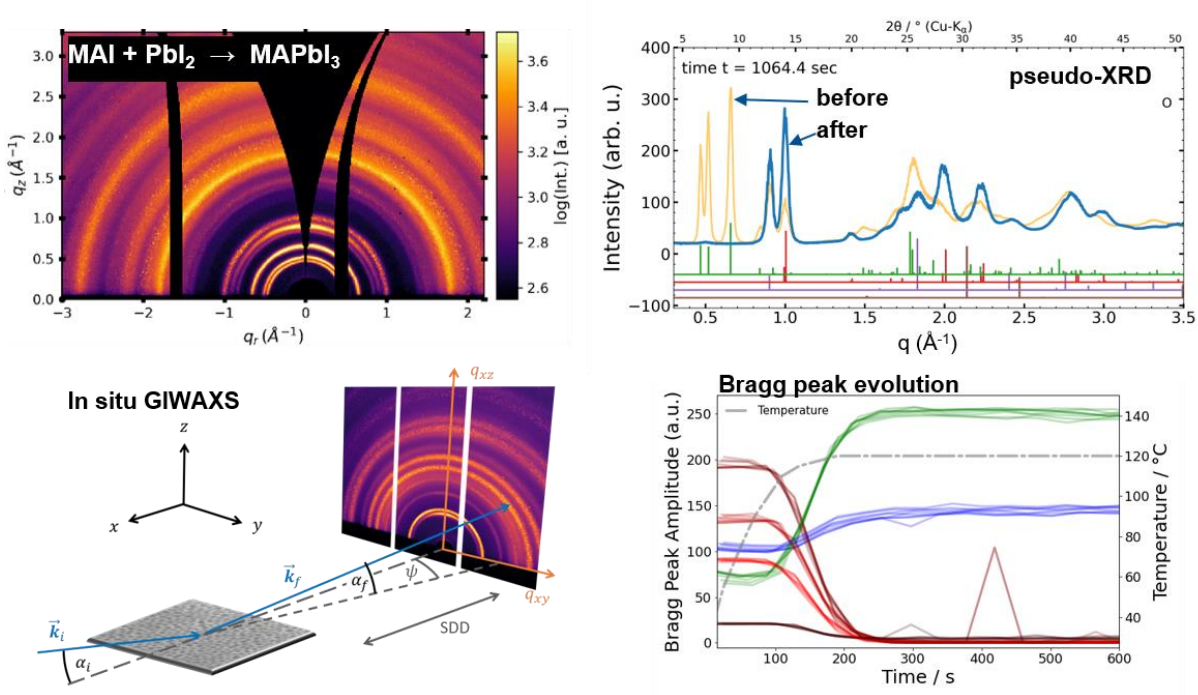

Fig. 1 In situ GIWAXS analysis of the formation of perovskite MAPbI3 from a MAI/PbI2/solvent complex upon annealing using the software tool INSIGHT.

Using our python based software tool INSIGHT, we conducted the loss-free batch processing of data, including transformation to reciprocal space and data reduction (e.g. cutting). This leads to detailed time resolved information about the respective signal ratio of respective phases present in the thin film. In addition, information about the phase-respective texture present in the thin-film can be extracted. Lorentz corrected azimuthal tube cuts make it possible to quantify the texture present in the respective material at each point in time.