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## Investigation and Tuning of Slot-Die Coated Perovskite Solar Cells Using X-Ray Diffraction

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Perovskite solar cells (PSCs) have attracted increasing attention in research and industry due to their high efficiency, low material cost and simple solution-based fabrication process, which allow the manufacture of thin, flexible photovoltaic modules.

In laboratory devices, the efficiency already exceeds 25% and is comparable with c-Si.[1] However, one of the most important steps towards commercialisation is upscaling the production of PSCs to a larger area. Slot-die coating is one of the most promising technology being a fast process with minimum material consumption and waste.[2]

Furthermore, the highly tuneable perovskite ink composition strongly determines the final morphology of the film, providing an outstanding opportunity to develop a comprehensive understanding of the kinetic processes during film formation. The focus of the work is the effect of additives, such as methylammonium chloride ( $\text{CH}_3\text{NH}_3\text{Cl}$ ) and methylammonium bromide ( $\text{CH}_3\text{NH}_3\text{Br}$ ), on the perovskite layer. A complete study - using spectroscopic and X-ray scattering methods - allowed us to effectively understand the role of the halide atoms in the crystallization process.

The ultimate goal of our work is to investigate suitable ink compositions and the resulting final perovskite thin-film to develop a systematic and reproducible printing technique for printed flexible and high-efficiency PSCs.

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