Advancing roll-to-roll printed all-polymer solar cells with combined X-ray scattering morphology study and molecular design

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All-polymer organic photovoltaics (OPVs) have achieved over 9% efficiency and outperform their fullerene-based competitors in terms of thermal and mechanical stability, making them an attractive alternative to silicon solar cells. However, industrial scale roll-to-roll (R2R) printing without deterioration in performance has yet to be achieved for OPVs to become a viable option.

We plan to develop a detailed understanding of the morphology evolution of all-polymer OPV during R2R fabrication to bridge the gap between lab and industrial fabrication by means of a combined X-ray scattering morphology study and molecular design.

For this purpose, we will use in-situ and ex-situ grazing incidence wide angle scattering (GIWAXS), resonant soft X-ray scattering (RSoXS) and scanning transmission X-ray microscopy. This will allow for a comprehensive characterization of the morphology of the final film but also give insights into the morphology evolution during R2R fabrication. With feedback from device performance characterization, this study is expected to yield meaningful morphology-performance correlations.