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Tracking the morphology formation of printed non-fullerene active layer for solar cells

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Non-fullerene organic solar cells (OSCs) have attracted great interests due to the low cost materials, which make it easier to be commercialized in industries. Despite the power conversion efficiency (PCE) of related devices have been well developed with lab scaled fabrication processes, like spin-coating deposition, the situation for the devices fabricated by industry preferred depositions, like printing as one of the most promising methods, might be quite different. This is because the inner morphology of the active layer, namely the bulk heterojunction (BHJ) layer, is strongly influenced by the deposition method. Thus, to understand the inner structure as well as the structure forming process during the printing deposition is important for the device optimizations in the future. In this work, we employed a low band gap polymer, pffBT4T-2OD, as donor and a non-fullerene material, EH-IDTBR, as acceptor to form a BHJ film as active layer in our solar cell architecture. The solution containing donor and acceptor was deposited on the substrate by printing in ambient conditions. During the printing process, the film morphology was observed in situ by grazing incidence small-angle X-ray scattering (GISAXS). In addition, atomic force microscopy (AFM) and scanning electron microscope (SEM) techniques were used to get the surface morphology information of the printed active layers.

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