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Morphology of printed active layers for organic solar cells as studied with advanced scattering techniques

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Bulk heterojunction (BHJ) organic solar cells have gained significant improvements via novel organic synthesis methods and optimized fabrication routes, especially with respect to their potential roll-to-roll processing for large-area device manufacturing. Printing techniques allow for up-scaling to industrial-oriented scale which is not the case for laboratory deposition techniques like spin coating. Thus, roll-to-roll processing on flexible substrates is very attractive to be implemented as production techniques for organic solar cells. Several methods of printing techniques can be used to reach this goal, such as for example slot-die coating. In a BHJ polymer structure, the morphology plays an important role for the device efficiency. Different factors can influence the morphology of the active layer. For example, the different ratio of donor material and accepter material can influence the nanostructure and the phase separation of the active layer. In our experiment, the active layers were fabricated with different ratios of low-bandgap polymer PTB7 and fullerene derivate PCBM using the slot-die printing technique. The morphology and structure of printed active layers are investigated by atomic force microscopy (AFM), scanning electron microscopy (SEM) and grazing incidence small angle x-ray scattering (GISAXS).

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