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Influence of solvent on the morphology and optical properties of printed active layers based on PBDB-T-SF:IT-4F for application in organic solar cells

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Polymer-based organic solar cells (OSCs) are of rising interest in research and industry due to their potential advantages such as light-weight, flexibility, semi-transparency and low production cost. The power conversion efficiency of OSCs has been significantly improved in recent years, by now up to about 15 %. Yet scalability is a still major factor to make OSCs economically viable. Producing the active layer via thin-film printing is a promising approach as it facilitates the fabrication of large-area organic solar cells compared to the more commonly used spin-coating technique. Still this technology has to be further investigated and printing parameters have to be optimized to increase the resulting quality. The active layer of OSCs consists of a blend of a polymer donor material and a non-fullerene acceptor material. In this work, the polymer PBDB-T-SF and the non-fullerene small molecule acceptor IT-4F with reported efficiencies up to 13 % have been investigated. As the PCE of OSCs greatly depends on the morphology of the active layer, factors influencing the morphology, such as the used solvent, are of great interest. Effects of different solvents can be studied by looking at the absorption characteristics via UV/VIS spectroscopy in solution as well as in a thin film. The morphology itself can be investigated via surface probing techniques such as AFM or grazing incidence small angle x-ray scattering (GISAXS) to gain statistical information about the inner structure.

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