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Enhanced air stability with solid additive EH-P in PBDB-TF-T1:BTP-4F-12 organic solar cells

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The performance of organic solar cells (OSC) has got great development due to material design and device engineer, while the poor stability of PSC and toxic solvents during device fabrication are the most two big issues nowadays. Here, we select a green-solvent based material system PBDB-TF-T1:BTP-4F-12, and explore a solid green fluorescent polymer additive EH-P, realizing the full fabrication without any aromatic or halogenated solvents. The EH-P doping solar cells exhibited comparable performance as DPE does. Furthermore, the in-situ GIWAXS measurement was carried out with the cell under light, where EH-P doped cells shown much better stability compared with the reference ones. The degradation process of the reference T1:Y12 cells was observed and the evolution of GIWAXS patterns could be divided into three stages, where the q and coherent length of π-π stacking would change both. The doping of EH-P could suppress the evolution at the first stage and stable the films crystallinity. GISAXS results before and after aging illustrate that EH-P could suppress the swelling of phases during the light degradation process. Improved phase separation with EH-P doping and enhanced stability after aging were found from AFM images. In a word, EH-P could improve the stability of PBDB-TF-T1: BTP-4F-12 solar cells without too much effect on performance, which shows great potential as a solid additive in organic solar cells.

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