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Gracing incidence scattering as a method to understand the influence of non-halogenated solvents on the morphology of organic solar cells

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Lately, organic solar cells (OSCs) have gained increasing attention due to their rapidly increasing efficiencies as well as the relatively easy scalability in their manufacture. However, their production relies heavily on the use of halogenated solvents, as organic solar cells made with environmentally friendly solvents often suffer from reduced performance, which is associated with the reduced solubility of some OSC materials. This can be partially reversed by raising the temperature of the solvents during formation of the bulk-heterojunction (BHJ), increasing the solubility of the respective material.

We investigate and compare the changes in morphology and performance stability of PTQ10:BTP-4F OSCs processed from various solvents, utilising operando grazing-incidence small and wide angle X-ray scattering during illumination and solar cell operation. We further show the impact of solvent composition on the charge carrier dynamics in the respective BHJs using time-resolved transient absorption spectroscopy, analysing the connection between thin-film morphology and device performance in polymer:non-fullerene acceptor OSCs.

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