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**Using resonant x-ray scattering to determine how structure controls the charge generation process in PCPDTBT:PC<sub>70</sub>BM solar cells** MICHAEL POPE, MATTHEW WALDRIP, THOMAS FERRON, BRIAN COLLINS, Washington State University — Increased solar power conversion efficiencies to 12% in bulk heterojunction organic photovoltaics (OPVs) continue to brighten their prospects as an economically viable source of solar energy. It is known that OPV performance can be enhanced through processing additives that change the nanostructure. We track these critical structure-property relationships in the OPV system PCPDTBT:PC<sub>70</sub>BM while varying the amount of DIO additive. Resonant Soft X-ray Scattering reveals domain purity, domain size, and molecular orientation to highlight the system's complex dependence on DIO concentration. We will show the effect the resulting structure has on charge generation and recombination via in-situ transient and steady state optoelectronic measurements. By measuring structure, excited state dynamics and device performance all on the same sample enables direct relationships to be measured. We show that the appropriate balance of crystallinity, domain size and domain purity are important for optimized excited state dynamics and device performance.

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