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Characterization of Nanostructure and Electrical Properties of Polymer-Fullerene Bulk Heterojunction Solar Cells DONG WANG, FENG LIU, XIAOBO SHEN, University of Massachusetts Amherst, KEN NAKAJIMA, Tohoku University, THOMAS RUSSELL, University of Massachusetts Amherst — The ability to control and optimize the active layer morphology is critical for achieving high power efficiency with bulk heterojunction (BHJ) organic photovoltaic (OPV) devices. Here, we fabricated three types of polymer-fullerene BHJ active layers: diketopyrrolopyrrole (DPP)/PCBM, poly[N-9"-hepta-decanyl-2,7-carbazole-alt- 5,5-(4',7'-di- 2-thienyl-2',1',3'- benzothi adiazole) (PCDTBT)/PCBM, and poly(3-hexylthiophene) (P3HT)/PCBM. A comparative study of the nanostructure and electrical properties resulting from different donors and annealing processes was done by conductive atomic force microscopy (c-AFM), grazing incidence small angle scattering (GI-SAXS), wide angle scattering (GI-WAXS), and transmission electron microscopy (TEM). To obtain a signal from the c-AFM, a percolated pathway for either electrons or hole is required, with details on the internal structure of the assemblies being provided by GI-WAXS and morphology of the assemblies being provided by GI-SAXS and TEM.

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