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Comparison of polymer-fullerene heterojunction morphology to bimolecular recombination kinetics DEAN DELONGCHAMP, DEANNA RODOVSKY, NIST, JEFF PEET, Konarka, TRACEY CLARKE, ATTILA MOZER, University of Wollongong, LEE RICHTER, ANDREW HERZING, JOSEPH KLINE, NIST — One of the most important physical processes limiting the practical power conversion efficiency of bulk heterojunction (BHJ) organic photovoltaic devices is the bimolecular recombination of holes and electrons. Reduced recombination would permit the use of thicker BHJ layers, enabling greater light absorption without a penalty in device current. A few polymer light absorbers, when combined in a BHJ with a fullerene electron acceptor, exhibit recombination that is slower than Langevin-type, but the origins of this behaviour are not understood. This talk will describe our effort to determine whether slower-than-Langevin recombination can be attributed to features of the nanoscale morphology or crystalline microstructure within the BHJ film. In comparing BHJ films made from two silole-based monomers, one with Langevin recombination and one with slower-than-Langevin, we find many aspects of the BHJ material structure such as order, orientation, and nanoscale domain size and shape, to be surprisingly similar. We will compare the two materials and emphasize opportunities in data analysis and new measurements to determine whether a morphological basis underlies different recombination kinetics.

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