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Mixing Behavior of a Molecular Acceptor and Polymeric Donors in Organic Solar Cell Blends M.A. BRADY, N.D. TREAT, L.A. PEREZ, J.E. COCHRAN, UCSB, M.F. TONEY, Stanford Synchrotron Radiation Lightsource, C.J. HAWKER, M.L. CHABINYC, E.J. KRAMER, UCSB — Organic photovoltaics represent potentially low-cost, solution-processable materials for sustainable energy generation. The concept of a bulk heterojunction relies on the belief that separated domains of donor and acceptor exist to maximize interfacial area for exciton dissociation, while pathways are retained for charge transport to each electrode. Although phase-pure domains are believed to exist due to phase separation of acceptor (PCBM) and donor (P3HT) components, our results suggest otherwise. In this work, the rapid interdiffusion of PCBM and P3HT is investigated using dynamic secondary ion mass spectrometry and grazing-incidence wide angle X-ray scattering, illustrating the significant miscibility of PCBM within P3HT amorphous regions, especially at temperatures (150 °C) at which devices are often annealed to improve performance. The solubility of PCBM in the P3HT-rich phase decreases at lower temperatures. This mixing behavior is contrasted with that of PCBM with PBTTT, a poly(thiophene) of reduced side chain density.

Michael Brady
University of California, Santa Barbara

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