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Kinetics of Structure Formation in Polymer-Fullerene Solutions for Organic Photovoltaics MARGARET SOBKOWICZ, RONALD JONES, R. JOSEPH KLINE, DEAN DELONGCHAMP, National Institute of Standards and Technology — Bulk heterojunctions (BHJs) composed of poly(hexylthiophene) (P3HT) and phenyl-C61-butyric acid methyl ester (PCBM) are promising active layers for organic photovoltaics. The nanoscale morphology of the BHJ is critical to the performance of solar devices because exciton diffusion, charge separation, and carrier transport require domains that have specific optimal sizes and connectivity. Processing parameters have been shown to influence the morphology and thus device performance. Because P3HT crystallization during film formation is the driving force for phase segregation, casting solution properties are vital to film electronic properties. Small angle neutron scattering (SANS) is an ideal measurement technique to study the blend morphology and phase formation in P3HT:PCBM solutions due to the large difference in neutron scattering length density between P3HT and PCBM, the length scale probed, and the excellent sensitivity of SANS to concentration fluctuations. In this work SANS and solution rheology are developed as characterization tools for organic photovoltaic materials. Scattering data from P3HT:PCBM solutions are correlated to gelation kinetics to develop a picture of the nanoscale organization and the influence of processing on morphology.

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