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TEM Phase-Contrast Imaging of the nanomorphology of the Polymer/Fullerene Bulk Heterojunction CHRISTOPHER TAKACS, UC Santa Barbara — Measurement and, ultimately, control of the nanoscale morphology is of central importance in high-performance polymer electronics. Direct measurement of the morphology is critical to characterization but few techniques are capable of imaging on the nanometer length scale required to resolve the phase separation in the BHJ. The TEM is well-suited in accessing this length scale; however, in-focus images of the current generation of high-performance polymers give little contrast due to small density differences between phase-separated regions. Invasive techniques such as staining with heavy elements can increase contrast but may also have substantial effects on morphology. Phase-Contrast Imaging with the TEM provides a non-invasive way to increase the measurement sensitivity to phase-separated regions in the BHJ. In this method, we defocus the image and transition into a regime where the TEM can be quantitatively described as a near-field scattering instrument. From analysis of the data, we characterize the morphology of the BHJ for systems of P3HT/PCBM and PCDTBT/PCBM.

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