Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Observation the Nanoscale Blending Morphology of P3HT:PCBM Bulk-Heterojunction by Energy-Filtered TEM and Contrast Transfer Function. NOPPORN RUJISAMPHAN, ISMAT SHAH, University of Delaware — The efficiency of bulk-heterojucntion organic solar cells is strongly related to the blending morphology of donor and acceptor materials. By understanding the intermixed morphology would improve device performance. Herein, we present the ways to improve contrast images in the transmission electron microscopy of P3HT:PCBM. In general, TEM images took at the focus point gives one low contrast. We take advantage of the contrast transfer function (CTF) to improve contrast images in bright field TEM. By changing the defocus values, the fibril structure of the P3HT is obviously observed and distinguished. In order to observe the nanoscopic blending morphology, fibril size, and distribution of those fibrils, we carry out the energy filtered TEM (EFTEM). The energy window centered at 19 eV with the slit width energy of 7 ev is selected for looking only P3HT domain. In contrast, the energy window is centered at 25, and 30 eV for observing PCBM domains with the same slit width energy for a comparison. When used the window at 19 ev, we are able to clearly observe the P3HT fibril structure with the diameter and the length of 15 ± 1 nm and 51 ± 20nm, respectively. The diameter size of those fibrils did not change even in the annealed samples implying that the PCBM diffused only into an amorphous region of P3HT. The distribution of those fibrils seemed to be homogeneous without any preferred direction. Together with XRD results, we found that in only one P3HT fibrils, there are 40 pi-pi stacking layers with 9 layers parallel to the fibril length.

Nopporn Rujisamphan
University of Delaware

Date submitted: 15 Nov 2012 Electronic form version 1.4