Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Optimization of low band gap polymer photovoltaics through structure modification[1] FENG LIU, YU GU, ALEJANDRO BRISENO, THOMAS RUSSELL, University of Massachusettes-Amherst, CHENG WANG, Lawrence Berkeley National Lab — In BHJ-type solar cells, the ability to control and optimize the active layer morphology is a critical issue to improve device efficiency, and this is usually achieved by optimizing the processing conditions, eg. using varied annealing procedures and choosing the right solvent additive. In this work, we shown that device performance of DPP based low band gap polymers should be optimized both in processing and structural optimization approach. Without the use of chemical additive in blended thin film preparation, large size-scaled phase separation, up to several hundred of nanometers exist. This morphology is due to the surface aggregation of phenyl-C71-butyric acid methyl ester (PCBM), which forms large oval structures and then buried by a polymer-PCBM mixture thin film. In this process, the miscibility of polymer matrix plays an important role. While using chemical additive processing method can tune the general morphology to a more fibril network texture, fine-tuning of fibril dimensions and domain size needs delicate chemical structure modification. Through this modification, a 30% device performance enhancement was observed, which mostly came from an enhancement of short circuit current, thus strongly related to the morphological details. Besides conventional morphology characterizations, an initiative effort of understanding the domain interface structure was also carried out by using polarized soft x-ray scattering, in which we observed polymer crystal orientation plays an important role.

[1]DOE DE-PS02-08ER15944; DOE, Office of Science, and Office of Basic Energy Sciences

Feng Liu
University of Massachusettes-Amherst

Date submitted: 26 Nov 2012 Electronic form version 1.4