Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Analysis of Charge Carrier Transport in Organic Photovoltaic Active Layers XU HAN, DIMITRIOS MAROUDAS, University of Massachusetts, Amherst — We present a systematic analysis of charge carrier transport in organic photovoltaic (OPV) devices based on phenomenological, deterministic charge carrier transport models. The models describe free electron and hole transport, trapping, and detrapping, as well as geminate charge-pair dissociation and geminate and bimolecular recombination, self-consistently with Poisson's equation for the electric field in the active layer. We predict photocurrent evolution in devices with active layers of P3HT, P3HT/PMMA, and P3HT/PS, as well as P3HT/PCBM blends, and photocurrent-voltage (I-V) relations in these devices at steady state. Charge generation propensity, zero-field charge mobilities, and trapping, detrapping, and recombination rate coefficients are determined by fitting the modeling predictions to experimental measurements. We have analyzed effects of the active layer morphology for layers consisting of both pristine drop-cast films and of nanoparticle (NP) assemblies, as well as effects on device performance of insulating NP doping in conducting polymers and of specially designed interlayers placed between an electrode and the active layer. The model predictions provide valuable input toward synthesis of active layers with prescribed morphology that optimize OPV device performance.

Xu Han
University of Massachusetts, Amherst

Date submitted: 13 Nov 2014 Electronic form version 1.4