Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Hydrogen Bonding-mediated Conjugated Polymers for Bulk-Heterojunction Organic Photovoltaics YEN-HAO LIN, Rice University, WANYI NIE, ADITYA MOHITE, GAUTAM GUPTA, Los Alamos National Laboratory, RAFAEL VERDUZCO, Rice University — We use hydrogen bonding interactions to prevent large scale phase separation and improve polymer blend OPVs. Poly(3-hexylthiophene) (P3HT) donor polymer and poly(2,7-(9ʹ,9ʹ-dioctyl-fluorene)-alt-5,5-(4ʹ,7ʹ-di-2-thienyl-2ʹ,1ʹ,3ʹ-benzothiadiazole) (PFTBT) acceptor polymer with self-associating, quadruple hydrogen bonding end groups (2-ureido-4[1H]-pyrimidinone, UPy) are used to explore the role of hydrogen bonding associations on blend morphology and photovoltaic performance. We study three systems: P3HT/PCBM, PFTBT/PCBM and P3HT/PFTBT and analyze by AFM, impedance, and device performance. In P3HT/PCBM, the performance is improved from 1.21% to 2.16% using UPy-terminated P3HT due to the enhanced long range order of semi-crystalline P3HT. In PFTBT/PCBM, the performance is decreased from 1.84% to 1.08% using UPy-terminated PFTBT due to entanglement of non-crystalline PFTBT chains. In P3HT/PFTBT system, the performance is improved from 0.43% to 0.77% with the use UPy-terminated P3HT and PFTBT because of suppressed macro-phase separation with maintained long range order of P3HT under annealing temperature. The impedance analysis under short circuit and illumination conditions indicates the faster charge transport and reduced charge recombination within the better performed devices. This study shows that the hydrogen bonding interactions can reduce phase separation but not produce better BHJ devices in all cases perhaps because some phase separation in blends is still required.

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Date submitted: 14 Nov 2014 Electronic form version 1.4