

Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

The impact of miscibility on organic solar cell performance and stability BRIAN A. COLLINS, North Carolina State University and National Institute of Standards and Technology, JOHN R. TUMBLESTON, North Carolina State University, JON A. BARTELT, MICHAEL D. MCGEHEE, Stanford University, CHRISTOPHER R. MCNEILL, Monash University, HARALD ADE, North Carolina State University — The recent demonstration of molecular miscibility/solubility between polymers and fullerenes [1] has revealed a much more complex picture of nanostructure, charge dynamics, and device stability – aspects that are all entangled. Here we show that miscibility is important in several ways that depends on the particular material blend. For example, recent absolute measurements on domain size and composition [2] have revealed nanostructure in PTB7:PC₇₁BM blends that is controlled by miscibility and that well-mixed regions likely hinder charge separation in this system. On the other hand, PBDTTPD:PC₆₁BM blends rely on high levels of mixing for electron percolation [3]. Such evidence leads to a complex interplay between charge separation, electron trapping, and percolation. Miscibility, a thermodynamic parameter, can, furthermore, determine the thermal stability of device active layers, which we show varies widely between materials systems. This suggests tailoring of the molecular interactions between donor and acceptor materials in solar cells may be the key to high-performing, highly stable and, therefore, economically viable organic electronics technologies. [1] B. A. Collins et al., *J Phys. Chem. Lett.* 1, 3160, (2010). [2] B. A. Collins et al., *Adv. Energy Materials* DOI: 10.1002/aenm.201200377 [3] J. A. Bartelt et al., *Adv. Energy Materials* DOI: 10.1002/aenm.201200637

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Date submitted: 19 Nov 2012

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