Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

X-ray and neutron reflectivity and electronic properties of PCBM-poly(bromo)styrene blends and bilayers with poly(3-hexylthiophene)[1] STUART KIRSCHNER, NATHANIEL SMITH, KEVIN WEPASNICK, HOWARD KATZ, Johns Hopkins University, BRIAN KIRBY, JULIE BORCHERS, NIST Center for Neutron Research, DANIEL REICH, Johns Hopkins University — We used neutron reflectivity to complement x-ray reflectivity characterization of PCBM-based layers formed on poly(3-hexylthiophene) (P3HT). Single-layer analyses were used to provide reliable scattering length density values for bilayer fitting. Atomic force microscopy analyses showed trends similar to the reflectivity experiments when observing upper surfaces. Styrene polymers added to PCBM in small concentrations (ca. 10 percent) led to processing advantages while retaining substantial electron mobility, about 0.001 cm^2/V s. The further introduction of a relatively heavy bromo atom substituent on the styrene rings greatly increased the film smoothness, as revealed by increases of the oscillation amplitudes in the reflectivity. In addition, the bromine heavy atom increased x-ray reflectivity scattering length density of the upper layer. Finally, we confirm that P3HT is capable of extracting PCBM from a subsequently deposited overlying layer, consistent with predictions based on published phase diagrams of the P3HT-PCBM system.

[1]This research was supported in part by NSF grant ECCS-0823947.

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Date submitted: 11 Nov 2011 Electronic form version 1.4