Electronic Supplementary Material (ESI) for Journal of Materials Chemistry

SUPPLEMENTAL MATERIAL

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X-ray and neutron reflectivity and electronic properties of PCBM-poly(bromo)styrene blends and bilayers with poly(3-hexylthiophene)

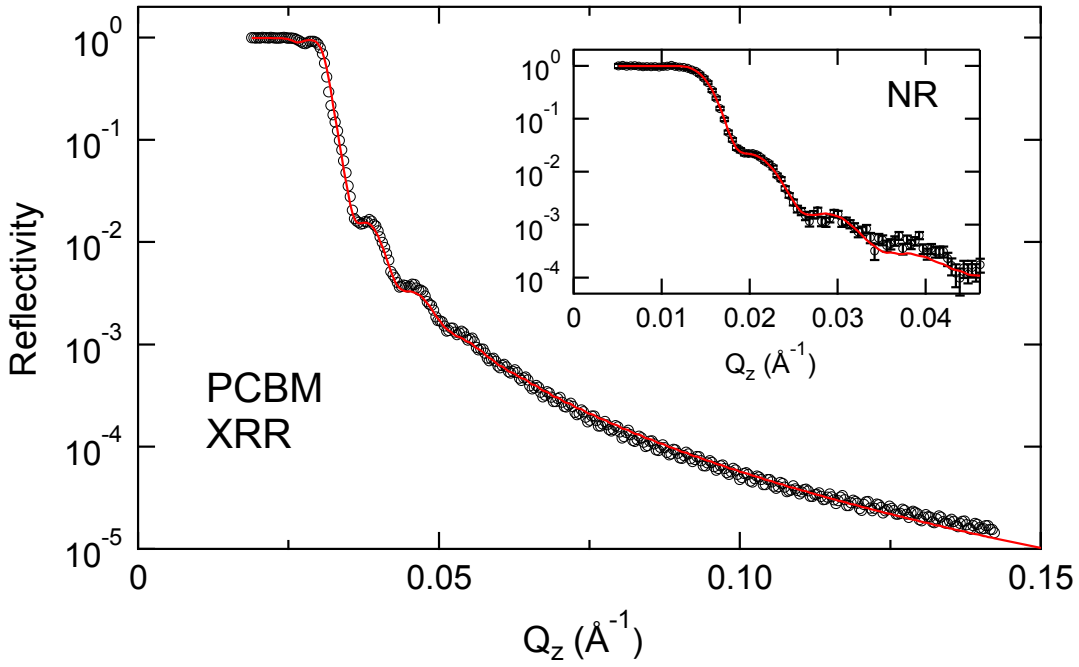

Figure S1. X-ray (XRR) and neutron (NR) reflectivity data for a PCBM film. The film was deposited on a HDMS-treated Si wafer with 300 nm SiO_2 thermal oxide by spin-coating at 3000 rpm from a 10 mg/ml PCBM solution in dichloromethane. The error bars for the XRR data are smaller than the symbol size. The solid lines are fits as described in the main text. The film had thickness 628(5) Å and surface roughness 134(5) Å, as determined from the XRR data. The x-ray and neutron scattering length densities determined for our PCBM samples from such measurements are $\rho_x = 12.7(1) \times 10^{-6}$ Å^{-2} and $\rho_n = 4.3(1) \times 10^{-6}$ Å^{-2}, respectively, in comparison to the calculated values $\rho_x = 12.9 \times 10^{-6}$ Å^{-2} and $\rho_n = 4.34 \times 10^{-6}$ Å^{-2} based on the bulk density of ~1.5g/cm^3 of PCBM.[24]

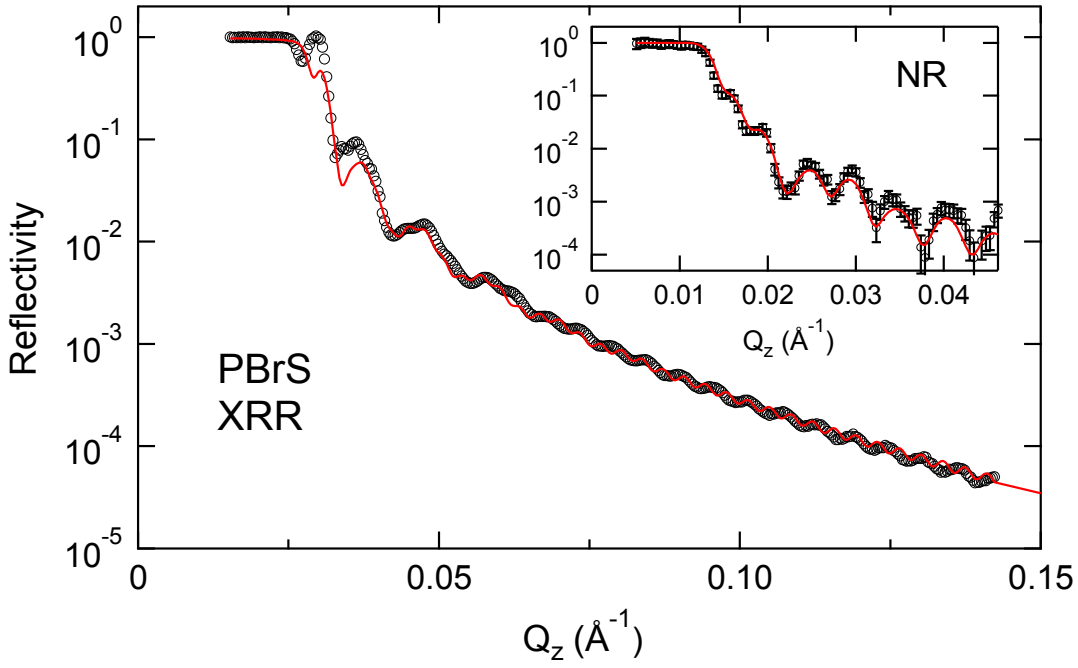

Figure S2. X-ray (XRR) and neutron (NR) reflectivity data for a PBrS film. The film was deposited on a HDMS-treated Si wafer with 100 nm SiO_2 thermal oxide by spin-coating at 1000 rpm from a 5 mg/ml PCBM solution in dichloromethane. The error bars for the XRR data are smaller than the symbol size. The solid lines are fits as described in the main text. The film had thickness 486 Å and surface roughness 13 Å, as determined from the XRR data. The x-ray and neutron scattering length densities determined for such samples from such measurements are $\rho_x = 14.9(1)\text{x}10^{-6}$ Å^{-2} and $\rho_n = 2.0(2)\text{x}10^{-6}$ Å^{-2}, respectively, in comparison to the calculated values $\rho_x = 15.3\text{x}10^{-6}$ Å^{-2} and $\rho_n = 2.05\text{x}10^{-6}$ Å^{-2} based on the bulk density of 1.87g/cm^3 of PBrS.

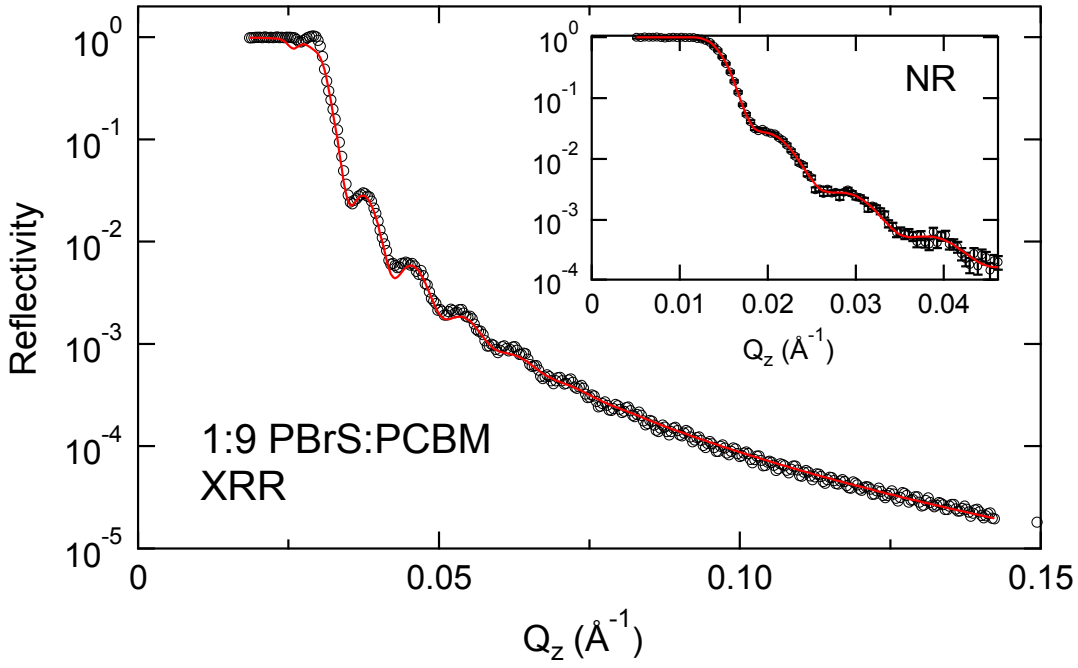

Figure S3. X-ray (XRR) and neutron (NR) reflectivity data for a 1:9 PBrS:PCBM film. The film was deposited on a HDMS-treated Si wafer with 300 nm SiO_2 thermal oxide by spin-coating at 4000 rpm from a 10 mg/ml PCBM solution in dichloromethane. The error bars for the XRR data are smaller than the symbol size. The solid lines are fits as described in the main text. The film had thickness 647 Å and surface roughness 107 Å, as determined from the XRR data. The neutron SLD for this sample was $\rho_n = 4.0(1)\text{x}10^{-6}$ Å^{-2}. The x-ray SLD for the fit shown was $\rho_x = 11.8\text{x}10^{-6}$ Å^{-2}. However, while it describes the full range of data reasonably well, this fit does not adequately model the data near the critical angle. Fits over a more restricted Q_z range ($Q_z < 0.04$ Å^{-1}) that may be more sensitive to ρ_x gave $\rho_x = 12.9\text{x}10^{-6}$ Å^{-2} , and so we report the average of these numbers $\rho_x = 12.4(6)\text{x}10^{-6}$ Å^{-2}.

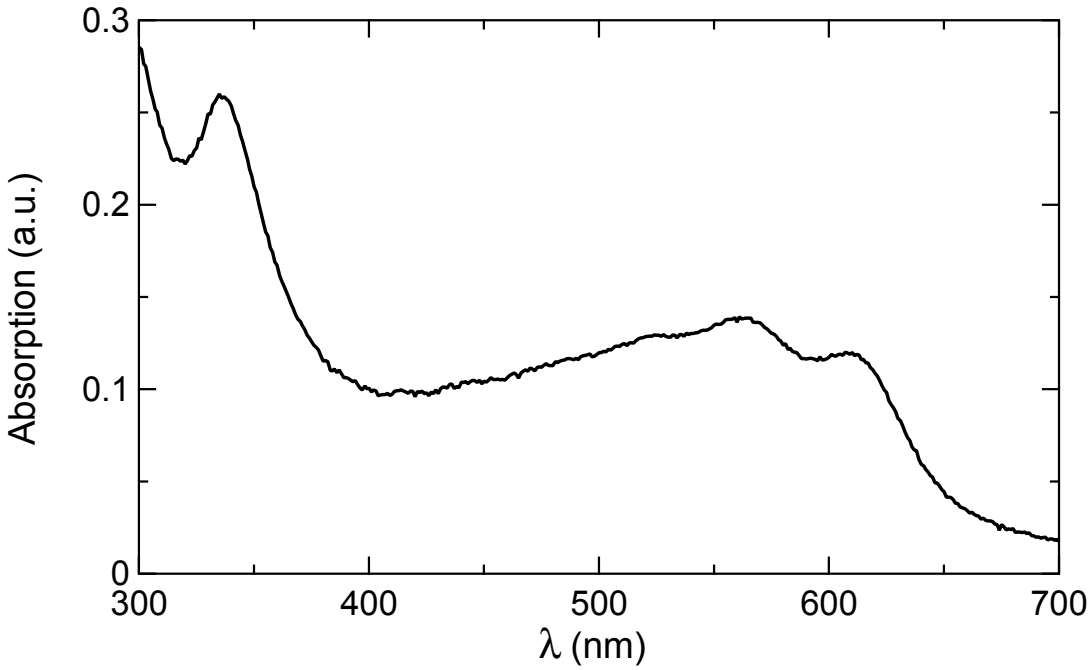

Figure S4. Ultraviolet-visible (UV-vis) absorption data vs. wavelength λ for a sample with PCBM spin-coated from dichloromethane on top of a P3HT layer. The characteristic absorption features for P3HT at λ = 525, 566, and 610 nm show that P3HT crystallinity is preserved (See: T.C. Monson *et al., Adv. Mater.,* 2008, **20**, 4755-4759). The peak near λ = 340 nm indicates the presence of PCBM, (See: G. Li *et al., J. Appl. Phys.,* 2005, **98**, 043704; L. Valentini *et al., Chem. Mater.,* 2008, **20,** 32-34) demonstrating that PCBM can be spin-coated on top of P3HT.

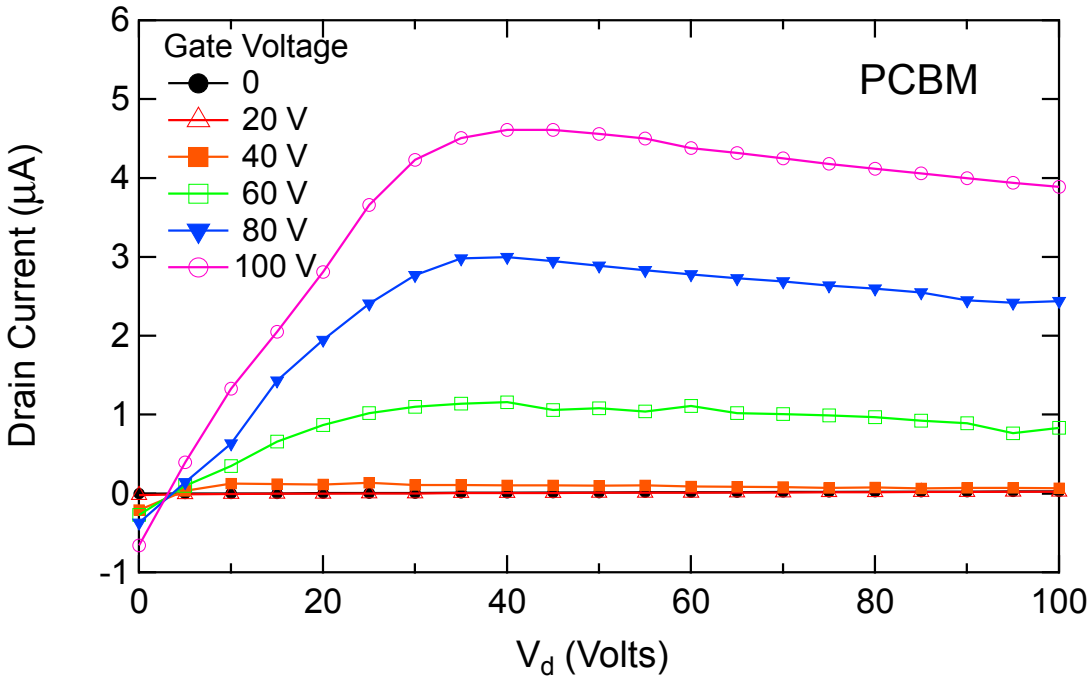

Figure S5. Drain current I_d vs. drain voltage V_d at fixed gate voltage V_g for an FET made from a pure PCBM layer. Such devices gave mobilities in the 10^{-3} to 10^{-2} cm^2/Vs range.