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Correlation of interfacial width with device characteristics in all-polymer thin film transistors based on P(NDI2OD-T2) HONGPING YAN, NCSU, TORBEN SCHUETTFORT, Cambridge, CHRISTOPHER MCNEILL, Monash Univ, HARALD ADE, NCSU — The interface between a conjugated polymer and a dielectric is critical to the performance of an organic thin-film transistor device, since charge transport occurs essentially along a 1 nm deep accumulation layer in the semiconducting polymer at the interface with the dielectric. Utilizing resonant soft x-ray reflectivity, we measure the interfacial widths of poly([N,N'-bis(2- octyldodecyl)- 11 naphthalene- 1,4,5,8- bis(dicarboximide)-2,6-diyl]-alt- 5,5'-(2,2'-12 bithiophene)) and differentially cast dielectric layers of polystyrene (PS), poly(methyl methacrylate) (PMMA) or CYTOP, respectively. We demonstrate that devices with PMMA as the dielectric layer show the sharpest interface, whereas CYTOP has the largest. The measured widths correlate with the onset voltages of the thin-film transistor devices and anticorrelate with the activation energies in these three systems. A comparison to the surface roughness prior to differential casting furthermore indicates that deposition of the top dielectric layer affects the thus-formed interfaces to a different extent for various dielectric materials. Overall, the results suggest that further control of the interfacial properties during fabrication is required for ultimate performance.

Hongping Yan
NCSU

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