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Confinement effects on P3HT-PCBM Morphology for Bulk Hetero-Junction Polymer Solar Cells[1] ABUL HUQ, Department of Polymer Engineering, The University of Akron, DHARMARAJ RAGHAVAN, Departemnt of Chemistry, Howard University, JOLANTA MARSZALEK, Department of Polymer Engineering, The University of Akron, DAVID BUCKNALL, Materials Science and Engineering, Georgia Institute of Technology, ALAMGIR KARIM, Department of Polymer Engineering, The University of Akron — Controlling morphology of the bulk hetero-junction in solar cell development is the key aspect for higher efficiency. We controlled the morphologies of phenyl-C61-butyric acid methyl ester (PCBM) and poly(3-hexylthiophene) (P3HT) blend thin films by tunable surface energy polydimethylsiloxane (PDMS) elastomer confinement. The advantages of replacing air-polymer interface with PDMS-polymer interface are its flexibility, easy detachability, facile tunability of surface energy by UVO exposure. We hypothesize that the confined annealing will suppress PCBM crystallinity, control crystallinity of P3HT, direct the vertical segregation of PCHT-PCBM blend, and thus influence the composition distribution of P3HT and PCBM at the interfaces. The annealed films were characterized by dark field optical microscopy, GISAXS, GIWAXS, AFM, and SANS. PCBM crystallization was indeed suppressed in the films during confinement annealing. On the other hand the phase separated interpenetrating network and favorable crystallinity of the P3HT evolved. The optimum surface energy of the confining PDMS yields the best structural features of the film. The morphology developed under different PDMS surfaces is an important step towards improvement of efficiency of OPV's.

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