

Abstract Submitted
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Nanostructure Control of P3HT:PCBM Bulk Hetero-junction Polymer Solar Cells¹ J. SEOK, E. GANN, C.M. BALIK, H. ADE, NCSU, B. OCKO, X. LU, H. HLAING, BNL — Highly regioregular Poly(3-hexyl thiophene) (P3HT) and [6,6]-phenyl-C61-butyric acid methyl ester (PCBM) are a widely used model system for Bulk hetero-junction (BHJ) solar cells. For optimized P3HT:PCBM BHJ solar cells, not only is a small domain size on the order to the exciton diffusion length ($\sim 10\text{nm}$) required, but the orientation of P3HT crystallites should be optimized as well. Small domains result in effective charge separation and minimize charge recombination at the interface between P3HT and PCBM. Additionally, face-on crystalline orientation of P3HT in which the $\pi - \pi$ stacking direction is parallel to the electric field enhances the hole charge carrier mobility. We are presenting a new strategy to achieve somewhat increased face-on P3HT crystalline orientation and smaller domain size in P3HT/PCBM BHJ solar cells than what is readily achievable with thermal annealing alone. This improved nanostructure control is achieved by in-situ polymerization of 2,5-dibromothiophene present in the thin films after short vapor annealing. Improvements in power conversion efficiency of approx. 30% relative to thermal annealing alone were achieved.

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