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Directed alignment of conjugated polymers for enhanced long-range photocurrent collection ANTON LI, DAVID BILBY, BAN DONG, JIN-SANG KIM, PETER GREEN, Univ of Michigan - Ann Arbor — To realize the full potential of conjugated polymers, possessing anisotropic structure and properties, it is often desirable to extend their organization to larger length scales. An epitaxy-directing solvent additive 1,3,5-trichlorobenzene was combined with an off-center spin-casting technique to produce poly(3-hexylthiophene) (P3HT) fibers with uniaxial in-plane alignment on the centimeter scale, which were incorporated into planar heterojunction solar cells with PCBM acceptor. Topography and photocurrent were mapped by photoconductive AFM; in devices with aligned P3HT, local photocurrent measured on fibers was over 4 times higher than in control devices with unaligned polymer. Even at large distances (>200 μm) between laser spot (carrier excitation) and conductive probe (charge extraction), significant long-range photocurrent was measured in the aligned devices, especially when the separation was oriented parallel to the fiber alignment. Complementary TFT measurements of neat P3HT fibers revealed that the anisotropy of in-plane carrier mobilities was greater than a factor of 3. Together, these findings highlight the importance of conjugated polymer alignment for improving carrier transport and ultimately the performance of solar cells and other devices.

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