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Donor-acceptor block copolymer self-assembly in polymer-based photovoltaics MICHAEL A. BRADY, SUNG-YU KU, JUSTIN E. COCHRAN, NEIL D. TREAT, CRAIG J. HAWKER, MICHAEL L. CHABINYC, EDWARD J. KRAMER, University of California, Santa Barbara — Polymer-based photovoltaics represent potentially low-cost, solution-processable devices for achieving sustainable energy generation. The optimal polymer-fullerene bulk heterojunction photovoltaic relies on a phase-separated microstructure in which domains of each component exist to allow for exciton dissociation at the interface and transport of each free electron (hole) through the n-type (p-type) domain to the cathode (anode). Due to the kinetically trapped, complex microstructure and phase-impure domains formed in this multi-component system, the development of a single-component material with pure n- and p-type domains is of great interest. Here we explore the microstructural evolution of a diblock copolymer of donor and acceptor segments, P3HT-b-DPP, due to various thermal treatments. Atomic force microscopy (AFM), resonant soft X-ray scattering (RSoXS), and grazing incidence wide-angle X-ray scattering (GIWAXS) are exploited to demonstrate that thermal treatments above the melting transition of each segment lead to an ordered domain structure containing both types of crystals. The effect of cooling rate from the melt on domain size and crystalline structure within those domains is investigated.

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