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**Printing Polymer Semiconductors with Controlled Crystal Orientations** NIKHILA MAHADEVAPURAM, DAVID SHAKARISAZ, SUCHANUN MOUNGTHAI, PAUL RUCHHOEFT, GILA STEIN, University of Houston — Solar energy is considered to be an alternate promising source of clean energy. Polymer-based solar cells have low manufacturing costs and these devices can be fabricated in light weight, flexible and durable modules. The most widely studied active layer in polymer-based solar cells is the bulk heterojunction (BHJ) design. BHJs are formed by arresting the phase separation of a polymer/fullerene blend and producing an interpenetrating network that provides a large interfacial area for charge separation. However, the non-equilibrium BHJ structure makes it difficult to understand the fundamental structure-property relations. We report a simple approach to control the active layer morphology by direct patterning of $\pi$-conjugated polymers into nanostructures or microstructures.[1] We studied polymer crystallinity in patterned poly(3-hexylthiophene) (P3HT) films as a function of developing solvent using grazing incidence wide angle X-ray scattering. It was observed that the $\pi - \pi$ stacking of patterned P3HT domains can be changed from edge-on to face-on orientation by varying the developing solvent. This change in orientation improves the power-conversion efficiency by nearly a factor 2.

[1] Moungthai and Mahadevapuram et al, ACS Appl. Mater. Interfaces, 2012.

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