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Effects of Side Chains on the Self-Assembly and Photovoltaic Properties of Conjugated Polymer Semiconductors SAMSON JENEKHE, University of Washington — Conjugated polymer semiconductors are of growing interest in electronics and optoelectronics. Although it is now well established that the electronic band structure, charge transport, and electronic properties of conjugated polymers can be varied over a wide range through manipulation of the molecular backbone structure, little is known about the effects of alkyl side chains on the solid state morphology and properties of these materials. We have investigated homologous series of conjugated homopolymers, block copolymers, and random copolymers with controlled variation of their alkyl sides towards understanding the effects the size and typology of the side chains on self-assembly, morphology, and photovoltaic properties. We found that diblock copoly(3-alkylthiophenes) exhibit highly crystalline and phase-separated nanostructures in blend films with fullerene derivatives, resulting in superior photovoltaic properties compared to the corresponding homopolymers. The solid state morphology and photovoltaic efficiency of a series of donor-acceptor copolymer semiconductors that have the same optical band gap but different alkyl side chains were found to vary dramatically. Self-assembled block copolymer nanowires with widths of 10-30 nm and aspect ratios of up to 900 have been found to be promising building blocks for constructing efficient bulk heterojunction solar cells.

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