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Conjugated backbone orientation variation in high mobility regioregular PT based copolymers LOUIS PEREZ, LEI YING, GUILLERMO BAZAN, EDWARD KRAMER, University of California - Santa Barbara — The synthesis of novel solution processable conjugated polymers is an active field of study due to the potential to fabricate low cost, high though-put electronic devices such as organic field effect transistors (OFET). A regioregular copolymer based on cyclopenta[2,1-*b*:3,4-*b*′]dithiophene (CDT) and pyridal[2,1,3]thiadiazole (PT) structural units has been prepared by using polymerization reactions involving reactants specifically designed to avoid random orientation of the asymmetric PT heterocycle. Compared to it's regiorandom counterpart, the regioregular polymer exhibits a two orders of magnitude increase in hole mobility from 0.005 to 0.6 $\mathrm{cm}^2\,\mathrm{V}^{-1}\,\mathrm{s}^{-1}$. A combination of X-ray scattering techniques were employed to quantitatively access the degree of orientation and crystallinity in thin films (15-20 nm) that matched device architecture. We examined the backbone orientation dependence as a function of depth via grazing incidence wide angle X-ray scattering (GIWAXS) and found significant differences in the backbone stacking orientation between the regiorandom and regioregular copolymers. These experiments suggest the backbone regularity leads to significant differences in the structural arrangement and it is another important design criteria to consider in the design of new conjugated copolymers with asymmetric structural units.

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