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Manipulating the backbone structure of semiconducting polymers

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Pi-Conjugated polymers are being used in the fabrication of a wide variety of organic electronic devices such as organic field-effect transistors (OFETs), organic photovoltaic (OPV) devices, and organic light-emitting diodes (OLEDs). The advances made in organic electronics have been driven by the syntheses of pi-conjugated polymers with increasingly complex structures but have heavily relied on an Edisonian approach. Despite these advances, there are many contradictory reports in the literature about our understanding of the performance of π-conjugated polymers in many applications. Our group has been studying and developing techniques to grow semiconducting polymers using a living polymerization method. This has allowed us to synthesize polymer architectures that we haven't been able to access till now including polythiophene brushes, star-shaped P3HT, as well as hyperbranched P3HT. It also allows us to accurately control the molecular weights of P3HT and produce materials with a narrow molecular weight distribution. In this presentation, our work towards creating brush polymers will be presented where a series of fully conjugated graft copolymers containing poly(3-hexylthiophene) (P3HT) side chains and a p-type carbazole-diketopyrrolopyrrole donor–acceptor backbone were synthesized via a graft through Suzuki polymerization.