Semiaromatic Polyamides Comprising Bithiophene Segments

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Materials often feature varying degrees of structural order, which plays a key role in determining their macroscopic properties. Approaches to control the balance between short-range order and overall disorder are also relevant for developing mechanically durable polymer semiconductors. In this context, we designed polyamides comprising semiconducting segments, with the aim to exploit hydrogen bonding and the nanoscale crystalline features (Figure 1) of polyamides to control short-range order and macroscopic transport properties. To this end, we developed a three-step, gram scale synthesis of a bithiophene dibutyric acid monomer. Seven polyamides with different diamines (**PA*n*T2)** were synthesized by solution-phase polycondensation using Yamazaki-Higashi conditions. All polymers had distinct melting and crystallization behavior depending on the length of the diamine, showing an odd even effect. The resulting polyamides can be melt-processed, providing uniform films with instrumented moduli of 1.5–2.9 GPa, that are comparable to the industrial-grade polyamides. Furthermore they exhibited promising conductive properties, yielded a mobility of about 0.018 cm^2/Vs for **PA6T2** and **PA12T2**, one magnitude higher than other bithiophene derivatives, similar to the oligothiophenes, as studied by pulse-radiolysis time-resolved microwave conductivity (PR-TRMC).

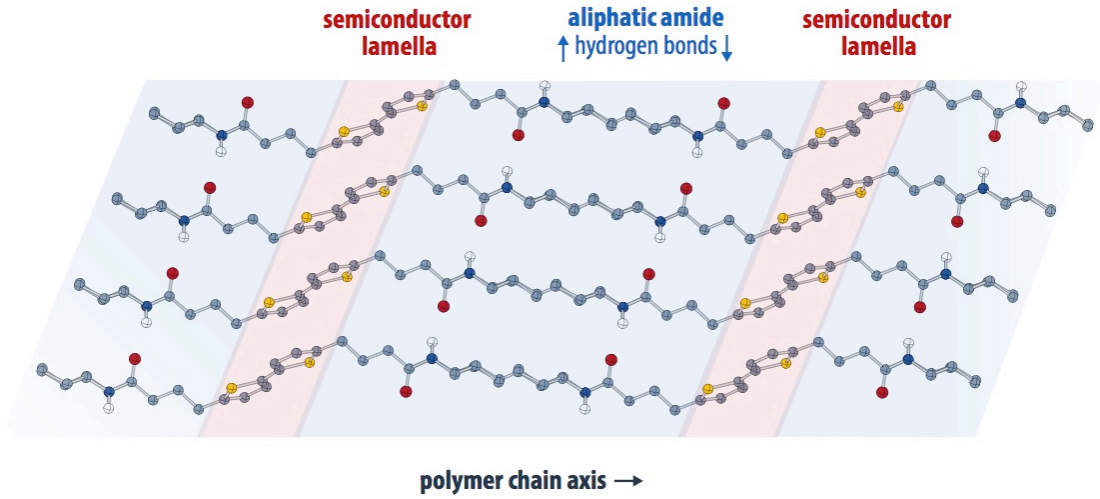

Figure 1. Schematic illustration of the expected lamellar structures in polyamides comprising bithiophene segments in the solid state.