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Spectroscopy of single conjugated polymers and aggregates

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A comprehensive understanding about the structure-photophysics correlations in conjugated polymers (CPs) is crucial for its development in optoelectronics. Unfortunately, this has remained elusive to date largely due to the macroscopic heterogeneity in both structural and photophysical properties of polymer materials. With single molecule/aggregate spectroscopy, we performed a systematic examination on the relationship between structure and important photophysical properties from single polymer chain up to bulk state. Single polymer chain conformation was studied using polarization spectroscopy to examine how side-chains affect folding of the polymers. The effects of this folding are then correlated with differences in both single molecule spectra as well as transient "blinking". Single molecules and aggregates of a variety of polythiophenes were examined. Tunable interchain morphologies, i.e., packing order and distance, were achieved through altering the regioregularity, size of side-chains, and backbone alterations. It was noted that the polymers switched between either dominant interchain coupling or intrachain coupling based on their planarity and packing distance.

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