Tuning Molecular Fluorescence via Polymerization-Mediated Charge Transfer

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Tuning emission color of molecular fluorophores is of fundamental interest as it directly reflects the manipulation of excited states at the quantum-mechanical level.[1] However, owing to the complex interplay between the charge-transfer and singlet excitons, it is highly challenging to obtain multicolor emission from a single fluorophore in solid state.[2] In current study, we report a general strategy for tuning emission color from a single fluorophore by controlled radical polymerization-mediated charge transfer. Using a library of well-defined donor (D) polymers grown from an acceptor (A) fluorophore by atom transfer radical polymerization, we reveal their solid-state emission color can be efficiently tuned by precision macromolecular engineering, including: (i) varying monomer substituent, (ii) transforming end groups, and (iii) tailoring polymer chain length. Both experiments and multiscale modelling confirm that the color tunability originates from the structurally dependent through-space charge transfer (TSCT) process that regulates the CT energy. Thanks to the simple chemical composition, we further demonstrate that such polymer systems can be processed into thin films enabling versatile photolithography.

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Reference

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