Light-Harvesting and Charge Separation in a π-Conjugated Antenna Polymer Bound to TiO_2

Meyer

Scientific Achievement

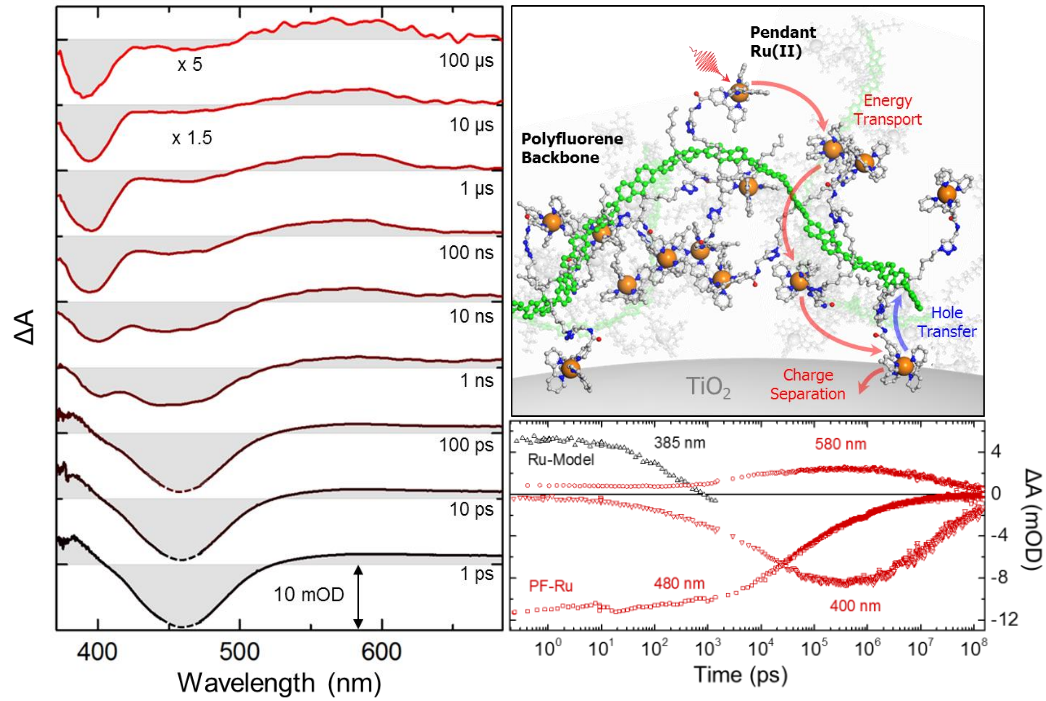
Multifunctional polymer-based molecular assembly capable of light-harvesting, charge-separation, and charge storage

Significance and Impact

The design of molecular assemblies to enable effective transfer of excitation energy to charge-separation sites, while hole transfer away from the surface for use in multielectron catalysis for solar fuels production.

Research Details

- **Functionalization of ~30% of the pendant Ru(II) sites enables site binding to metal oxide surface.**
- **Excitation of surface-bound sites results in prompt (ps) electron injection into TiO_2 nanoparticle, followed by ultrafast hole transfer to the backbone.**
- **Energy transport from unbound sites to surface sites for charge separation occurs on longer time scales.**
- **Charge separated state persists for hundreds of microseconds**



(Left) Transient absorption spectra of a PF-Ru-loaded TiO_2 film following excitation at 450 nm from 1 ps to 100 μs. The 10 and 100 μs spectra have been scaled for clarity, while regions containing scatter from the 450 nm pump have been marked with a dashed line.

(Upper right) Illustration of the initial dynamic processes occurring following the excitation of the Ru(II) pendants within the PF-Ru assembly attached to the surface of a TiO2 nanoparticle.

(Lower right) Combined kinetics traces from 200 fs to 150 μs for the PF-Ru assembly (red) at 400, 480 and 580 nm and the Ru-Model (black) at 385 nm.

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