Using Photochromic Compounds to Regulate Electron Transfer Reactions in Porphyrin Assemblies

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Molecules that toggle between two distinct forms when exposed to specific external stimuli, where each form exhibits unique physical properties, are promising candidates for fabricating controllable nano-devices. Photochromic compounds exhibit reversible variations in color when stimulated by light. The scope of potential applications for photochromic materials extends far beyond those that harness only these optical changes. Applications can also utilize other structural and electronic changes that accompany the photochromic event. These include changes in topology and skeletal flexibility, changes in optical rotation and emission, and changes in redox chemistry. It is this last accompanying variation that will be the focus of the talk.

The use of two photochromic derivatives to regulate photo-induced electron transfer reactions within porphyin *supramolecular* assemblies and polymers will be highlighted. The first system takes advantage of the reversible photo-induced isomerization of substituted phenoxynaphthacenequinone derivatives (Figure 1). The two photogenerated isomers (*trans* and *ana*) of this chromophore possess significantly different reduction potentials and thus exhibit different abilities to act as the electron acceptor species within the chromophoric arrays and polymers.

The second example of regulating photoinduced electron transfer involves porphyrins covalently linked to the photochromic 1,2-dithienylcyclopentene backbone (Figure 2). Owing to the fact that the fluorescence of the macrocycles is quenched when the photochromic component is in its ring-closed form, this system has the potential to be used in digital data storage applications where a non-destructive read-out event is required. The observation that the photoinduced electron transfer process also promotes the ring-opening reaction of the 1,2-dithienylethene skeleton will be discussed.

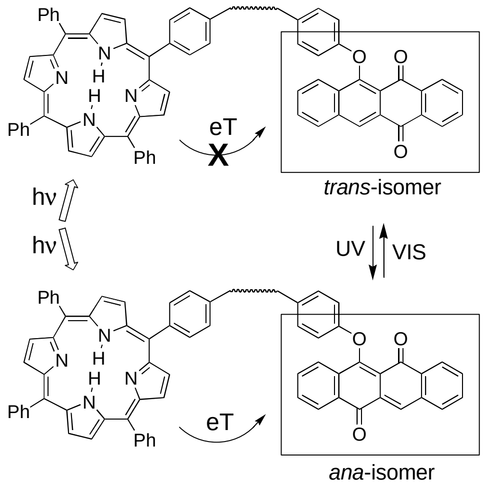
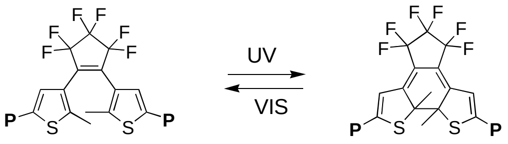


Figure 1. Regulating photoinduced electron transfer between a porphyrin and a photochromic phenoxy-naphthacenequinone derivative.



P = porphyrin

Figure 2. The photochemical ring-closing and ring-opening reactions of porphyrinic 1,2-dithienylethenes.