ELECTROCHROMIC RING-OPENING AND RING-CLOSING REACTIONS OF 1,2-DITHIENYLCYCLOPENTENES

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Photochromic 1,2-dithienylcyclopentene derivatives are highly regarded for photonic device applications due to their possessing appealing properties such as photofatigue resistance and bistability of both isomers. This photochromic system interconverts between colourless (open) and coloured (closed) isomers using appropriate wavelengths of light (see the figure). We have recently discovered a series of 1,2-dithienylcyclopentene systems that also exhibit unprecedented electrochromic behavior. Using an electrochemical stimulus, these systems undergo ring-opening and ring-closing reactions with high efficiency. When aromatic substituents (phenyl or thienyl) are introduced at the 2-positions of the thiophenes, oxidation of the closed isomers results in complete conversion back to the open forms (Figure 1). Also, this electrochemical ring-opening process is catalytic: thus only a small amount of electrical current is needed to initiate the entire conversion process to occur. Oxidation of the closed isomer using only one mole percent of a chemical oxidant completely regenerates the open isomer. This is particularly appealing for incorporation into electrochromic devices such as image displays since they will be extremely energy efficient.

Electrochemical ring-closing has also been observed for other 1,2-dithienylcyclopentene derivatives when simple dithiophene units are present in the molecular scaffold (Figure 2). Oxidation of the ring-open isomer results in cyclization to the ring-closed product. This demonstrates the versatility of dithienylcyclopentene systems for incorporation in either photochromic or electrochromic molecular scale devices. In this poster the unique electrochromic properties of several dithienylcyclopentene derivatives will be presented.

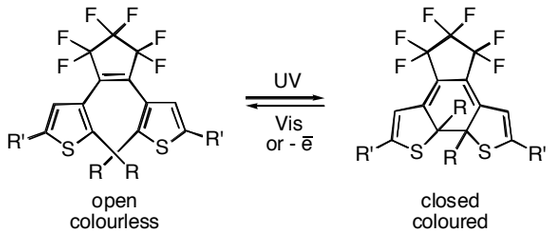

Figure 1: Oxidative electrochromic ring-opening of 1,2-dithienylcyclopentenes.

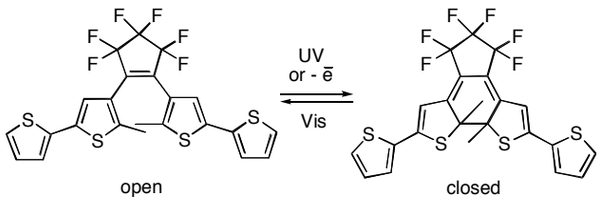

Figure 2: Oxidative electrochromic ring-closing of 1,2-dithienylcyclopentenes.