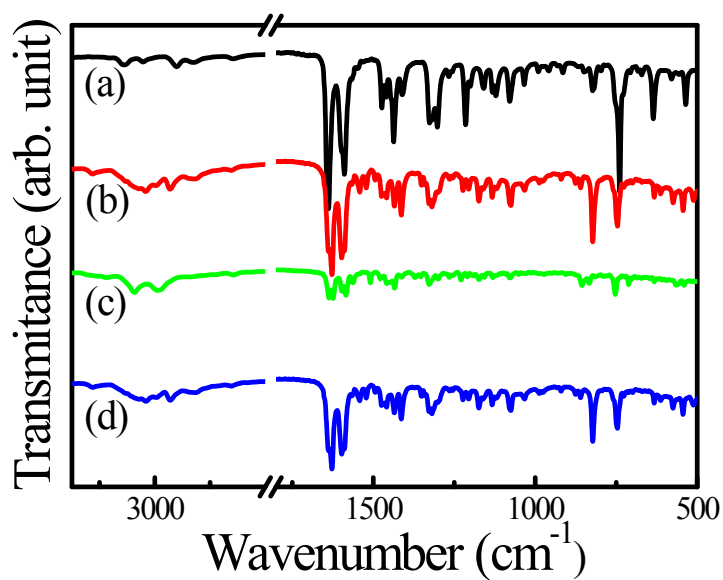
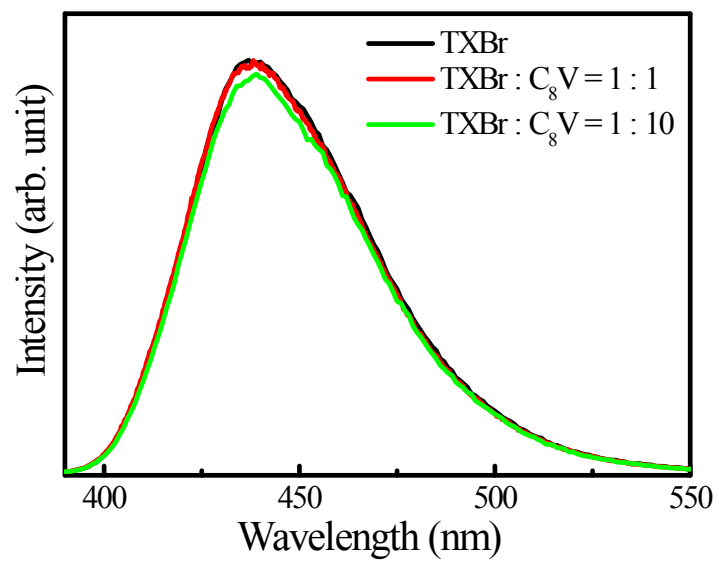


# Photophysical and Electrochemical Properties of Newly Synthesized Thioxathone-Viologen Binary Derivatives and Their Photo-/Electrochromic Displays in Ionic Liquid and Polymer Gels

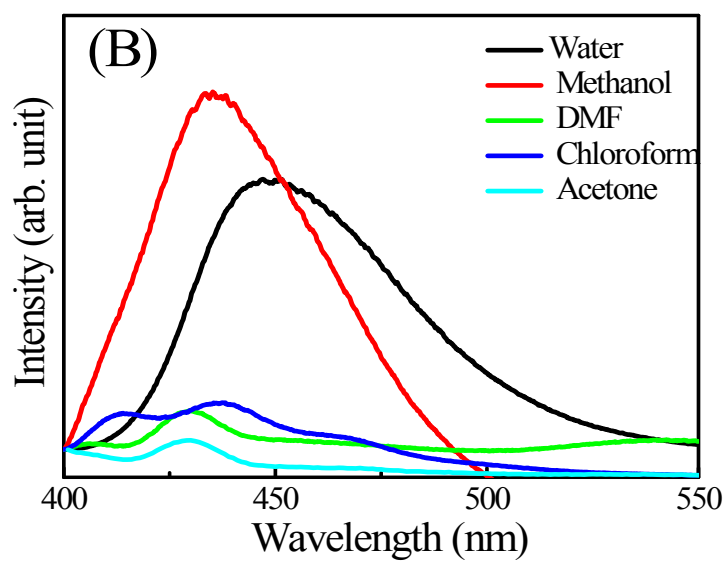
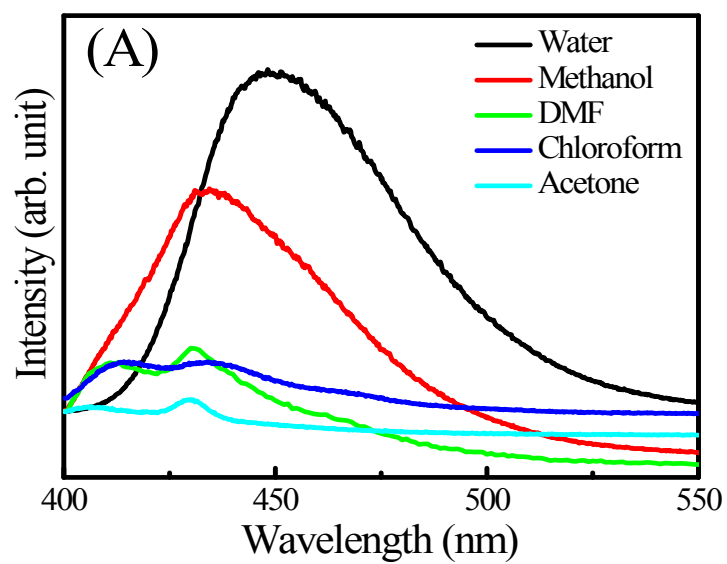
Dong-Mei Ma, Jing Wang, Hao Guo,\* Dong-Jin Qian\*



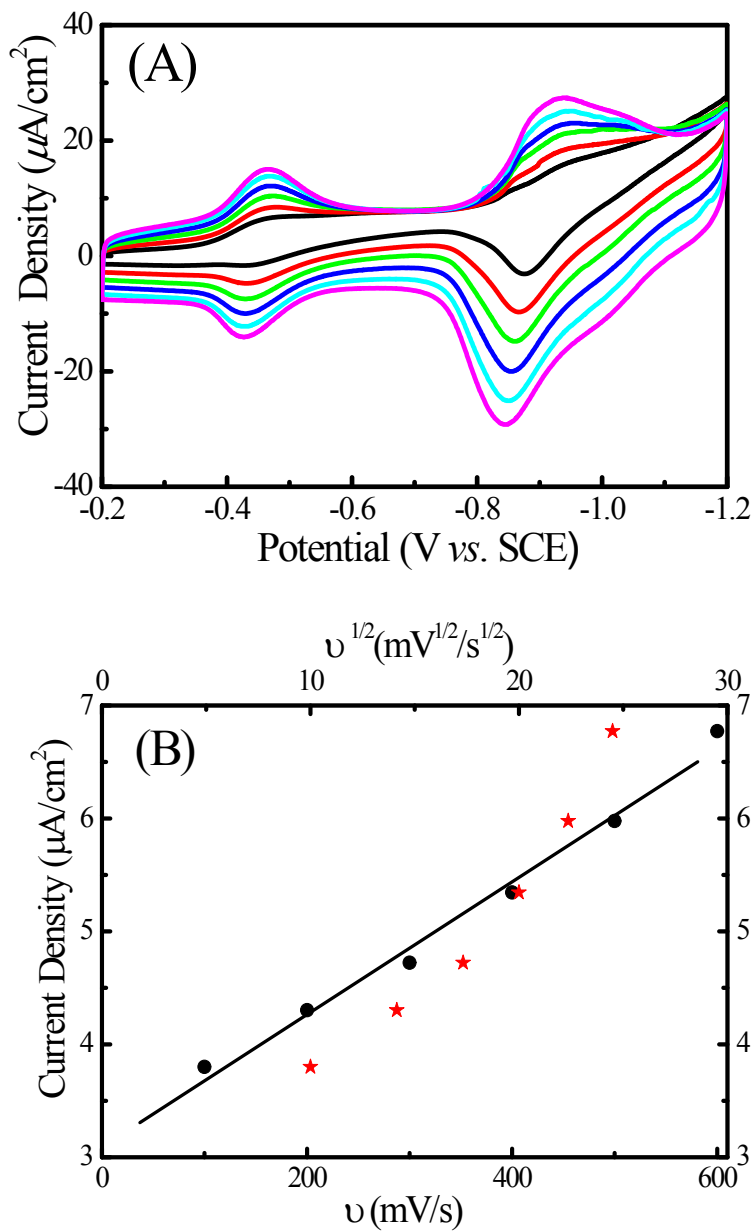
**Figure S1.** FTIR spectra of (a) TXBr, (b) TXVBPY, (c) TXVMe and (d) TX<sub>2</sub>V.



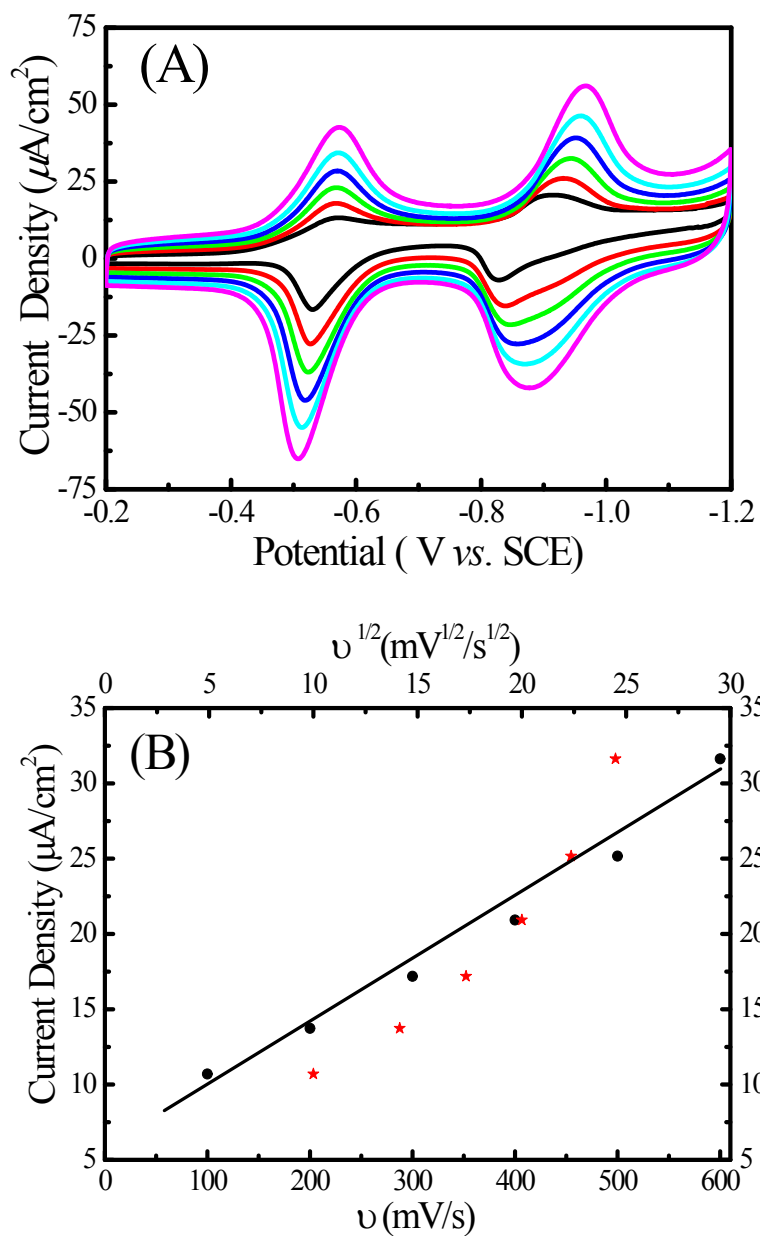
**Figure S2.** Fluorescent emission spectra for the mixtures of TXBr with octylviologen (C<sub>8</sub>V) at different molar ratios.



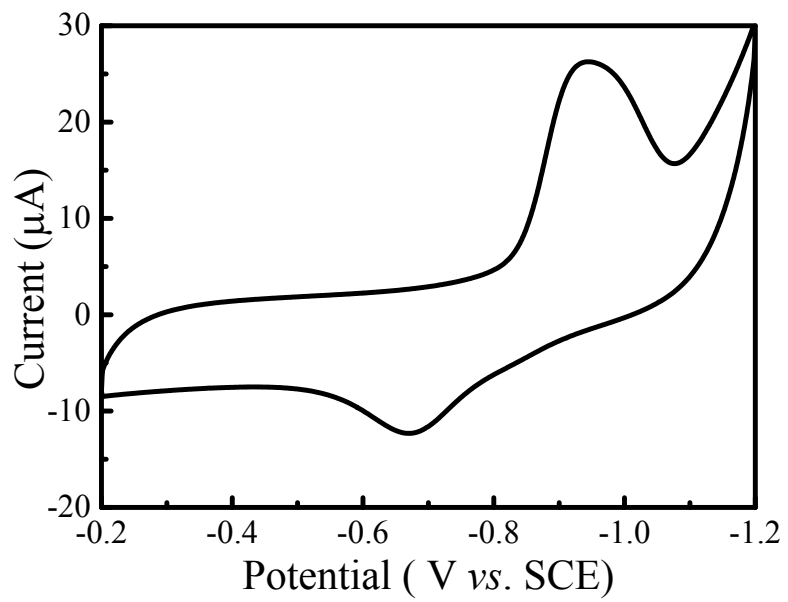
**Figure S3.** Fluorescent emission spectra for (A) TXVBPY and (B) TXVMe in different solvents.



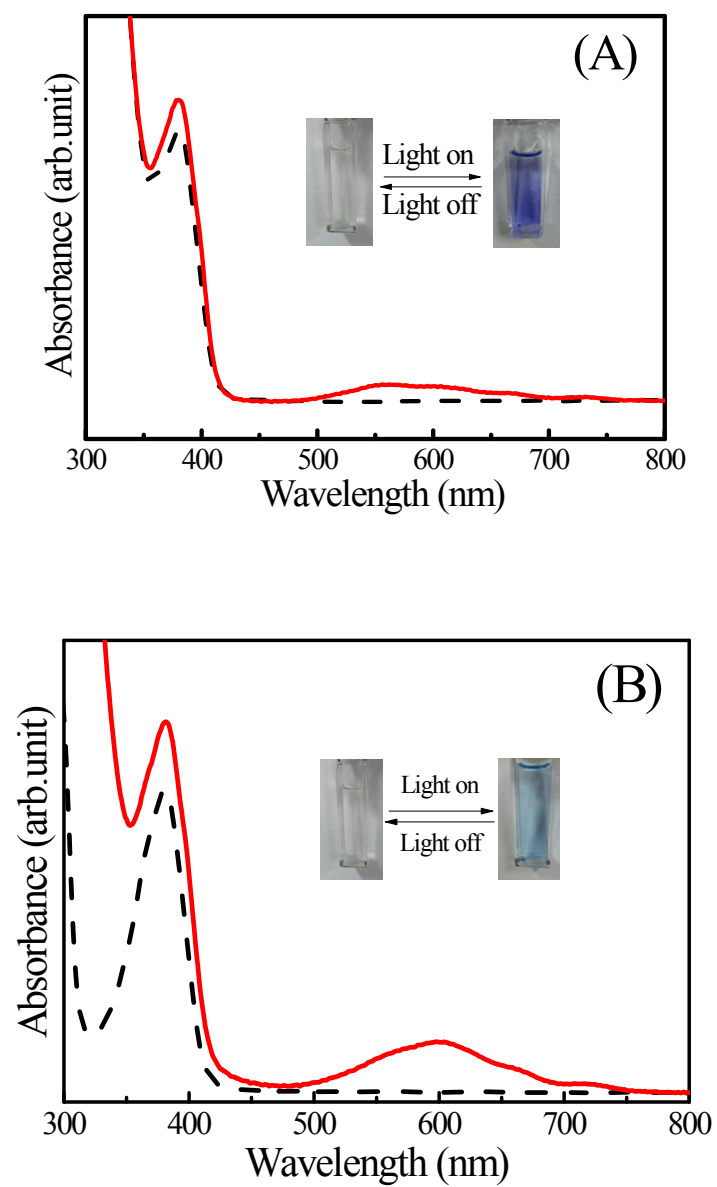
**Figure S4.** (A) CVs of GC electrode in the  $2 \times 10^{-5}$  mol/L TXVBPY, 0.05 mol/L KCl electrolyte solutions at the scan rates from 100 to 600 mV/s. (B) Plots of current intensity obtained from CVs to the scan rates (●) and the root of the scan rates (★).



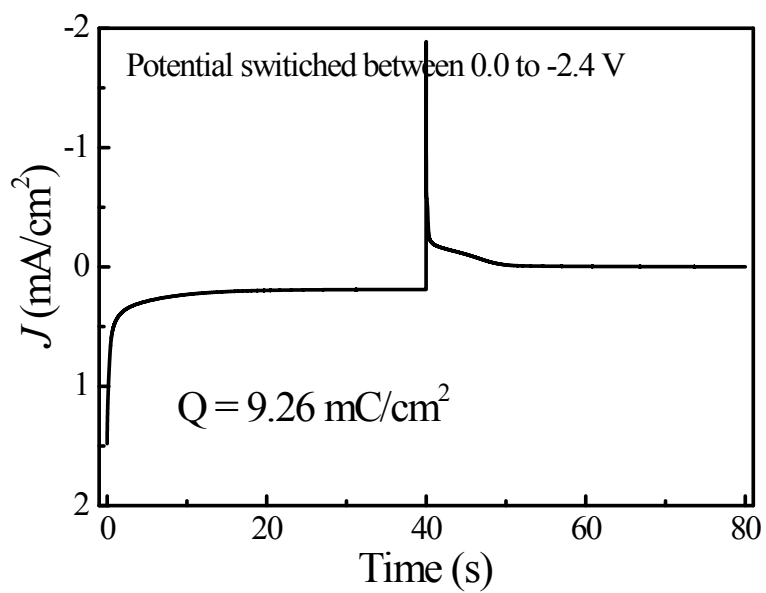
**Figure S5.** (A) CVs of GC electrode in the  $2 \times 10^{-5}$  mol/L TXVMe, 0.05 mol/L KCl electrolyte solutions at the scan rates from 100 to 600 mV/s. (B) Plots of current intensity obtained from CVs to the scan rates ( $\bullet$ ) and the root of the scan rates ( $\star$ ).



**Figure S6.** CV of ITO electrode covered by the casting film of TXBr in the 0.05 mol/L KCl electrolyte solution.

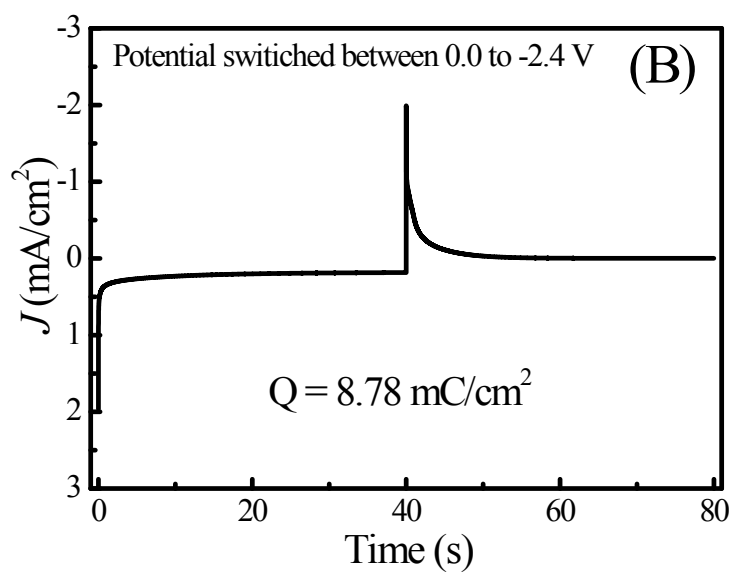
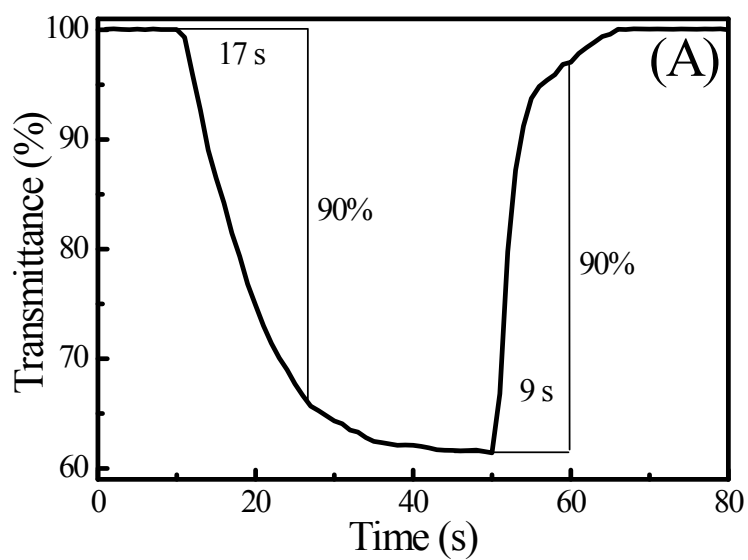


**Figure S7.** Absorption spectra for the aqueous solutions of (A) TXVBPY and (B) TXVME before (---) and after (—) radiation. Inserted: Photos of the TX-VIO solutions before and after the radiation.



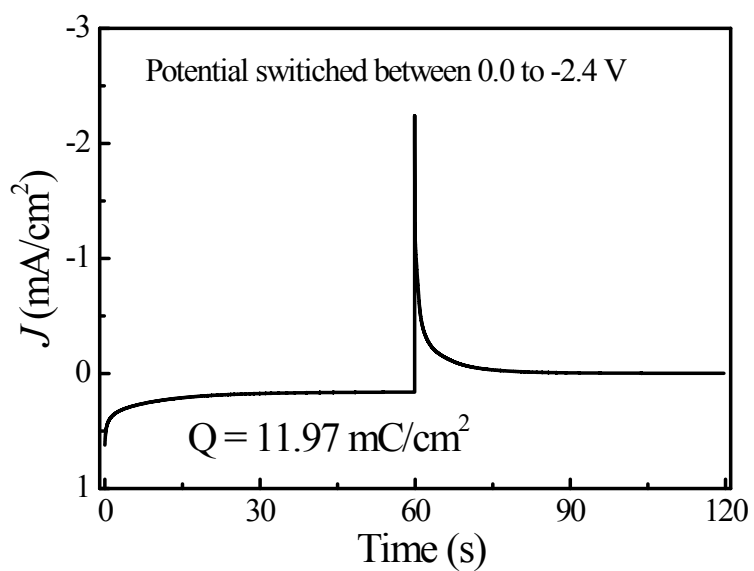
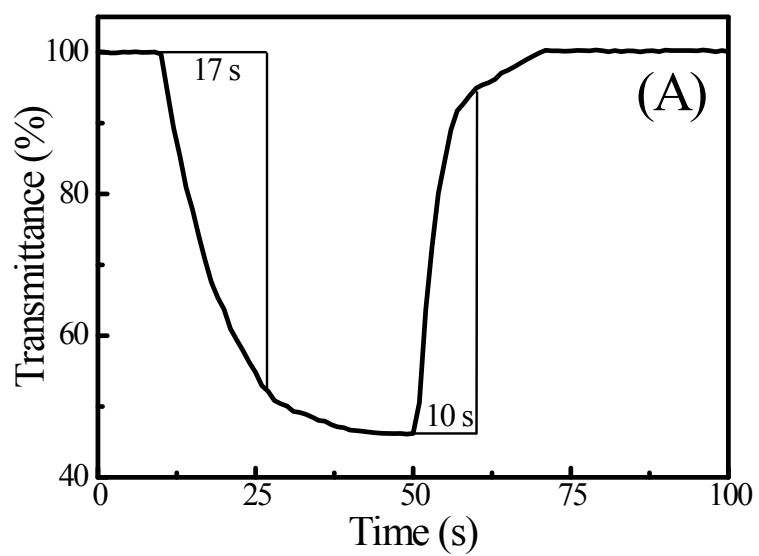
**Figure S8.** Chronoamperometry curve for the ECD of TXVMe between 0 and -2.4 V.





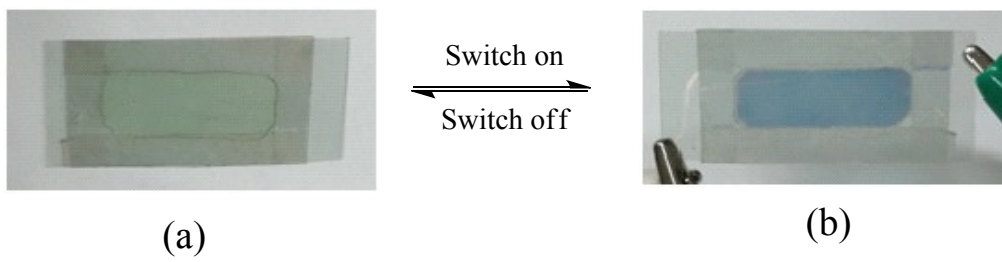
**Figure S9.** (A) Transmittance changes at 540 nm of TXVBPY ECD in the ionic liquids with a bias between 0 and -2.4 V. (B)

Chronoamperometry curve of TXVBPY ECD between 0 and -2.4 V.



**Figure S10.** (A) Transmittance changes at 540 nm of TX<sub>2</sub>V ECD in the ionic liquids with a bias between 0 and -2.4 V. (B)

Chronoamperometry curve of TX<sub>2</sub>V ECD between 0 and -2.4 V.



**Figure S11.** Photos of flexible device of TX<sub>2</sub>V in the polymeric gels.

**Table S1.** Coloration Efficiency ( $\eta$ ) and Decay of CE (%) for the TX-VIO ECDs.

Compounds	Cycling times <sup>a</sup>	$\Delta OD^b$	Q (mC/cm <sup>2</sup> ) <sup>c</sup>	$\eta$ (cm <sup>2</sup> /C) <sup>d</sup>	Decay (%) <sup>e</sup>
		540 nm		540 nm	540 nm
TXBPy	1	0.21	8.63	24	0
	100	0.19	11.44	17	41
TXVMe	1	0.17	9.87	17	0
	100	0.17	9.87	17	0
TX <sub>2</sub> V	1	0.17	10.34	16	0
	20	0.16	11.44	14	14

<sup>a</sup> Switching between 0 and -2.4 V for EC devices

<sup>b</sup> Absorbance change at 540 nm.  $\Delta OD = \log(T_b/T_c)$

<sup>c</sup> Ejected charge, determined from the in situ experiments

<sup>d</sup> Coloration efficiency,  $\eta = \Delta OD/Q$

<sup>e</sup> Decay of CE after various switching scans