Supporting Information

The Effects of Solvent on the Electrochromic Properties of Poly(3,4ethylenedioxythiophene)

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The optical switching of PEDOT in ACN, DMF and DMSO are shown in Figure S1 and the response times were summarized in table S1. Table S1 reveals that the PEDOT film in ACN can offer better response time compared with that of DMF and DMSO. The fastest response time of PEDOT in ACN is contributed from the lower viscosity (0.343 cp) than that of DMF (0.92 cp) and DMSO (1.996 cp). The lower viscosity of ACN can offer a higher ionic diffusion coefficient leading to fast redox reaction.

Sample	75%	85%	95%
de-coloring response time (s)			
ACN	1.1	1.6	1.8
DMF	1.3	1.9	2.3
DMSO	1.8	2.3	2.7
coloring response time (s)			
ACN	2.0	2.5	4.8
DMF	2.2	2.9	5.0
DMSO	2.6	3.4	5.5

Table S1. A summary of response times for the PEDOT film measured in different solvents.



Figure S1. The response times of PEDOT films in different electrolytes.

The optical switching for PEDOT between 0.3 and -0.9 V in DMSO (3.96 D), ethanol (1.69 D) and 1,2-dimethoxyethane (DME, 1.07 D)¹ is shown in Figure S2. It can be seen that the contrast of PEDOT films in DME and ethanol is 40.3 and 44.5%, respectively. The Δ %T measured in ethanol and DME is much lower than that obtained from DMSO (61.5%). After 200 cycles, an attenuation loss in transmittance of 21.9 and 13.1% for the samples measured in DME and ethanol was observed. However, for the sample tested in DMSO, the contrast loss was only 4.3%. Moreover, we also measure the conductivity of the PEDOT films treated from ethanol and DME. The measurement was performed at 40 °C. The conductivities of PEDOT treated from DME and ethanol are 2.2 S/cm and 2.4 S/cm, respectively. The results are lower than the value obtained from DMSO (9.1 S/cm, see Figure 2 in manuscript). It has been reported that the conductivity of PEDOT can be enhanced significantly by solvent treatment (such as DMSO, DMF and ethylene glycol).²⁻⁵ They conclude that the enhanced conductivity is contributed from the conformational change of PEDOT. The conformational transition of PEDOT from coil to linear structure is induced by the interaction between the dipole moment of solvent and polymer chains. The linear conformation can reduce the energy barrier for charge hopping leading to higher conductivity. Therefore, we believe the conformational change (from coil to linear structure) also can enhance the electrochromic properties. The electrochromic contrast and reversibility of ionic transfer both can be enhanced due to the linear structure.



Figure S2. In-situ transmittance response of the PEDOT during repeat potential steps switched between -0.9 V and 0.3 V in different electrolytes.

Reference

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