Supporting Information to

Infrared Electrochromic Conducting Polymer Devices

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Control measurements of the transmittance of substrate and electrolyte

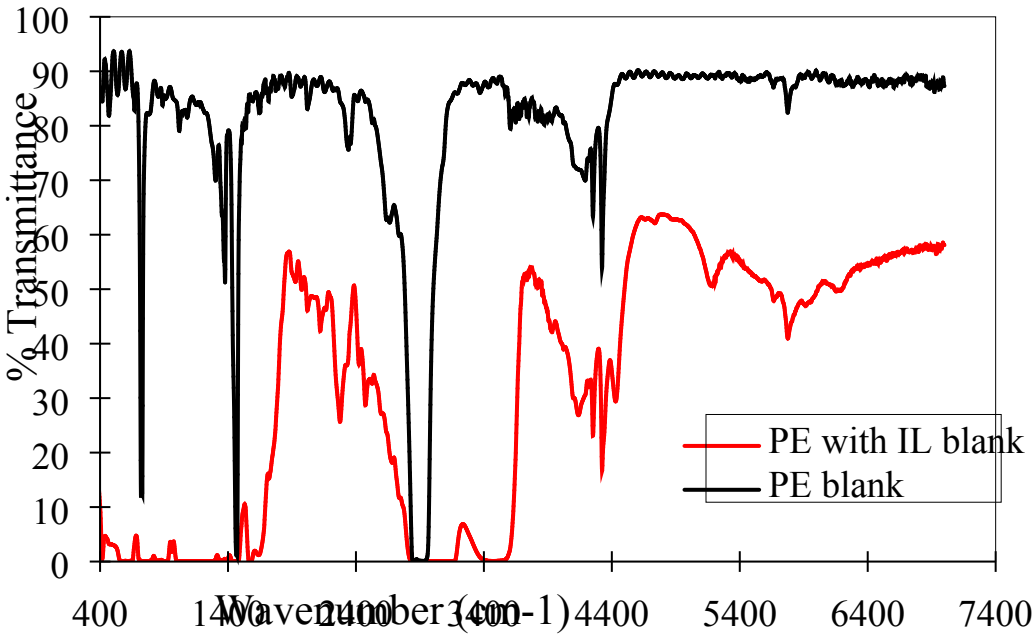

Figure SI1. FT-IR spectra of a blank PE substrate (black) and of the gel ionic liquid encapsulated between two PE substrates (red).

Thermal camera measurements

In order to obtain accurate thermal image measurements, reference materials were introduced. For this, we used a metal surface that reflects the open sky (giving a reading of -44.8 °C for the effective temperature) and a black rubber material that reflects minimally (giving an effective temperature of 7.6 °C) to provide an effective temperature scale for the measurements. A raw thermal image showing both a lateral IR electrochromic device and the reference materials can be seen in Figure SI2.

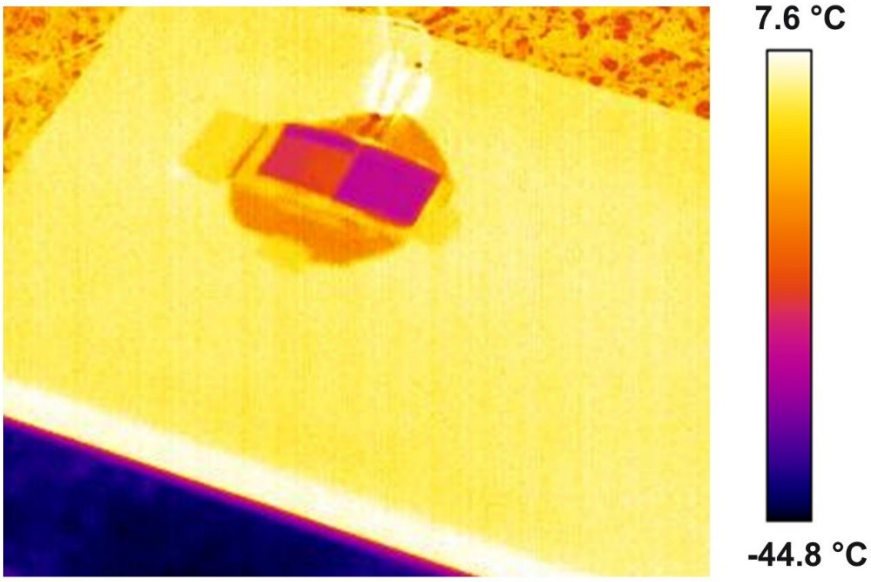

Figure SI2. Raw thermal image of a PEDOT:Tos lateral electrochromic device showing the low emissive metal (-44.8 °C, bottom part) and the high emissive black rubber (7.6 °C, support for the device)

Switching time measurements for lateral IR electrochromic device

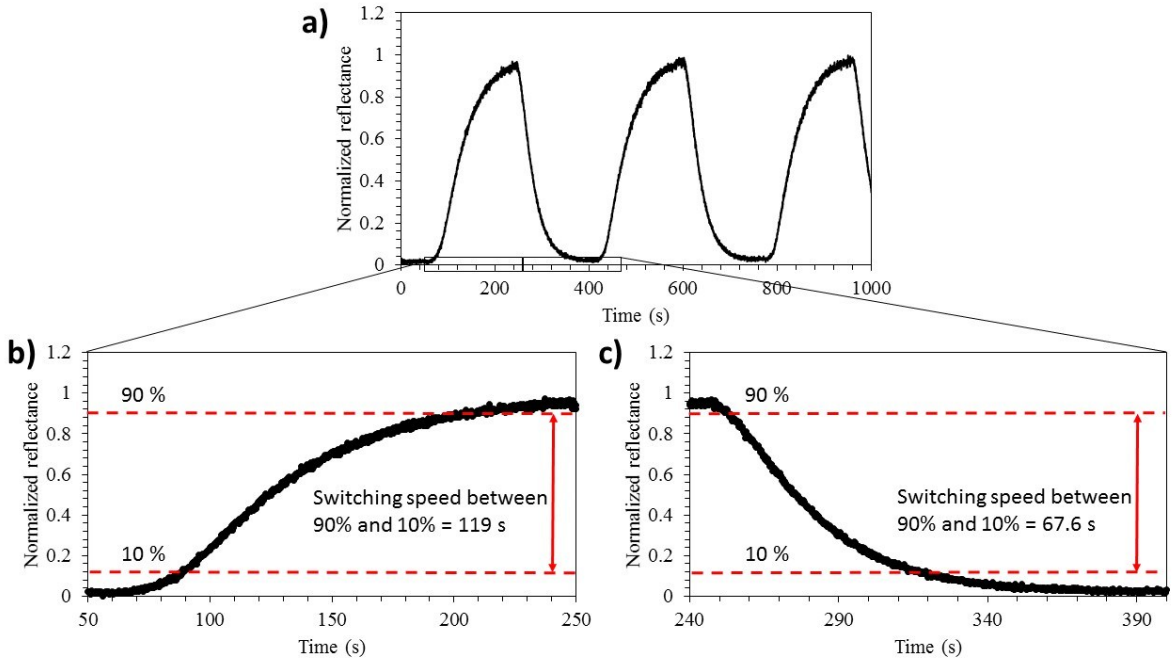

Figure SI3. Switching speed measurement of a lateral PEDOT:Tos electrochromic device, presented as the normalized reflectance at 600 nm over time. The device was switched using 1.5 V and negative 1.5 V until a full switch was observed. **a)** Multiple switches between 1.5 V and negative 1.5 V. **b)** A single switch from the reduced state to the oxidized state of the device. **c)** A single switch from the oxidized state to the reduced state of the device. The chromatographs were normalized to the maximum reflectance (1, oxidized state) and minimum reflectance (0, reduced state).

Investigation of charge and energy required for switching

Charge transfer and energy consumption upon electrochromic switching was evaluated using chronoamperometry, as detailed in the main manuscript. The table below is based on the analyzed results of Figure 4a.

Table SI1. *Charge and energy consumption for the PEDOT:Tos vertical electrochromic device, as measured by chronoamperometry. Conditioning potential (0 V) was applied for 10 seconds followed by cycles of 1.5 V for 60 seconds and -1.5 V for 60 s.*

Time (sec)	*Switch*	*Charge (mC)*	*Energy (J)*	*Energy (J/m²)*
60-120	'on'	26	0.039	15.6
120-180	'off'	29	0.044	17.6
180-240	'on'	26	0.039	15.6
240-300	'off'	29	0.044	17.6
300-360	'on'	26	0.039	15.6
360-420	'off'	29	0.044	17.6
420-480	'on'	26	0.039	15.6
480-540	'off'	29	0.044	17.6
540-600	'on'	26	0.039	15.6
Average:		**27**	**0.041**	**16.5**

Additional optical memory investigation

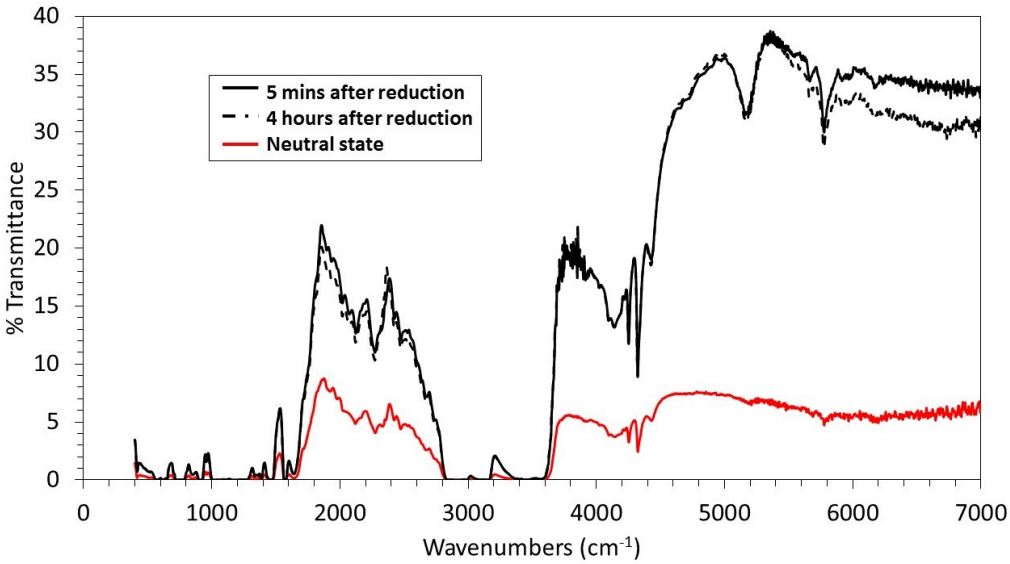

Figure SI4. Optical memory investigation in the IR region for a lateral PEDOT:Tos electrochromic device. The spectra were obtained in the neutral 0 V state (red), 5 minutes after reduction (black full ine) and 4 hours after reduction and disconnection from the power supply (black dashed line), showing minimal relaxation towards the neutral state.

Switching speed measurements for vertical IR electrochromic device

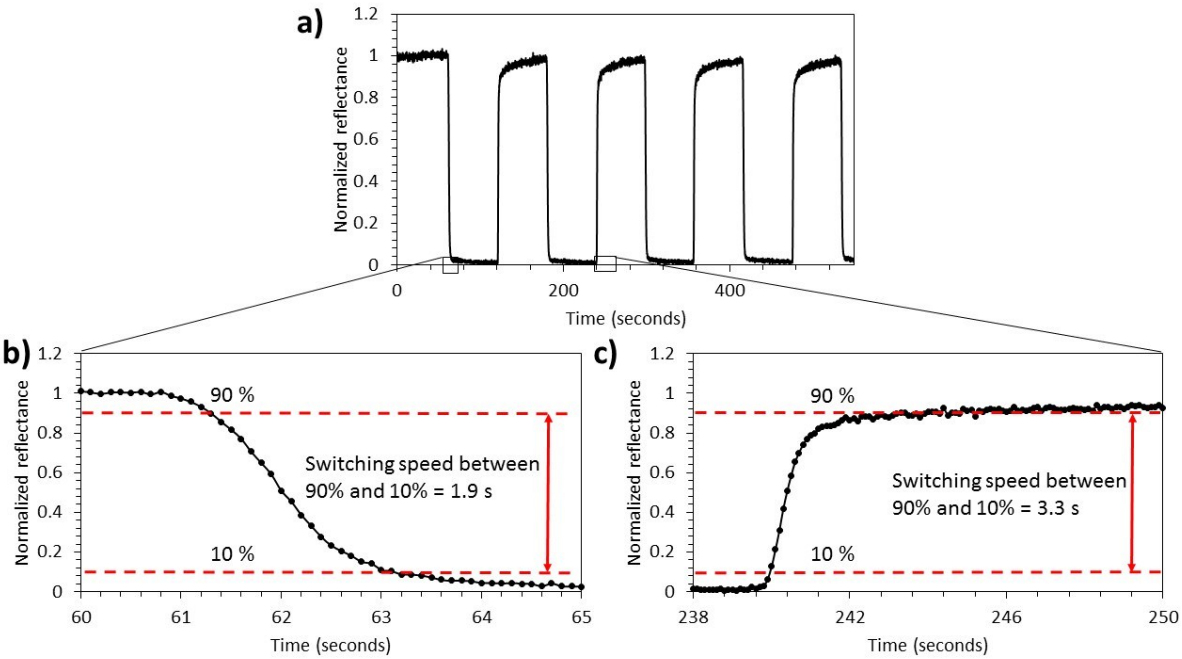

Figure SI5. Switching speed measurement of a vertical PEDOT:Tos electrochromic device, where the reflectance was measured over time at 600 nm. The device was switched using 1.5 V and -1.5 V. **a)** Multiple switches between 1.5 V and -1.5 V. **b)** A single switch from the oxidized 'off' state to the reduced 'on' state. **c)** A single switch from the reduced state to oxidized state. The chromatographs were normalized to the values for the two states of the device.