

## SUPPORTING INFORMATION

### **Ionic Liquid-Polymer Thermochromic Electrolyte with Wide and Tunable LCST for Application in Multi-stimuli-responsive Optical Modulation**

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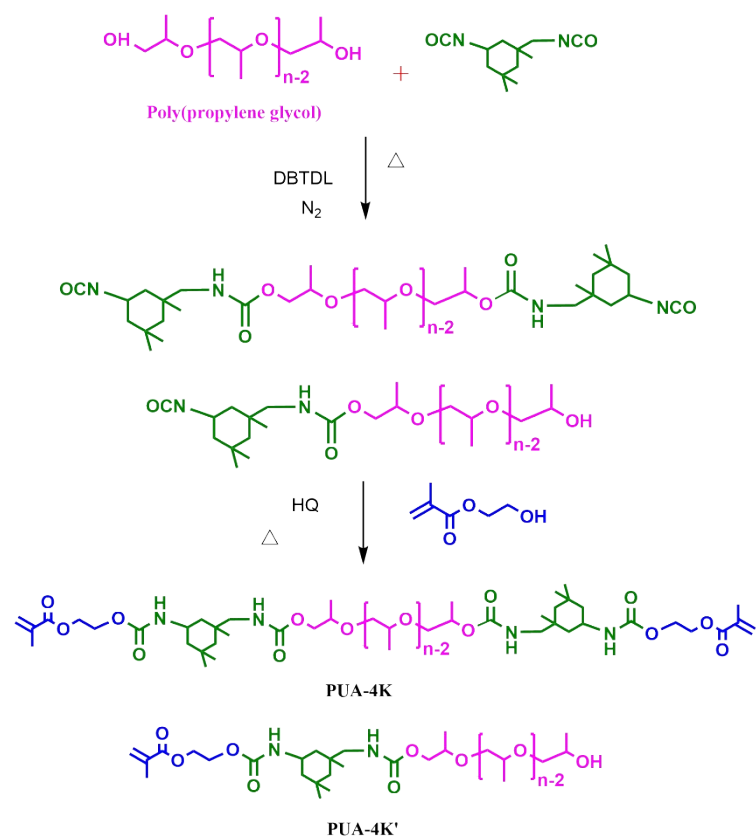
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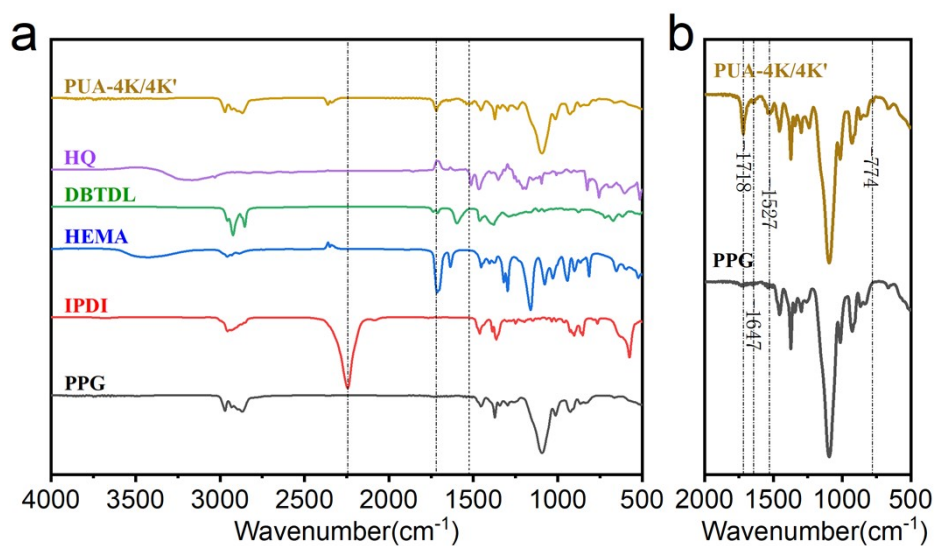
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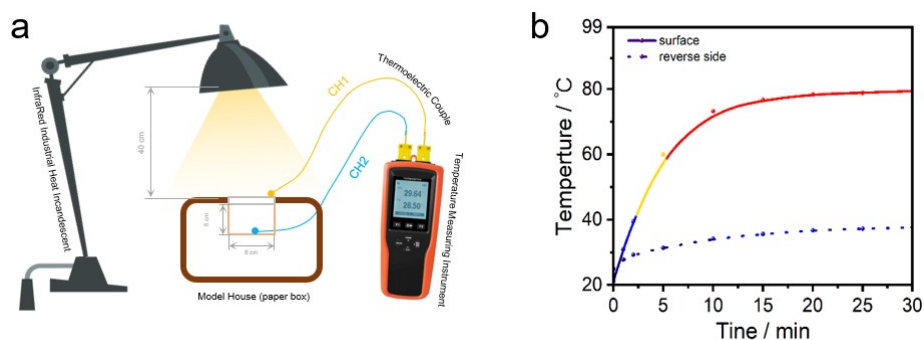


**Figure S1** Schematic of the synthetic route for the polyurethane acrylate monomer (PUA-4K/4K')



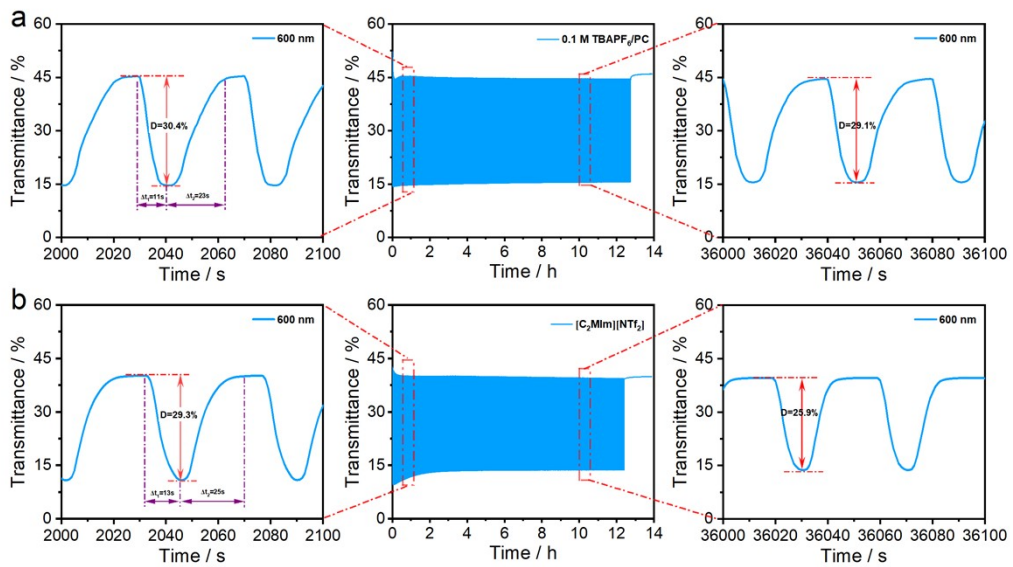
**Figure S2** Infrared spectra of PUA-4K/4K' monomer and raw material components. From the infrared spectrum of PUA-4K/4K' prepolymer and its raw materials, the -

NCO peak (IPDI) at  $2244\text{ cm}^{-1}$  and the -OH peak (HEMA) near  $3500\text{ cm}^{-1}$  disappeared, and C=C The vibration absorption peak of the double bond appeared at  $1647\text{ cm}^{-1}$ , indicating that HEMA successfully blocked the PUA oligomer.



**Figure S3** (a) Photographic illustration of the model house. (b) The surface and interior temperatures of the building model using the T-OSG smart window change over time, and the model is illuminated with a 250 W incandescent lamp to simulate sunlight exposure.

*Model House Test:* A model house ( $10\text{ cm} \times 10\text{ cm} \times 10\text{ cm}$ ) was made of thermal insulation plates with a top window ( $6\text{ cm} \times 6\text{ cm}$ ). The thermal insulation plates are 2 cm thick and have a sandwich structure with rigid polyurethane foams in the middle and aluminum foils on both sides. A lamp (PHILIPS, BR125 250 W), whose emission wavelength covers the main range of solar radiation, was used to irradiate the room through the window, while two thermoelectric couples were employed to monitor the indoor and outdoor temperature changes. The distance between the lamp and the window was 40 cm.



**Figure S4** The cycle stability curves of the T/E-DRDs with (a) 0.1 M TBAPF<sub>6</sub>/PC and (b) neat [C<sub>2</sub>Mim][NTf<sub>2</sub>] as the electrolyte and their partially enlarged views.