Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting information for

Photochromic/Electrochromic Strain Sensor with a Fast and Reversible Light-Printing Ability

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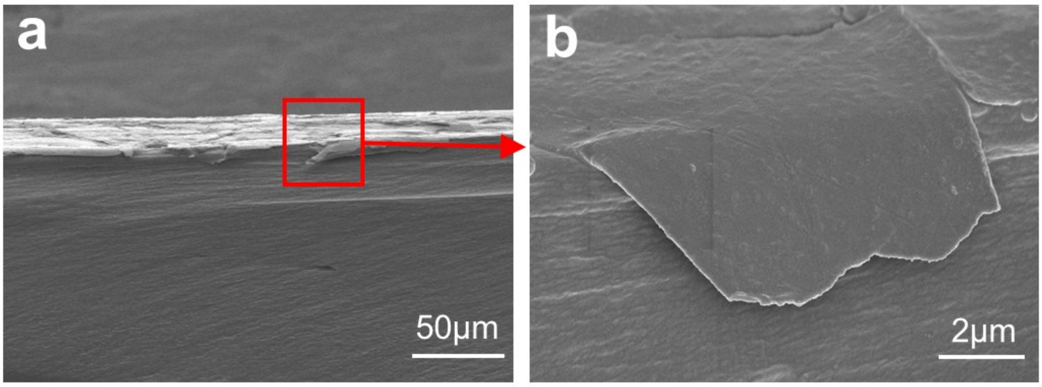

Fig. S1 SEM image of Au-sprayed ITO/PET.

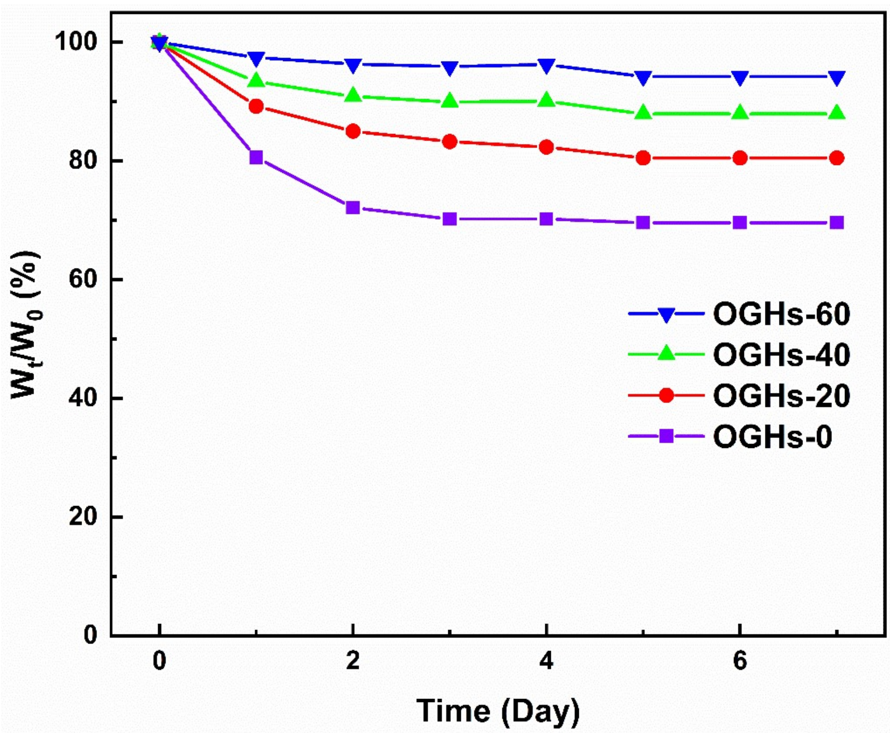

Fig. S2 The weight retention ratio curves of devices (30 °C, 50% RH).

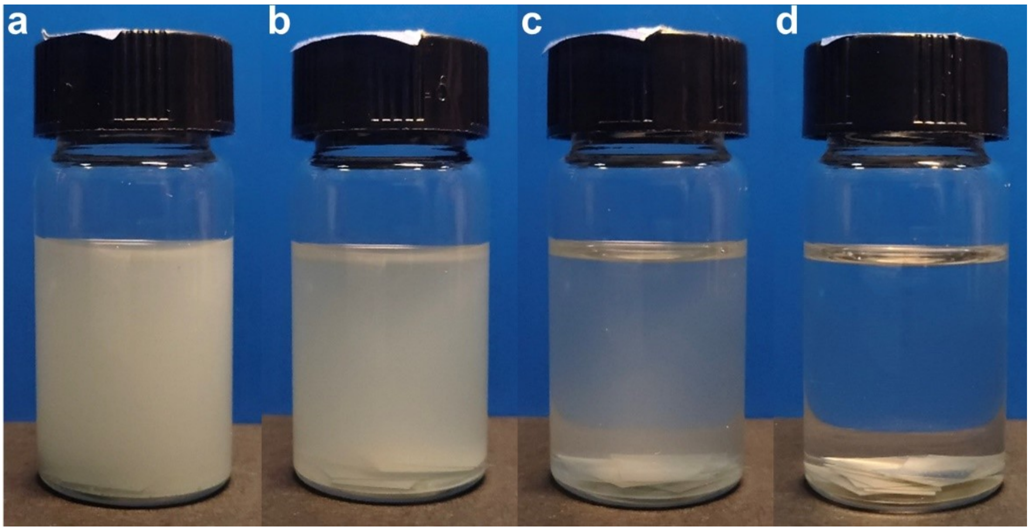

Fig. S3 Solvation of MoO_{3-x}/PEDOT:PSS composite in PPD/H_2O solvent mixture with (a) 20 wt% PPD, (b) 40 wt% PPD, (c) 60 wt% PPD and (d) 80 wt% PPD.

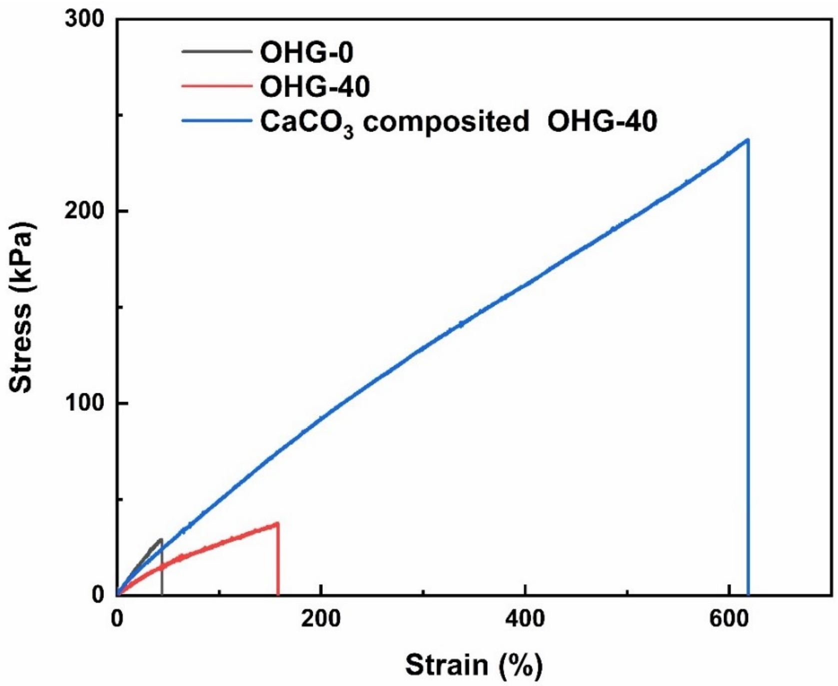

Fig. S4 Tensile strain-stress curves of PAAm hydrogel (OHG-0), organohydrogel (OGH-40) and CaCO3 composited OGH-40.

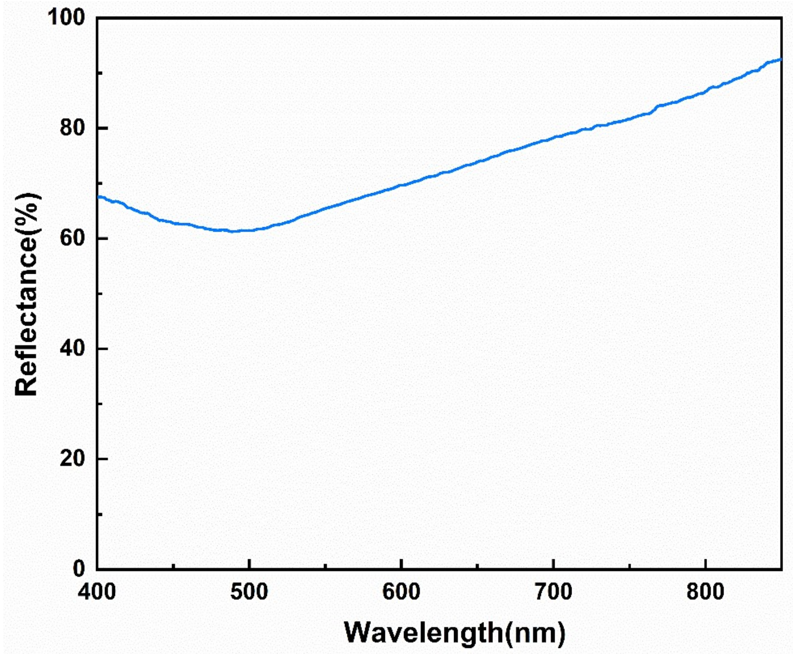

Fig. S5 UV-vis reflectance spectrum of $CaCO_3$ composited OHG-40

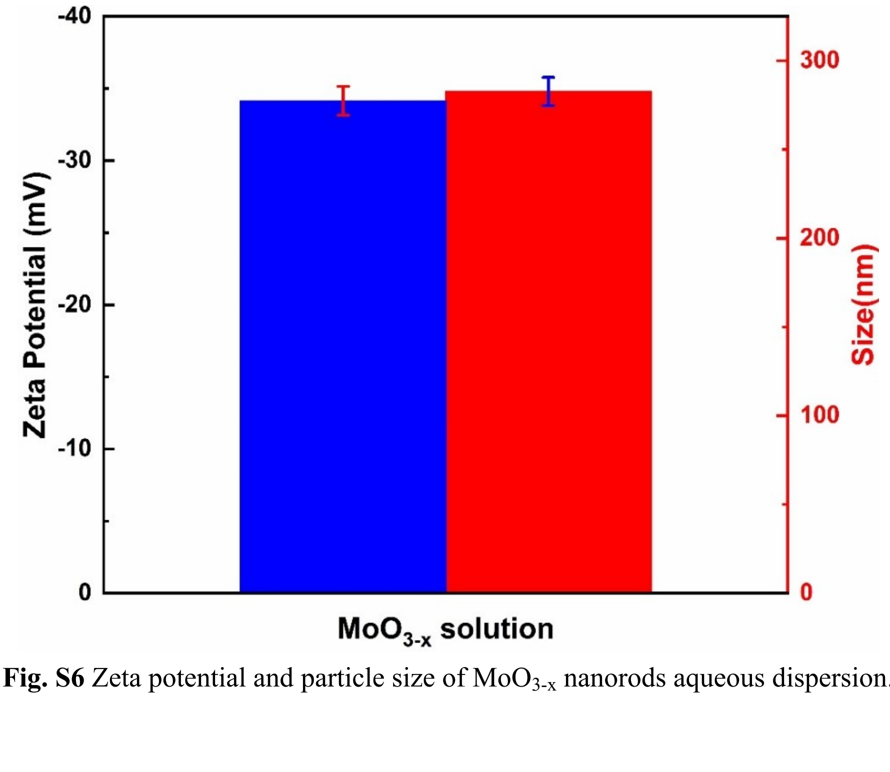

Fig. S6 Zeta potential and particle size of MoO_{3-x} nanorods aqueous dispersion.

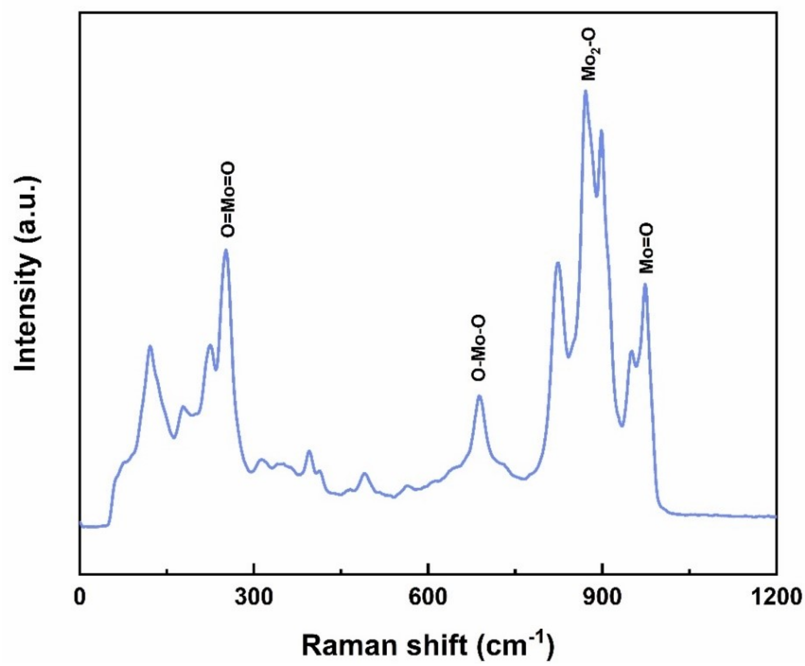

Fig. S7 Raman spectrum of MoO_{3-x} nanorods.

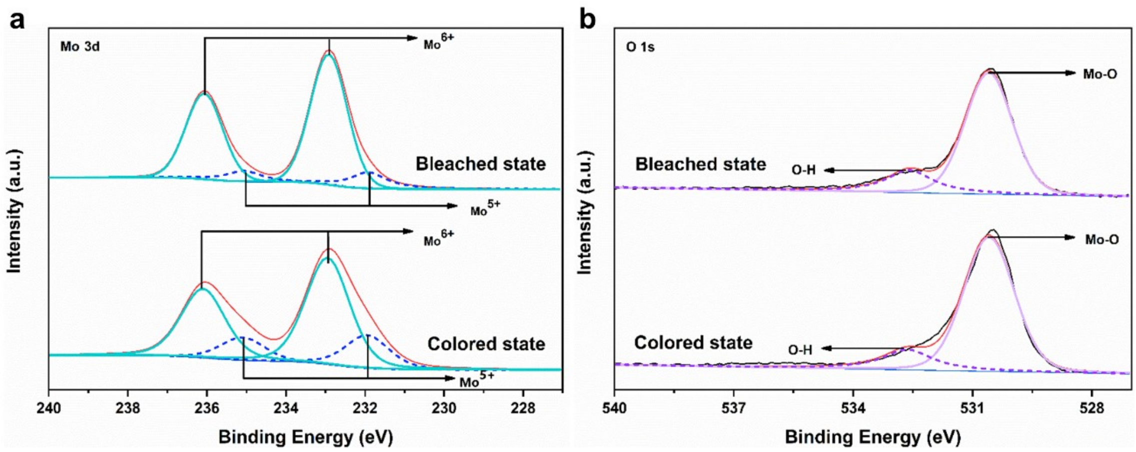

Fig. S8 XPS spectra of MoO_{3-x} (a) Mo 3d and (b) O 1s in the bleached and colored states

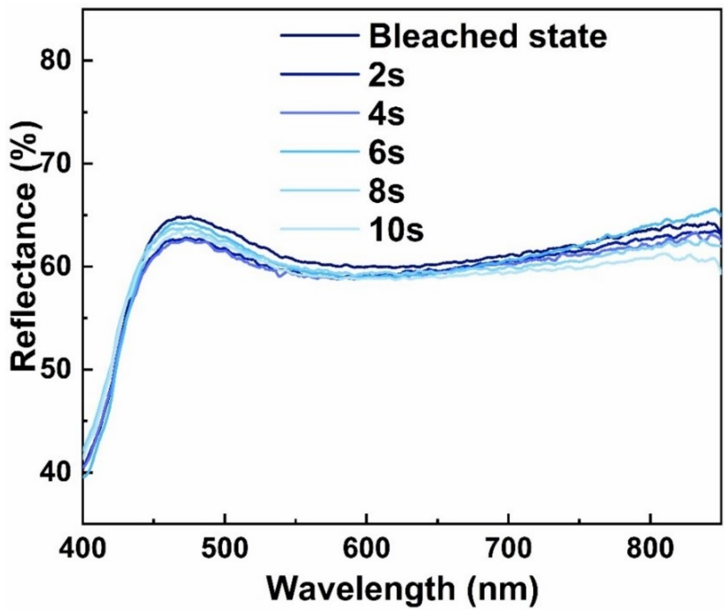

Fig. S9 Reflectance spectra of PEDOT:PSS_0-PESS upon applying bias voltage -2 V.

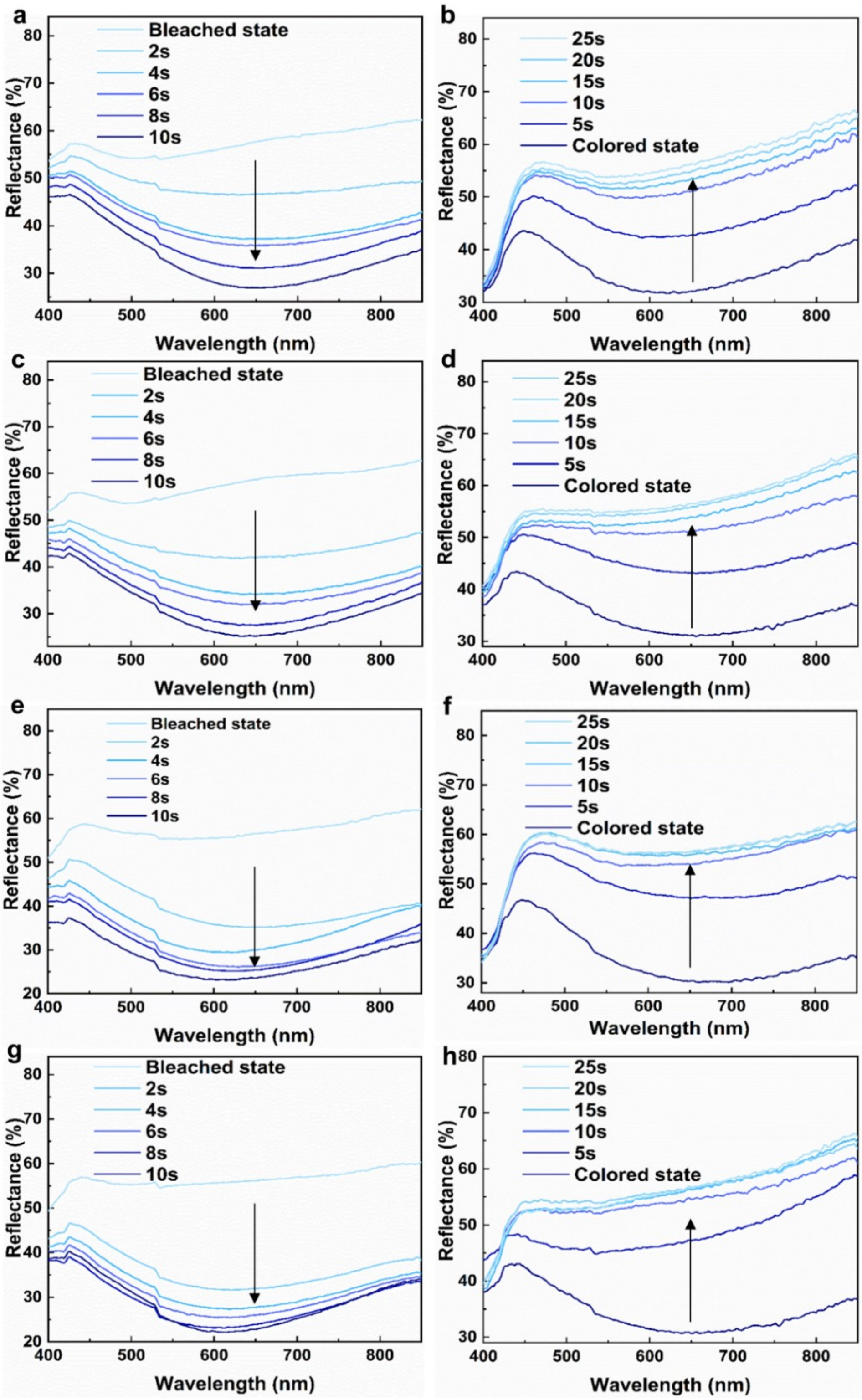

Fig. S10 UV-vis reflectance spectra of PESSs with different PEDOT:PSS contents versus time (coloring -2 V and bleaching +2 V). Spectra of PEDOT:$PSS_{3.4}$-PESS during (a) coloring and (b) bleaching process; spectra of PEDOT:$PSS_{5.0}$-PESS during (c) coloring and (d) bleaching process; spectra of PEDOT:$PSS_{8.4}$-PESS during (e) coloring and (f) bleaching process; spectra of PEDOT:$PSS_{10.1}$-PESS during (g) coloring and (h) bleaching process.

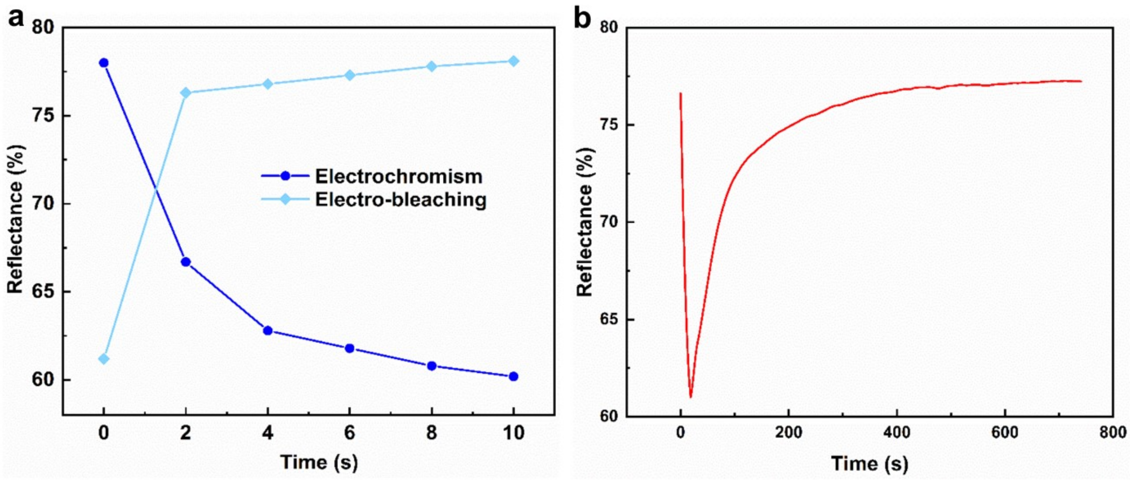

Fig. S11 (a) The time-reflectance curves of PESS at 650 nm with pure PEDOT:PSS (coloring -2 V and bleaching +2 V); (b) the time-reflectance curves of PESS with pure PEDOT:PSS during self-fading.

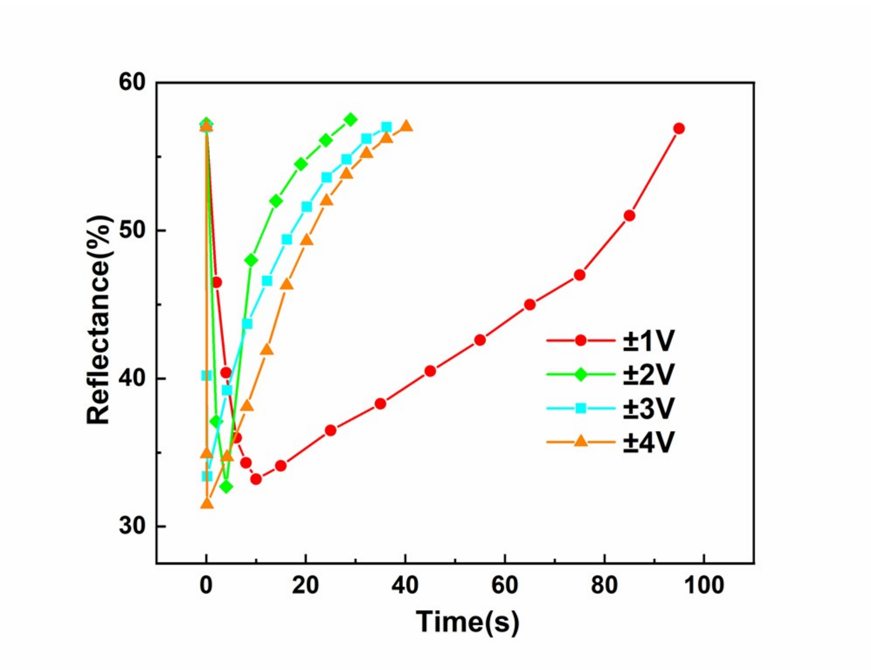

Fig. S12 Reflectance of PEDOT: $PSS_{6.7}$-PESS at 650 nm with applying different bias voltages.

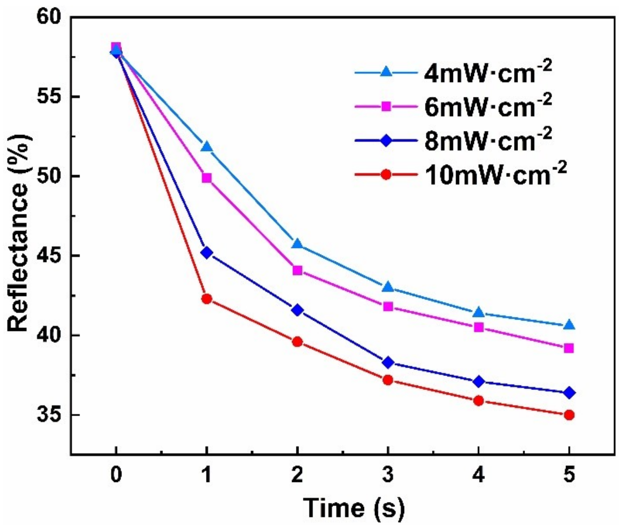

Fig. S13 Reflectance curves of PEDOT:$PSS_{6.7}$-PESS at 650 nm upon UV irradiation with different power density.

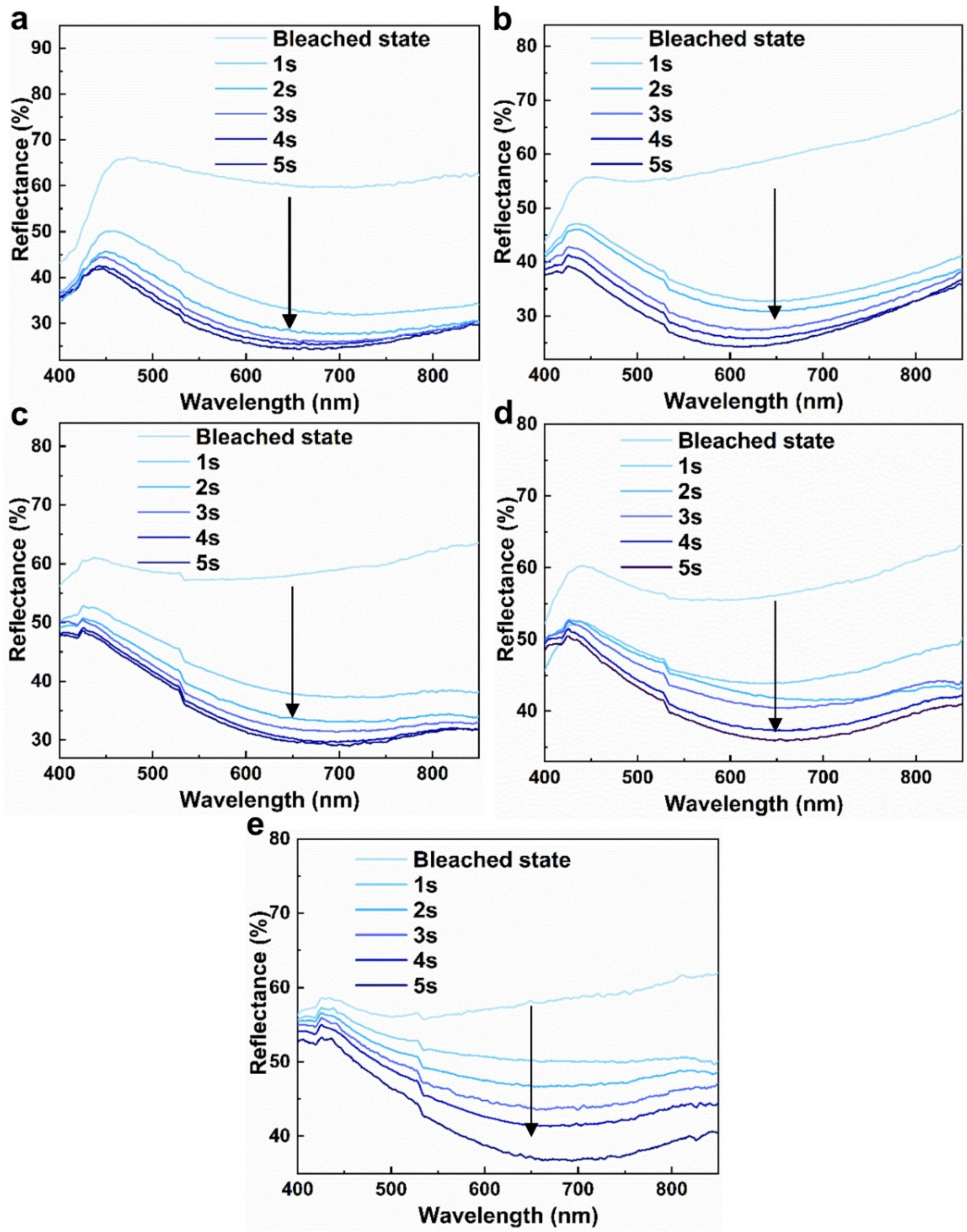

Fig. S14 UV-vis reflectance spectra of PESSs with different PEDOT:PSS contents upon 10 mW/cm^2 UV irradiation. (a) PEDOT:PSS_0-PESS, (b) PEDOT:$PSS_{3.4}$-PESS, (c) PEDOT:$PSS_{5.0}$-PESS, (d) PEDOT:$PSS_{8.4}$-PESS, (e) PEDOT:$PSS_{10.1}$-PESS.

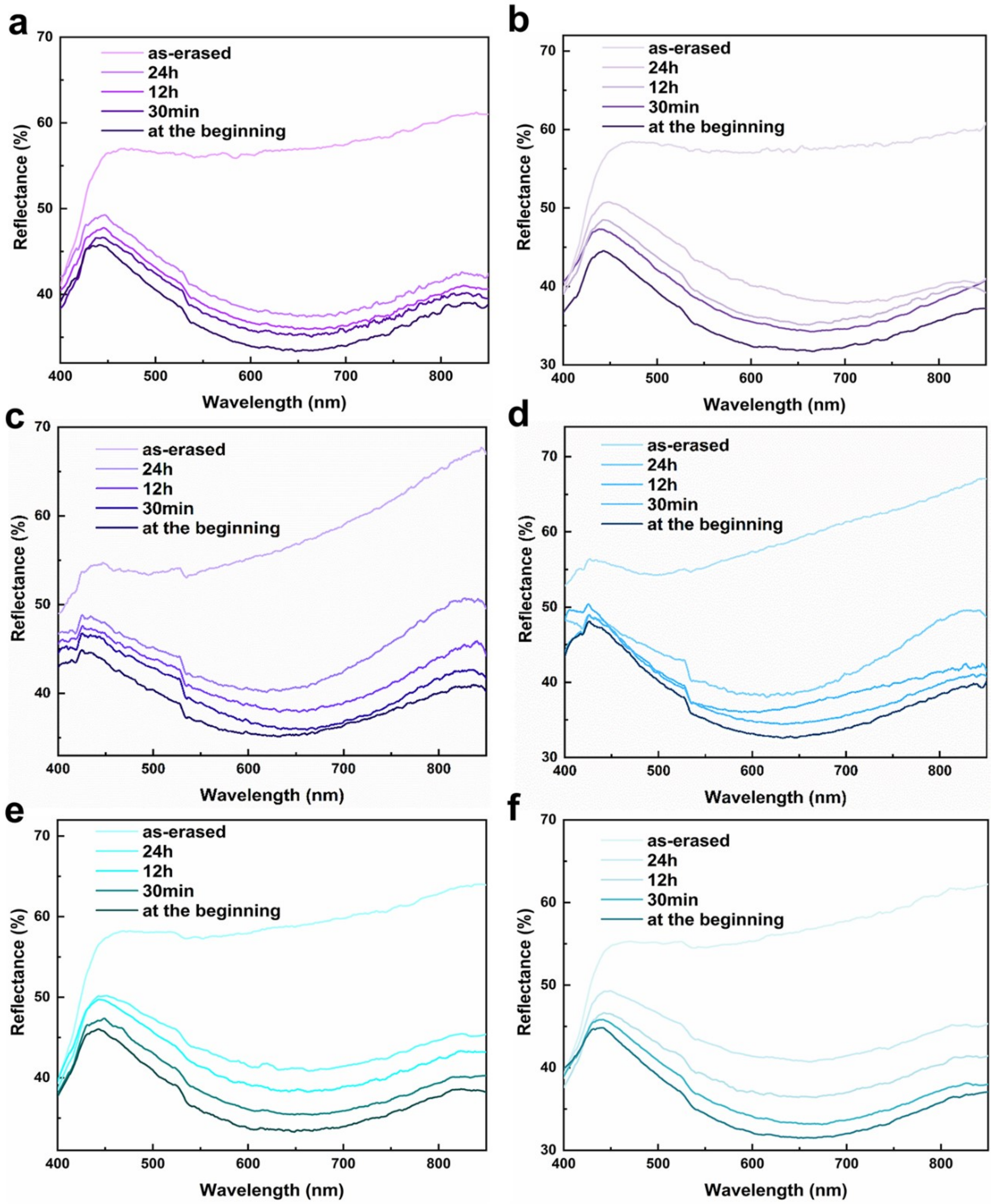

Fig. S15 UV-vis reflectance spectra of PEDOT:$PSS_{6.7}$-PESS stored at 0 °C after (a) UV irradiation (10 mW/cm^2, 5 s) or (b) applying bias voltage (-2 V, 4 s); stored at 25 °C after (c) UV irradiation (10 mW/cm^2, 5 s) or (d) bias voltage (-2 V, 4 s); stored at 40 °C after (f) UV irradiation (10 mW/cm^2, 5 s) and (f) applied bias voltages (-2 V, 4s).

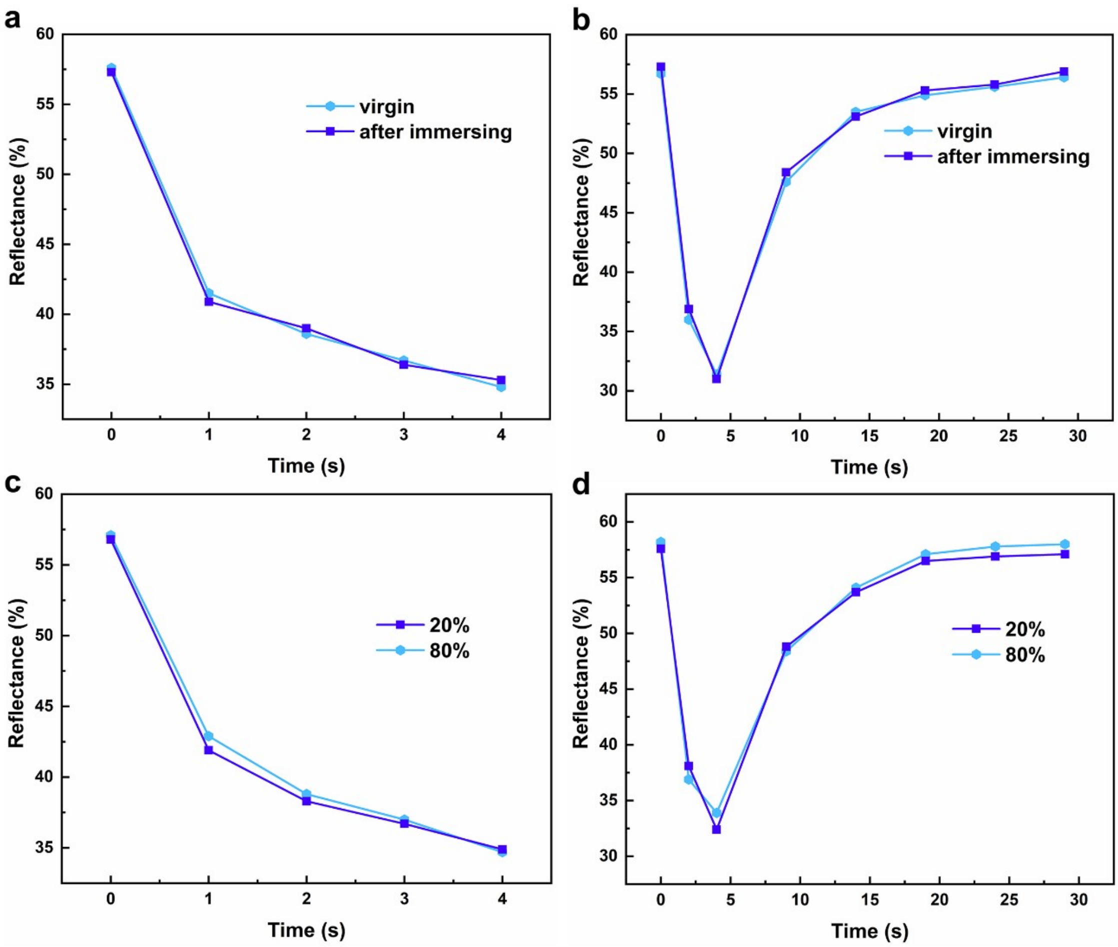

Fig. S16 Time-dependent reflectance of PEDOT:$PSS_{6.7}$-PESS at 650 nm before and after immersion in water for 5 min with (a) UV irradiation (10 mW/cm^2, 5 s) and (b) applying bias voltage (±2 V); time-dependent reflectance of PEDOT:$PSS_{6.7}$-PESS at 650 nm under different relative humidities with (c) UV irradiation (10 mW/cm^2, 5 s) and (d) applying bias voltages (±2 V).

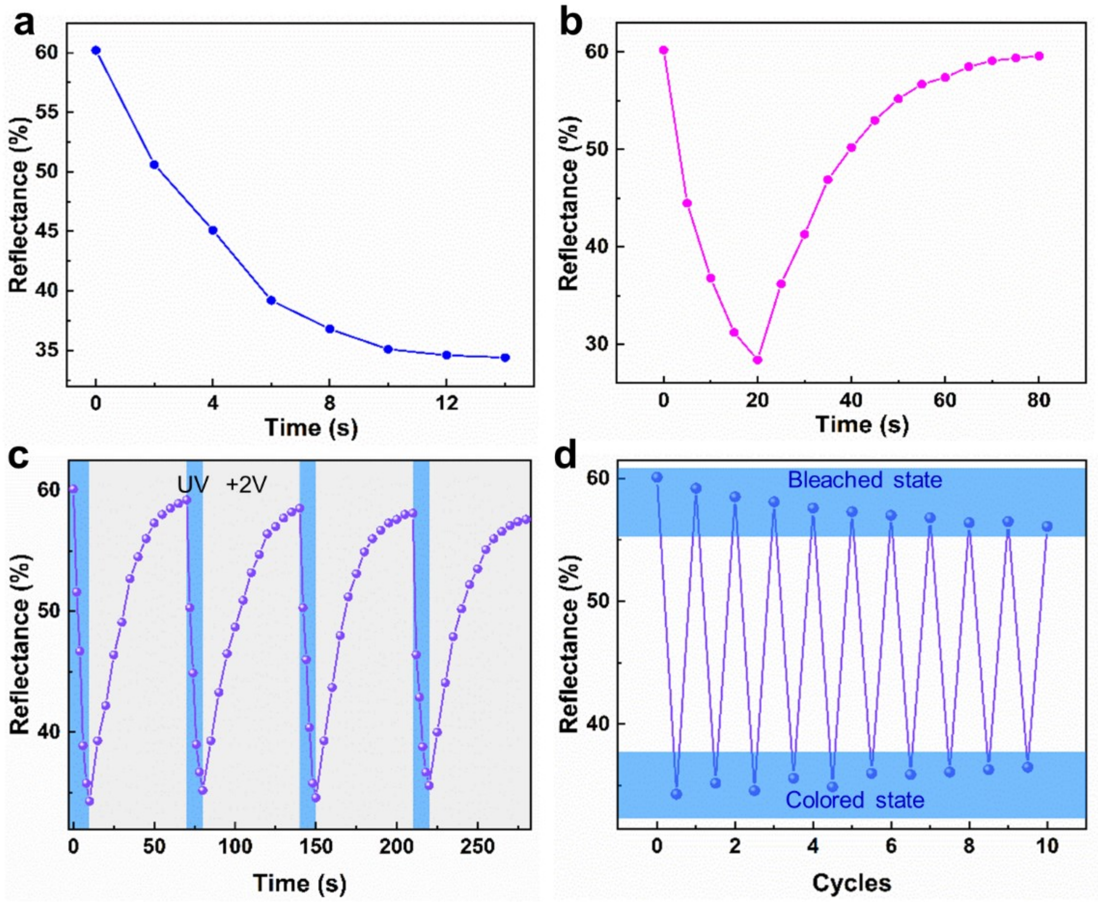

Fig. S17 Reflectance of PEDOT: $PSS_{6.7}$-PESS at 650 nm during (a) coloring process and (b) bleaching process (-15 °C, ±2 V), and cyclic experiment of light printing and electroerasing (+2 V, 60 s) for (c) 4 and (d) 10 cycles.

Table S1. The conductivity of devices with different components

No.	Components of the device	Conductivity ($\times 10^{-3}$ mS/cm）
1	ITO+OHG-40+ITO	2.5
2	ITO+MoO_3+OHG-40+ITO	0.3
3	ITO+MoO_{3-x}+OHG-40+Au+ITO	1.7
4	ITO+ PEDOT:$PSS_{6.7}$/MoO_{3-x}+OHG-40+Au+ITO	5.5

Table S2. Freezing point and electrical conductivity of Organohydrogels

Sample	Freezing point(°C)	Conductivity($\times10^{-2}$ mS/cm)
OHG-0	0	3.44
OHG-20	-7	1.75
OHG-40	-18	1.02
OHG-60	-23	0.30

Table S3. Inoic conductivity of PEDOT:PSS$_y$-PESS

No.	Device	Conductivity($\times10^{-3}$ mS/cm)
1	PEDOT:PSS$_{3.4}$-PESS	0.1
2	PEDOT:PSS$_{5.0}$-PESS	2.8
3	PEDOT:PSS$_{6.7}$-PESS	5.5
4	PEDOT:PSS$_{8.4}$-PESS	7.1
5	PEDOT:PSS$_{10.1}$-PESS	7.9

Table S4. The reported various color-changing devices and their performance

Device	Component	Performance	Application	Ref.
Photochromic/Electrochromic Strain Sensor	ITO/MoO_{3-x}/PEDOT:PSS/ organohydrogel	Photochromism; electrochromism; Strain sensor	Wearable devices with light printing ability	This work
All-Transparent Stretchable Electrochromic Supercapacitor	PDMS/ WO_3/ PEDOT:PSS/ hydrogel	Electrochromism; Supercapacitance	Wearable supercapacitor	1
Photochromic and Electrochromic Hydrogels	ITO/Thienoviologens/ hydrogel	Photochromism; Electrochromism	Anticounterfeiting materials; smart window	2
A highly-safe supercapacitor	Gel/electrochromic pseudocapacitance materials/transparent architectures	Supercapacitor; electrochromism; thermal responsiveness	Energy storage devices	3

Notes and references

1. T. G. Yun, M. Park, D.-H. Kim, D. Kim, J. Y. Cheong, J. G. Bae, S. M. Han and I.-D. Kim, *ACS Nano*, 2019, **13**, 3141-3150.
2. M. Chang, D. Liang, F. Zhou, H. Xue, H. Zong, W. Chen and G. Zhou, *ACS Appl. Mater. Interfaces*, 2022, **14**, 15448-15460.
3. H. Peng, H. Wang, Y. Wang, X. Wang, S. Chen and B. Yan, *J. Mater. Chem. A*, 2022, **10**, 20302-20311.