Electronic Supplementary Information

Fabrication of dual-functional electrochromic smart window based on low-cost hybrid transparent electrode coated with a solution-processable polymer

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Supplementary information - S1

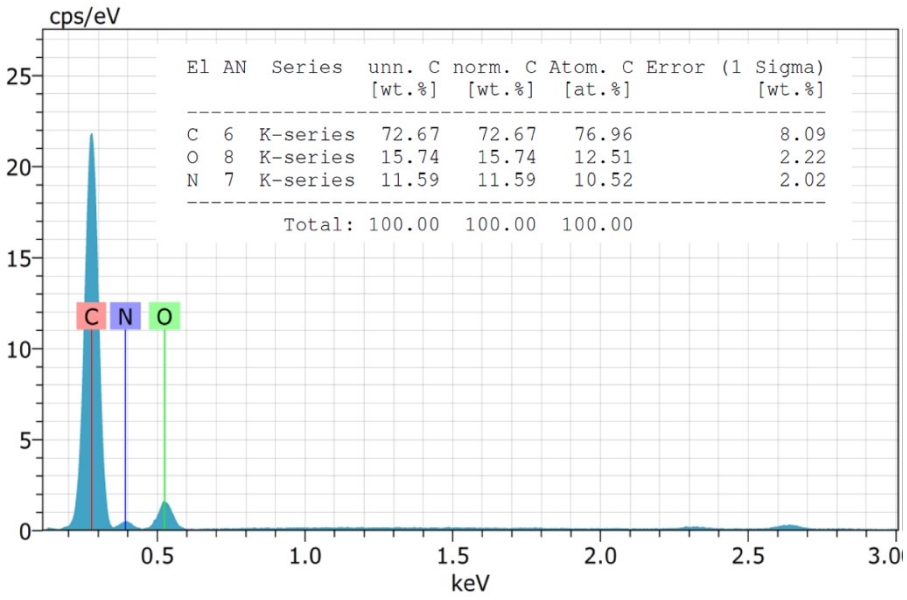

Figure S1: Energy dispersive spectroscopy elemental analysis of synthesized PMOANI.

Supplementary information - S2

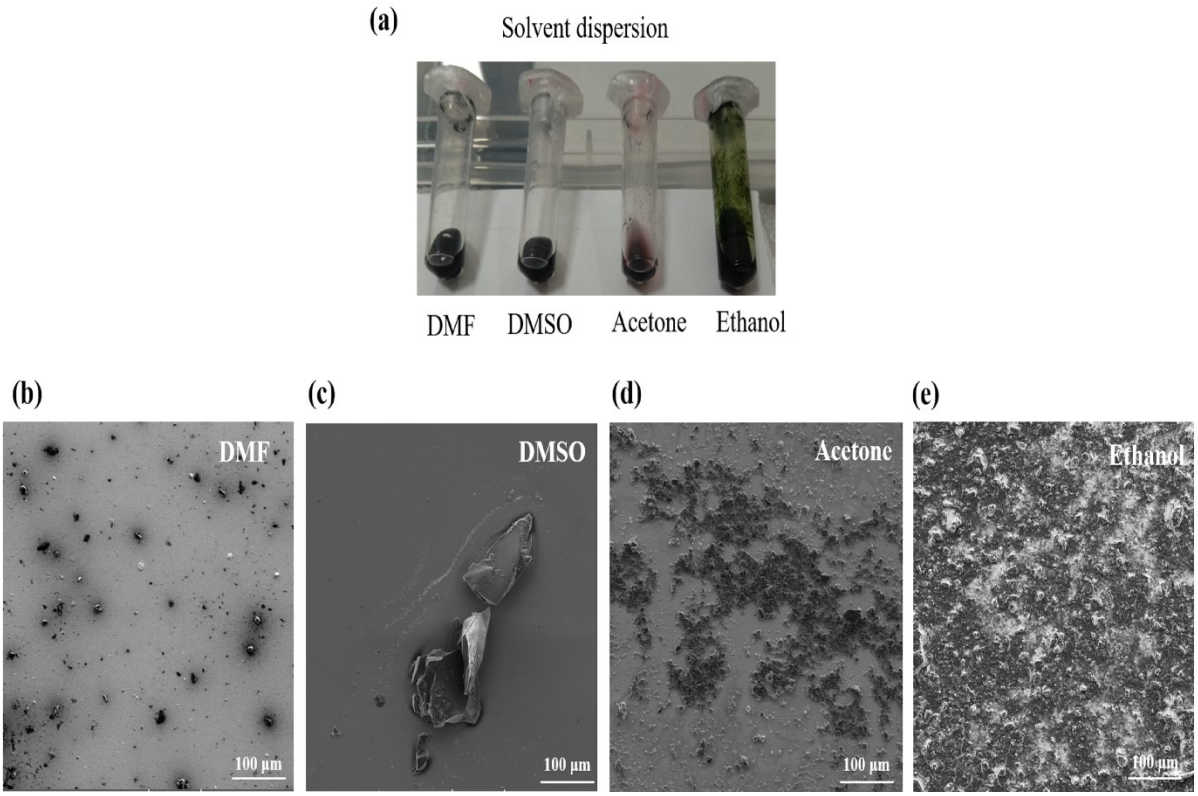

Figure S2: Solvent selection for dispersing PMOANI: (a) photographs of dispersion in different solvents, (b) – (e) FESEM images of PMOANI films dispersed in different solvents.

Supplementary information - S3

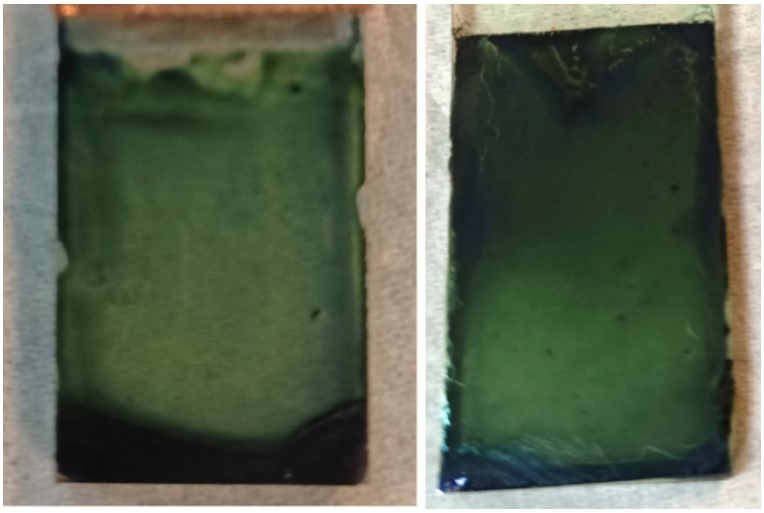

Figure S3: Photographs showing the sagginess of film at edges of spin coated PMOANI on electrode at lower acceleration (< 300 rpm/s^2).

Supplementary information - S4

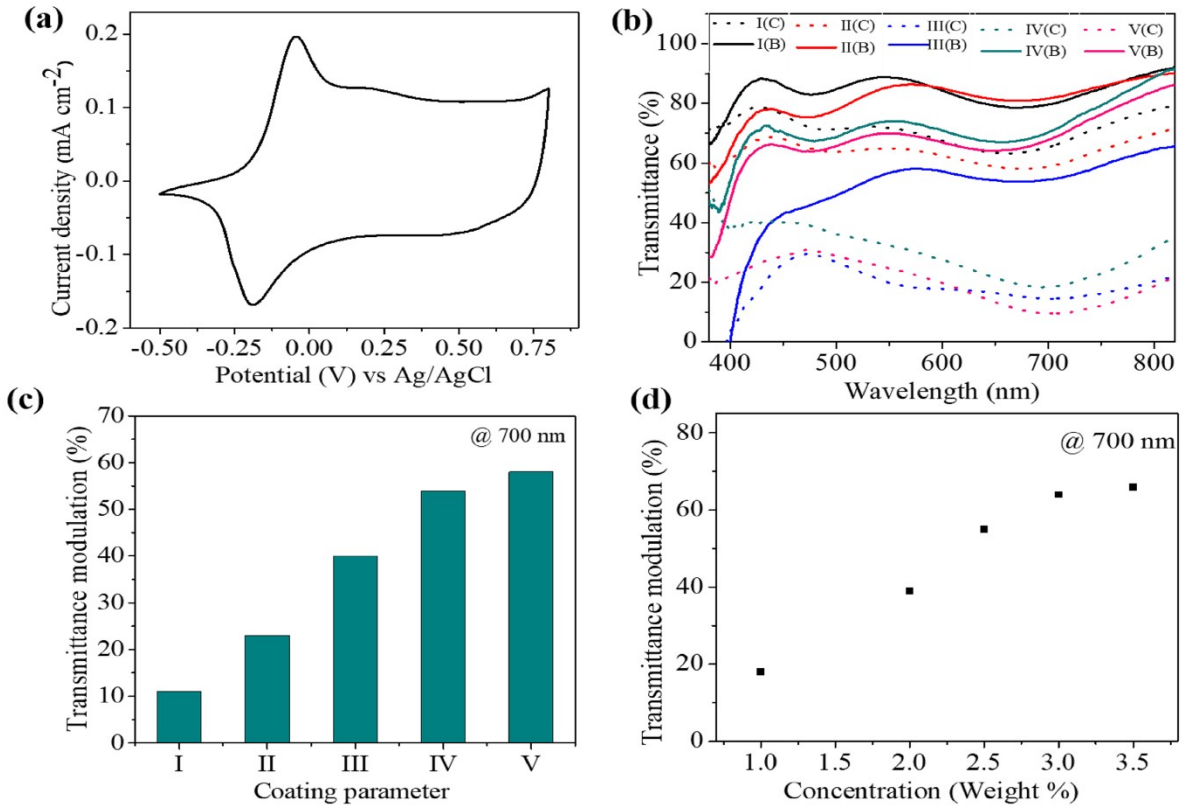

Figure S4: (a) Cyclic voltammogram of PMOANI coated on ITO using 500_500 ((RPM_ acceleration)) coating parameter. (b) bleached (B) and coloured (C) state transmittance spectra of the films coated at different spin coating recipe (I) 1000_150, (II) 1000_100, (III) 1000_40, (IV) 500_500,(V) 500_150. (c) the corresponding modulation plot at 700 nm (d) transmittance modulation by the films prepared using different concentrations of PMOANI at 700 nm.

Supplementary information - S5

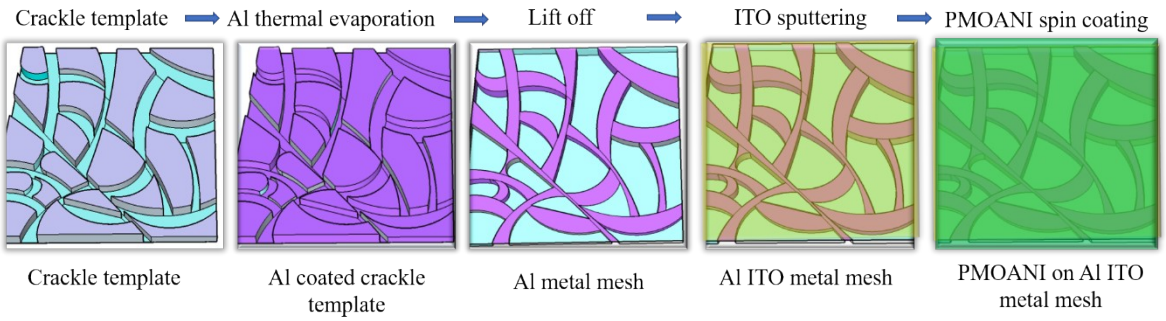

Figure S5: Schematic of fabrication steps for making PMOANI electrode on ITO/Al mesh transparent conducting electrode.

Supplementary information - S6

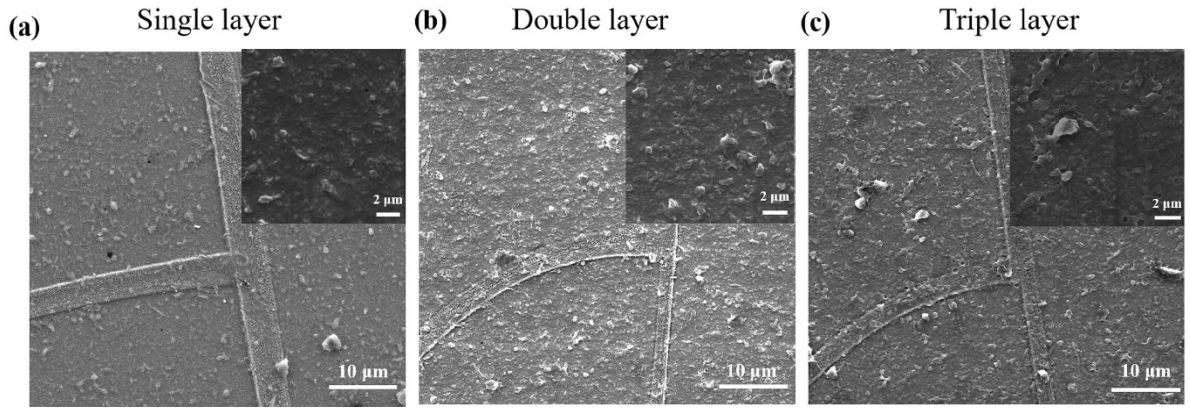

Figure S6: FESEM images of PMOANI coating on ITO (60 nm)/Al-mesh TCE in different layers (high magnification images are shown in inset) (a) single layer, (b) double layer, (c) triple layer.

Supplementary information - S7

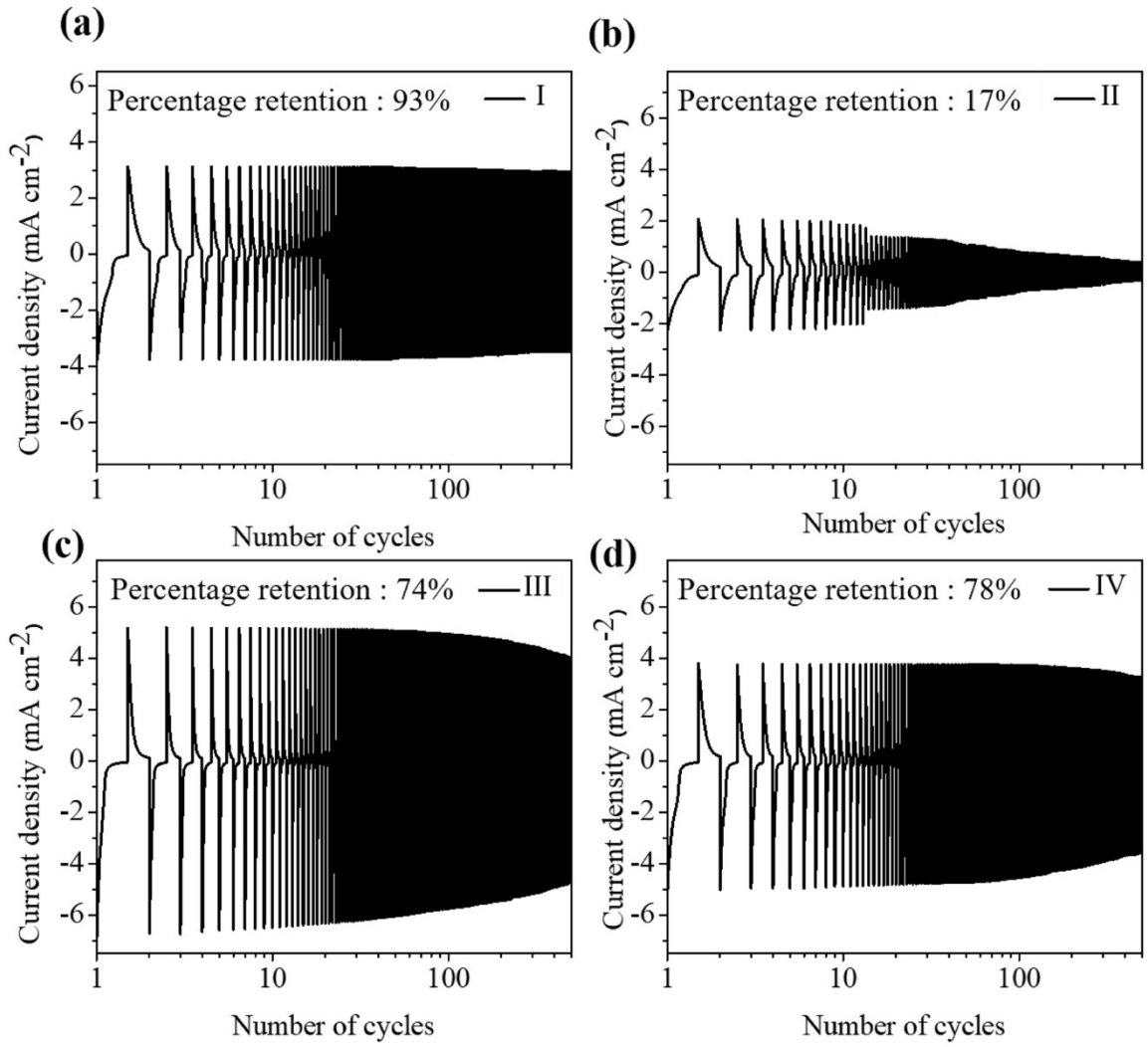

Figure S7: Cyclic stability of optimized PMOANI on different electrodes for 500 cycles when switched between -0.5 to +0.8 V for 10 s per step (percentage retention is also mentioned): (a) ITO (280 nm), (b) ITO (30 nm)/Al-mesh TCE, (c) ITO (60 nm)/Al-mesh TCE, (d) ITO (100 nm)/Al-mesh TCE.

Supplementary information - S8

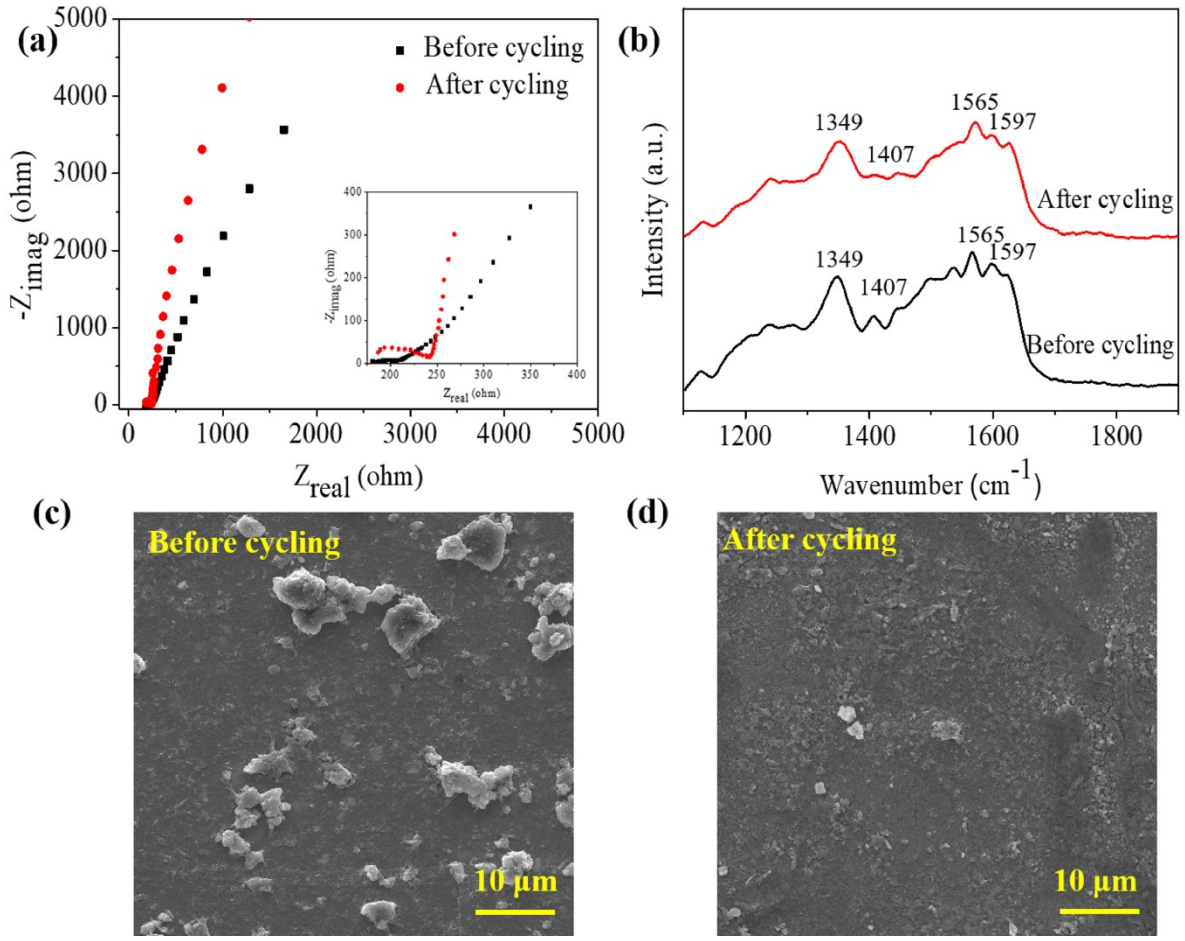

Figure S8: Characterization of PMOANI coated ITO-60 nm/Al-mesh before and after cyclic stability test (a) EIS spectra, high-frequency spectra in the inset, (b) Raman spectra, (c) FESEM image before cycling test, (d) FESEM image after the cycling test.

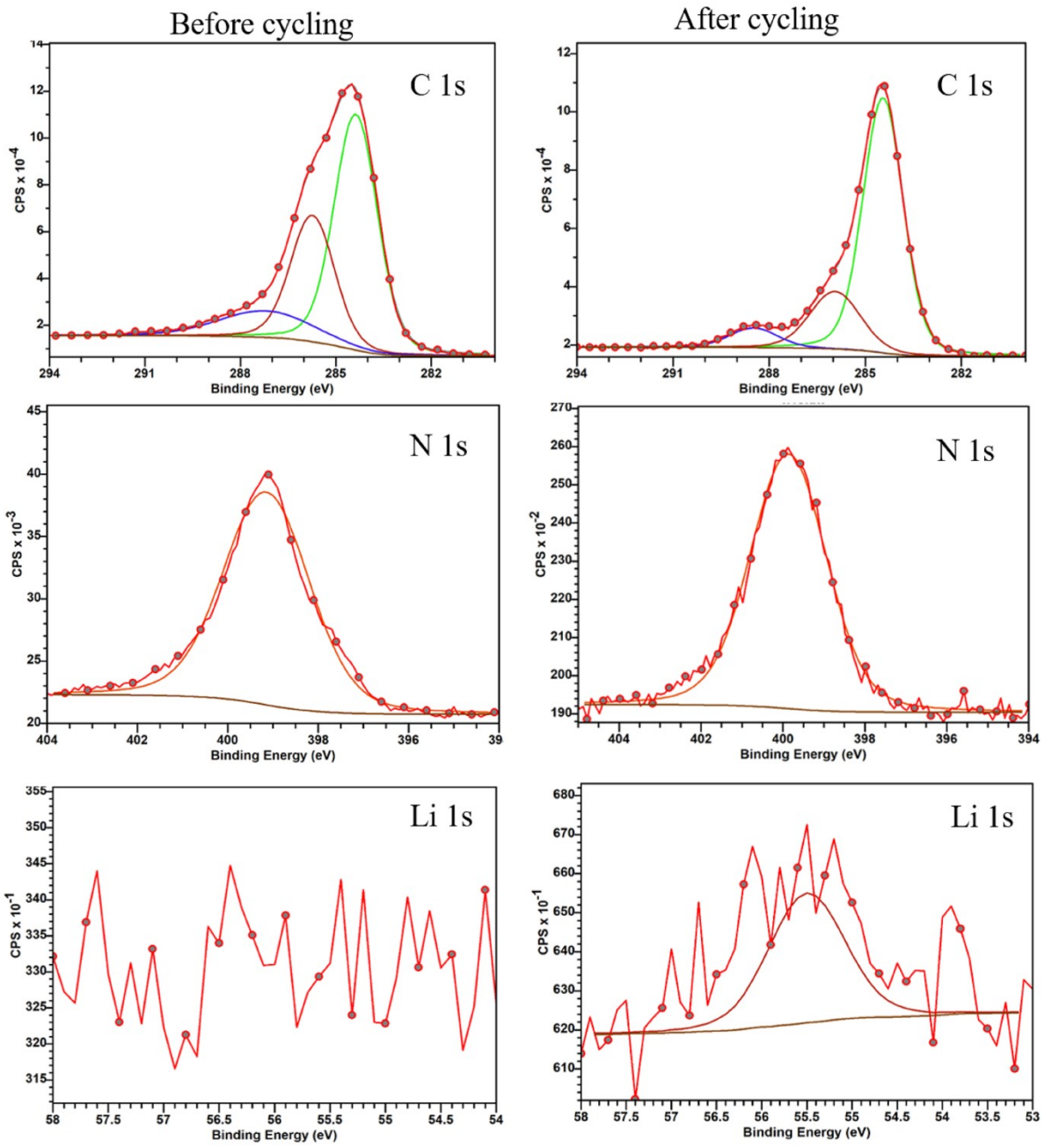

Figure S9: X-ray photoelectron spectroscopy of PMOANI coated ITO-60 nm/Al-mesh before and after cyclic stability test

Supplementary information - S10

Video showing dual functionality of EES device – Supplementary movie 1.

Supplementary movie 1 shows the dual functionality of the fabricated EES device of ~15 cm^2 size. The movie shows the charging of the EES device for 2 min and the colour of the device was changed to blue from transparent. After removing the charging terminal, the EES device was connected to a liquid crystal timer display (operational voltage: 1.2 V) and the timer display started glowing. The timer display shows 1 h : 02 min (1:02). The EES device was powering the display for more than 20 min, and the fading of the display started by showing 1 h: 25 min (1:25). While discharging, blue colour was slowly fading and approaching to transparency. The presented supplementary movie was 32x (32 times) fast-forwarded.

Supplementary information - S11

Comparative study on electrochromic and energy storage performance of reported devices

Active materials	Arial capacitance (mF cm^{-2})	Optical modulation (%)	Supplementary information reference number
Poly aniline	0.017	30	1
Poly aniline /Tungsten oxide	0.025	35.3	2
Tungsten oxide /graphene/Polyaniline	3.414	4.52	3
PANI-functionalized Nickel oxide	1.1	40	4
Polyaniline/ hybrid graphene/ Copper sulfide	17.3	40.1	5
Polyimide/indacenodithiophene	6.2	21.84	6
Poly(indole-6-carboxylic acid)	16.2	43	7
Vertical Gold Nanowires/ Polyaniline	11.76	-	8
Poly(3,4-ethylenedioxythiophene)	~10	-	9
Poly(o-methoxyaniline)/ hybrid transparent conducting electrode	~ 8	57	This work

Supplementary information references

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