Supporting Information

Ion Migration Process and Cyclic Stability of Voltage-Induced Vanadium Dioxide Phase Transition

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Table S1

Transmittance and optical contrast of the colored/bleached state of IV at specific wavelengths.

Cycles	670 nm			2250 nm		
	Colored/%	Bleached/%	Optical contrast/%	Colored/%	Bleached/%	Optical contrast/%
10	49	52.7	3.7	45.6	47.6	2
20	50.1	53.3	3.2	45.9	48	2.1
30	50.3	53.3	3	47.2	48.3	1.1
40	51.3	57.4	6.1	45.5	47.4	1.9
50	52.7	62.1	9.4	48.1	50.6	2.5

Table S2

Transmittance and optical contrast of the colored/bleached state of IVL at specific wavelengths.

Cycles	670 nm			2250 nm		
	Colored/%	Bleached/%	Optical contrast/%	Colored/%	Bleached/%	Optical contrast/%
10	49.1	49.9	0.8	59	66.66	7.66
20	49	51.1	2.1	54	68.1	14.1
30	48	50.4	2.4	53.4	60.5	7.1
40	48.4	50.3	1.9	46.5	53.2	6.7
50	49.3	51	1.7	47.8	52.6	4.8

Table S3

Phase change temperature (PCT) and rate of change of IV and IVL at different cycles.

Cycles	IV		IVL	
	PCT/℃	Rate of change/%	PCT/℃	Rate of change/%
0	67.59	/	65.59	/
10	54.84	22.14	61.81	5.76
20	54.36	22.96	61.51	6.22
30	55.37	18.08	58.06	11.48
40	52.09	22.93	59.43	9.39
50	51.59	23.67	58.68	10.53

Table S4

The offset angles of the (011) diffraction peaks of IV and IVL.

Cycles	IV	IVL
0	27.89°	27.89°
1	27.86°	27.84°
10	27.75°	27.76°
30	27.63°	27.73°
50	/	27.68°

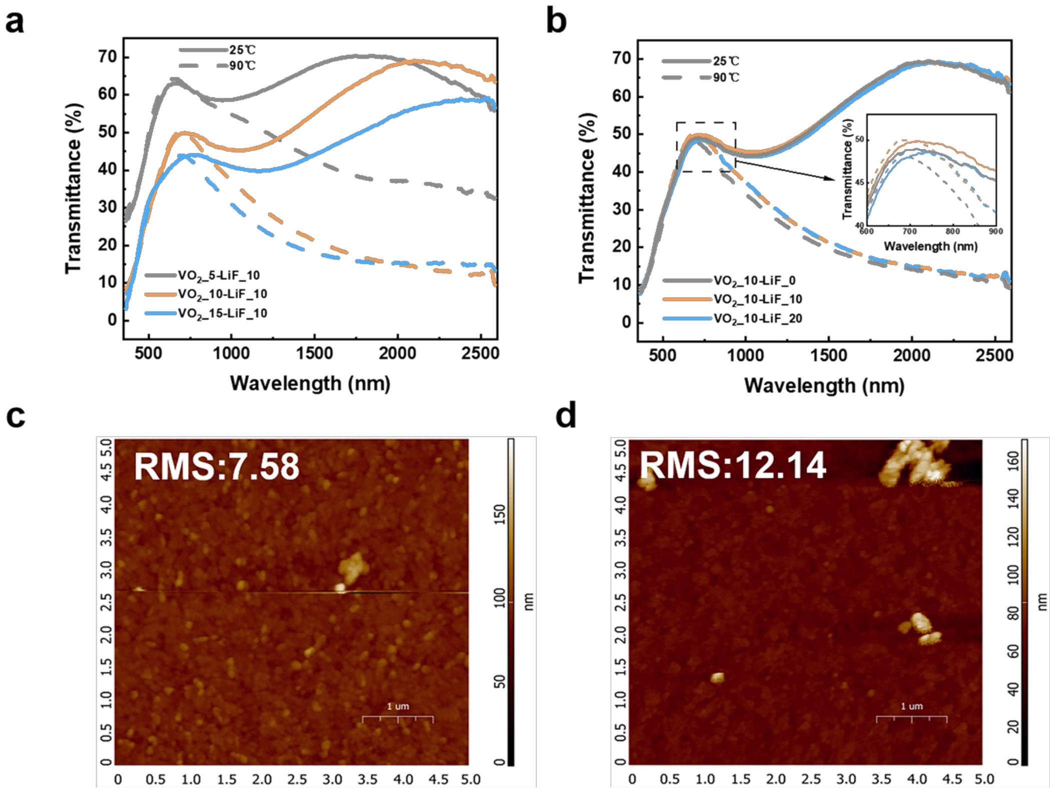

Fig. S1. High and low temperature (25°C and 90°C) transmittance spectra of VO_2 and LiF multilayers with different thicknesses: (a) LiF fixed sputtering for 10 min, VO_2 sputtering for 5 min, 10 min and 15 min. (b) VO_2 fixed sputtering for 10 min, LiF sputtering 0 min, 10 min and 20 min, and the illustration is a partial enlarged view. AFM images of (c) VO_2 film and (d) VO_2/LiF composite film on ITO glass substrate. Both VO_2 and LiF were sputtered for 10 minutes, and the thickness of these films below is the same.

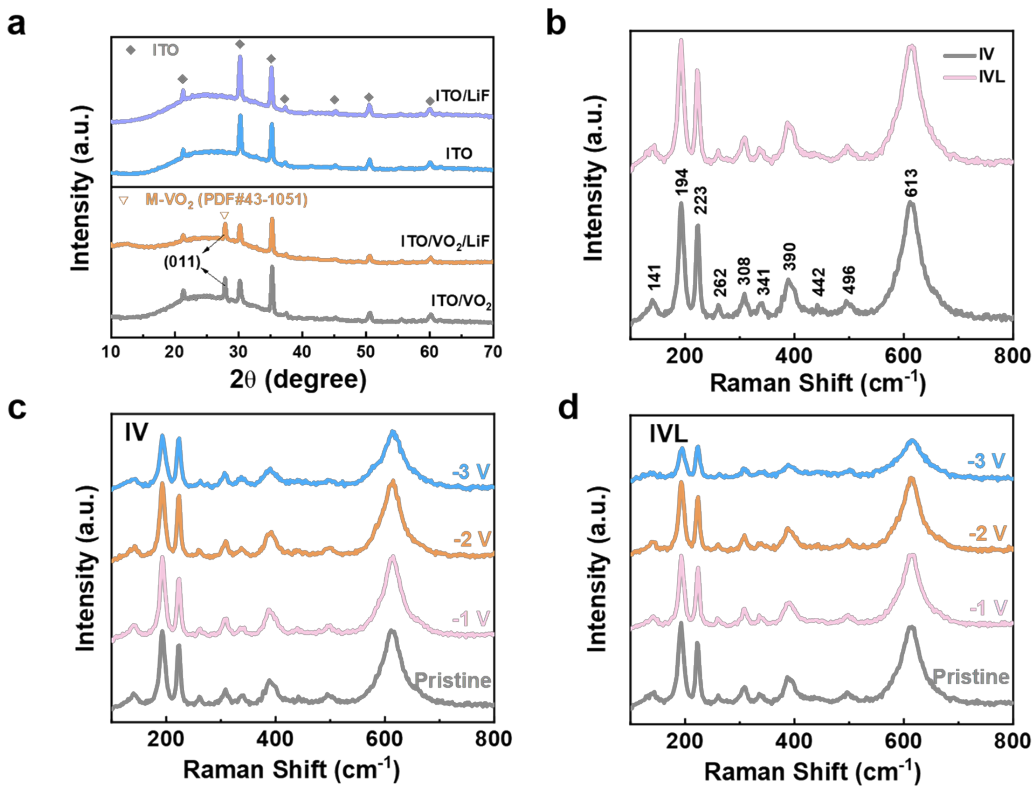

Fig. S2. (a) The XRD patterns of the components of the multilayer films and (b) Raman patterns of VO_2 (IV, gray line) and VO_2/LiF (IVL, blue line) on ITO glass substrates. Raman patterns of (c) IV and (d) IVL when different voltages were applied.

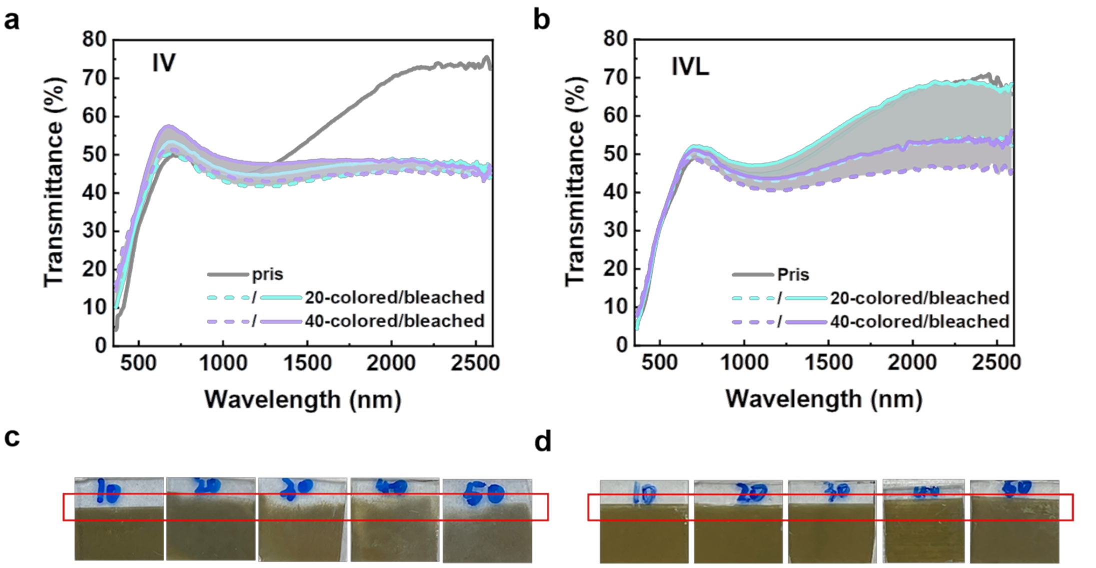

Fig. S3. Transmittance spectra of (a) IV and (b) IVL after 20 and 40 cycles; physical images of (c) IV and (d) IVL after 10, 20, 30, 40, and 50 cycles. The cycling voltage was ±2.5 V, and each voltage was maintained for 1 min.

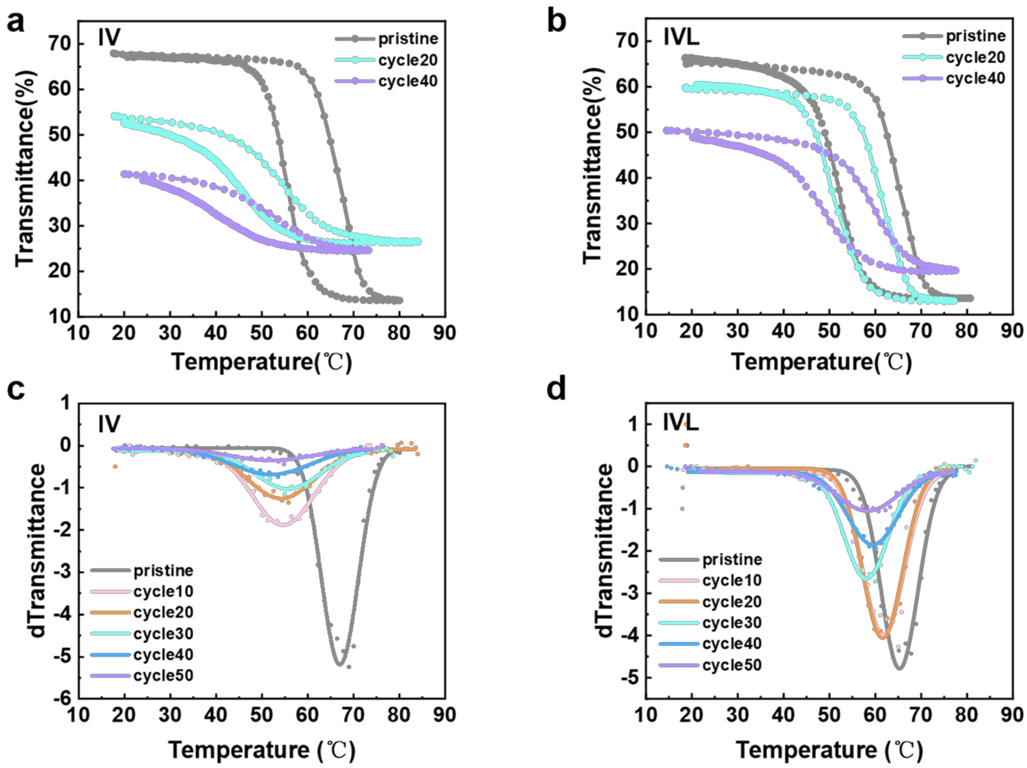

Fig. S4. (a) Thermal hysteresis line profiles at 2000 nm for the initial state of IV and (b) IVL after 20 and 40 cycles. (c) First-order differential curves of the thermal hysteresis line for the initial state and each cycling ramp-up phase of IV and (d) IVL. The cycling voltage was ±2.5 V and each voltage was maintained for 1 min.