Supporting Materials for

Room-Temperature Liquid-Phase Exfoliation of MoO_3 Nanosheets for Photochromic Smart Windows

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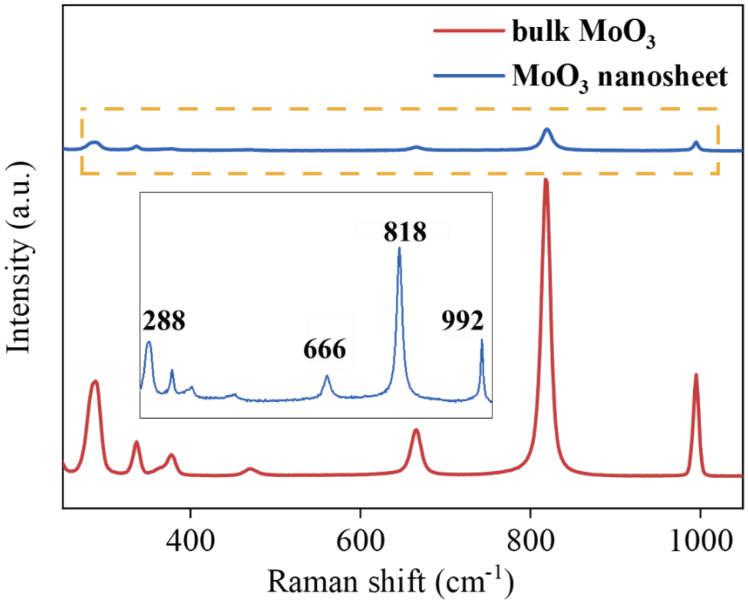

Figure S1. The Raman results of MoO_3 nanosheets and bulk MoO_3

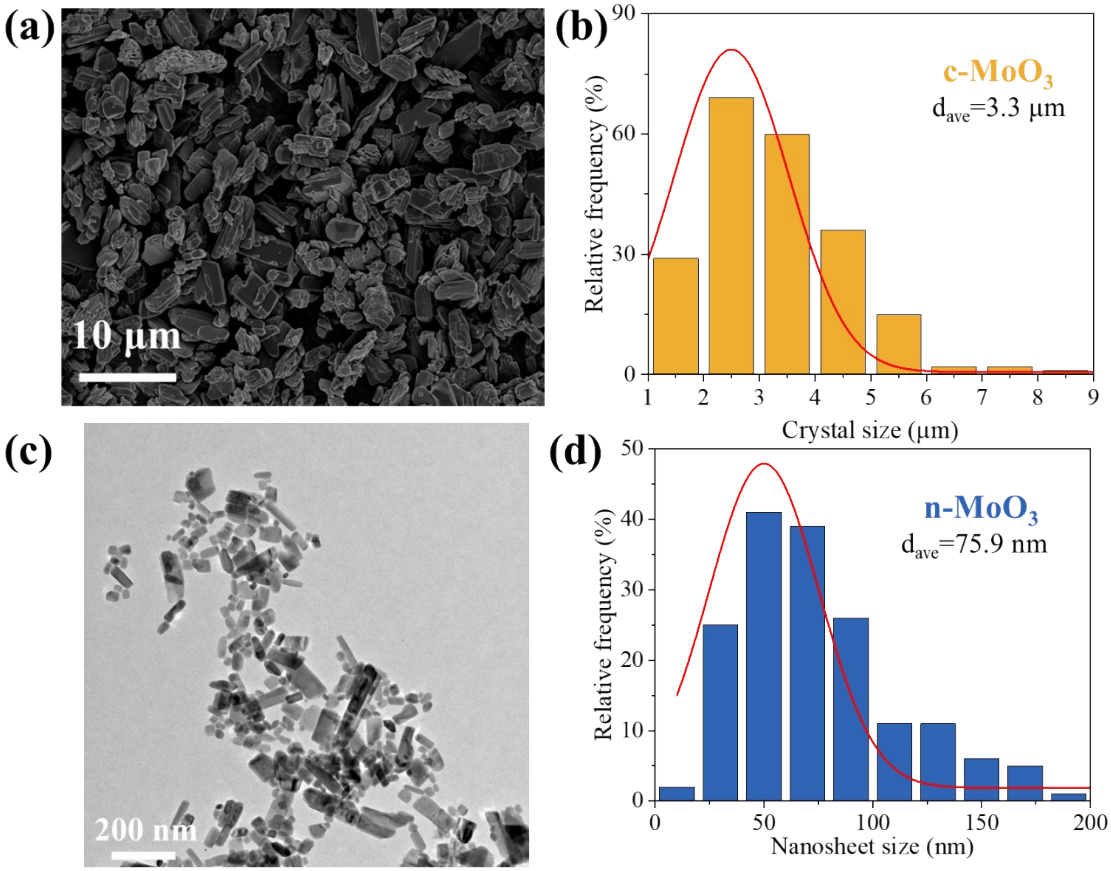

Figure S2. (a)The SEM image and (b) corresponding histograms of commercial MoO_3. (c) the TEM image and (d) corresponding histograms of MoO_3 nanosheets.

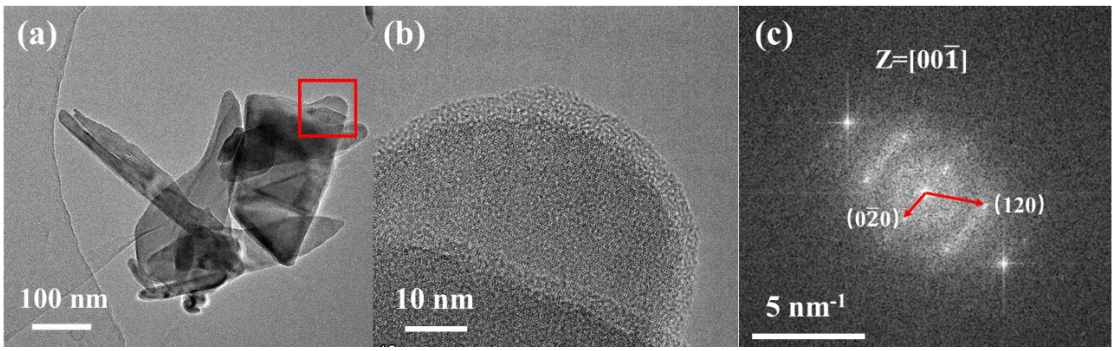

Figure S3. (a)The TEM image of MoO_3 nanosheets. (b)HRTEM and (c)SEAD image of MoO_3 nanosheets in the edge.

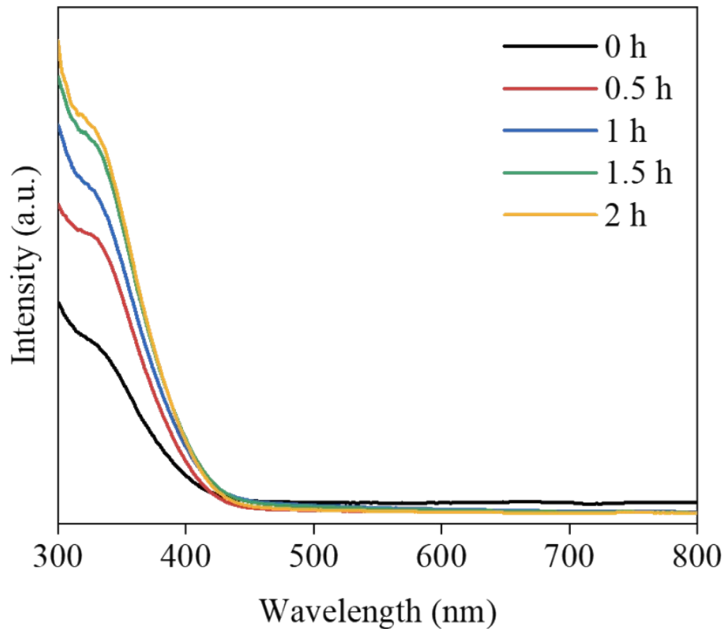

Figure S4. UV-Vis absorbance spectra of MoO_3 nanosheets at different ultrasonic time

Table S1. The concentration of the nanosheets obtained through weighing and calculation

Ultrasound treatment time(h)	Container quality (g)	The mass of the container containing the solution (g)	Residual mass(g)	MoO_3 nanosheet concentration(mg/mL)
0	16.6198	16.6215	0.0017	0.17
0.5	16.5967	16.6001	0.0034	0.34
1	16.7250	16.7297	0.0047	0.47
1.5	16.5936	16.5988	0.0052	0.52
2	16.2183	16.2238	0.0055	0.55

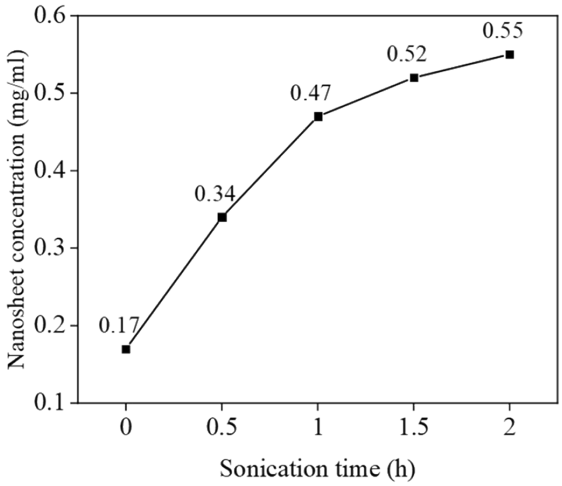

Figure S5. The curve shows the variation of nanosheet concentration with ultrasonic time.

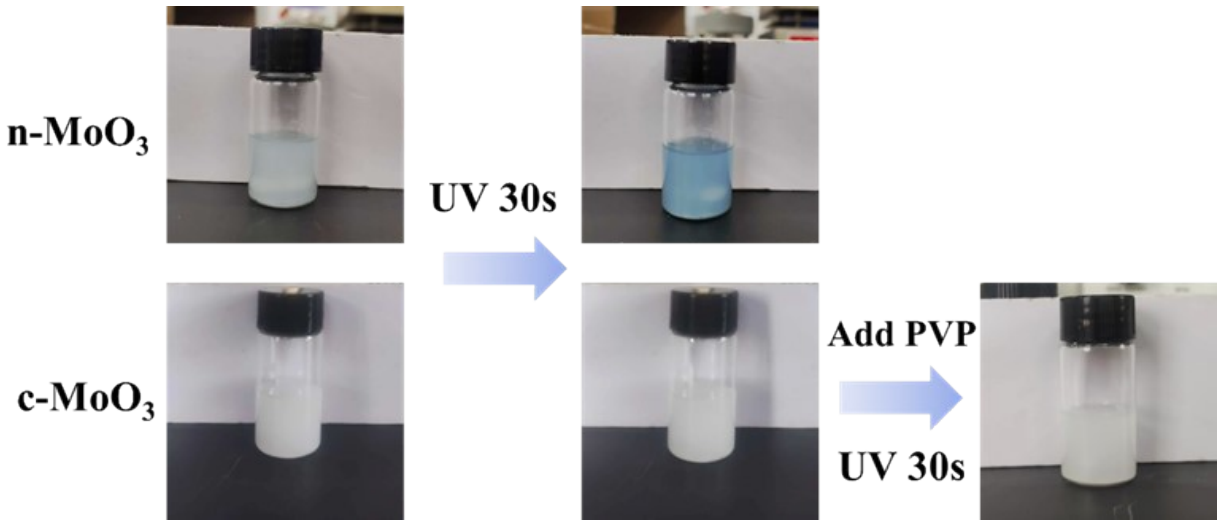

Figure S6. Photographs of MoO_3 with/without ultrasonication before UV and after UV

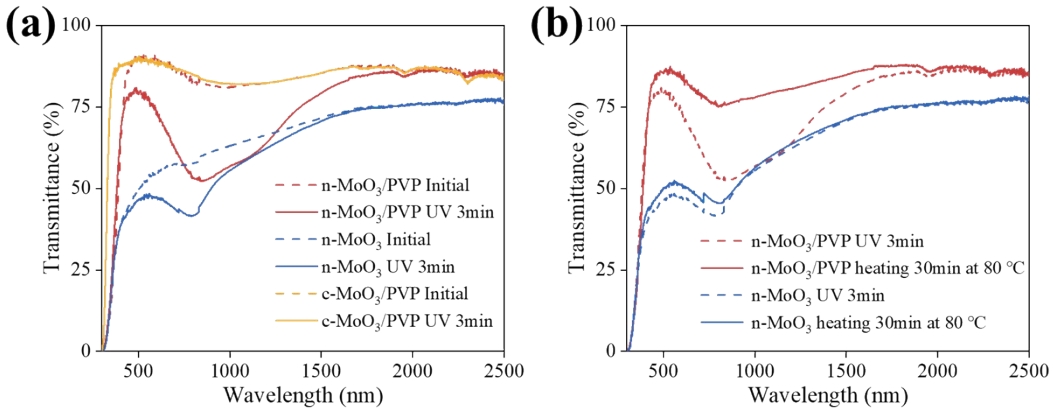

Figure S7. (a)Tinting and (b)Bleaching performance of the film of commercial MoO_3, MoO_3 nanosheet and MoO_3 nanosheet with PVP

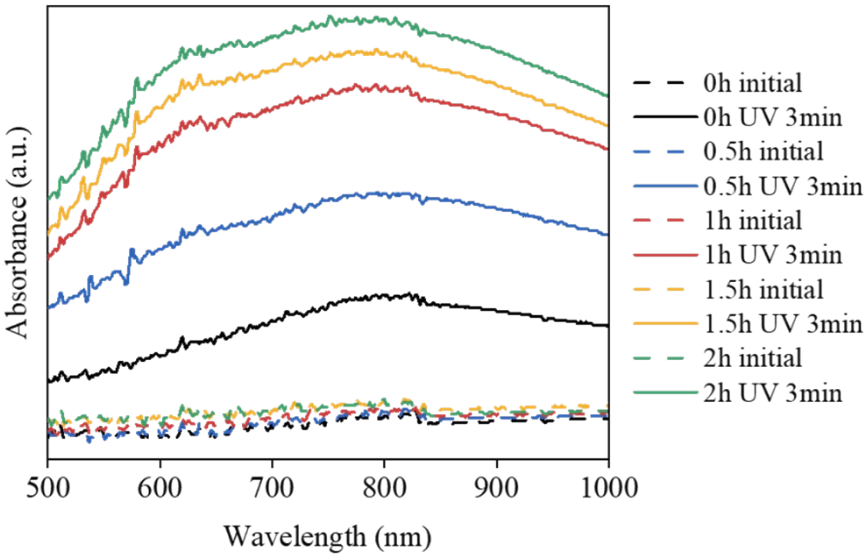

Figure S8. The UV-Vis absorbance spectra of initial/colored MoO_3 nanosheets at different ultrasonic times.

Figure S9. The photographs of MoO_3/PVP composite film at initial (a), tinted (b) and bleached state (c).

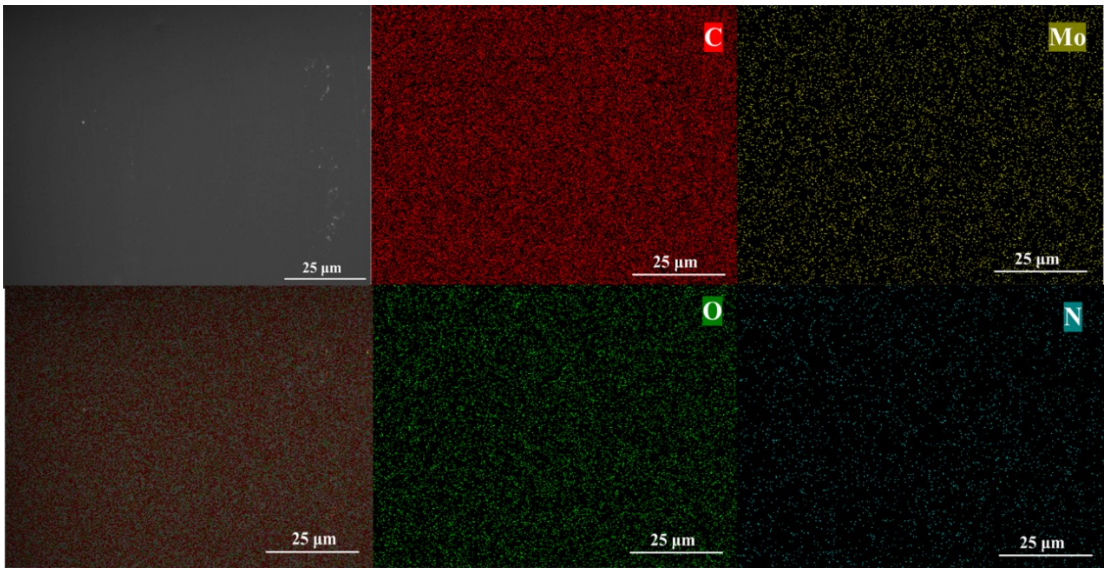

Figure S10. The surface element distribution of MoO_3/PVP composites film.

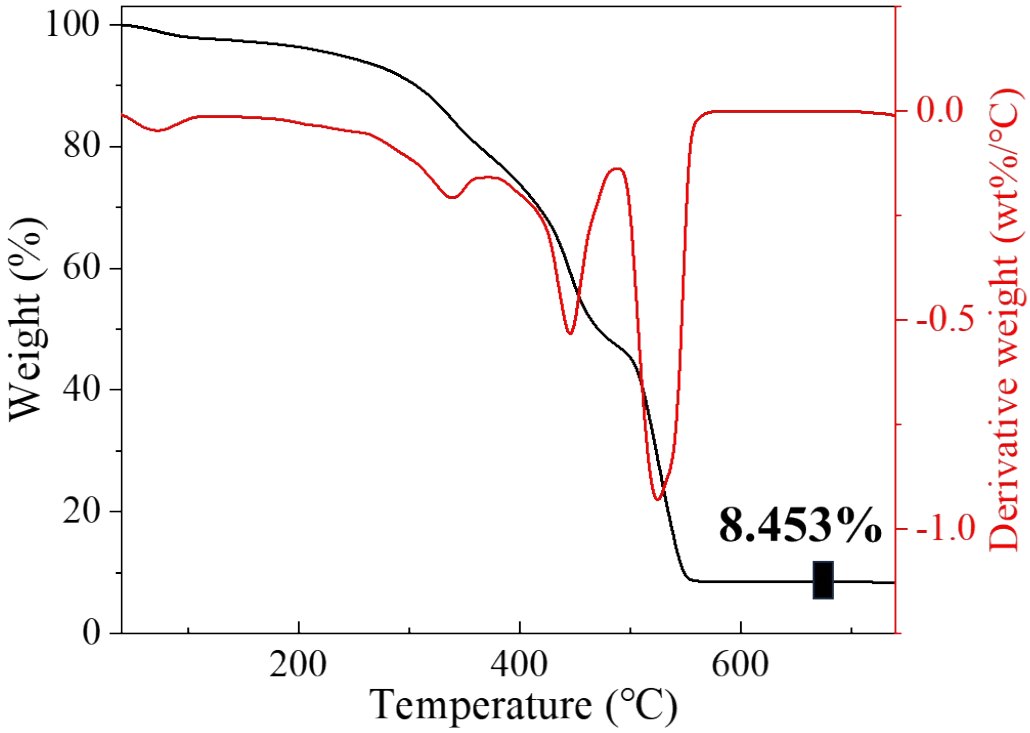

Figure S11. The TG and DTG curves of MoO_3/PVP composites.

Table S2. The comparation between this work and other related studies

Materials	T_{lum}	Tinting speed	ΔT (major performance)	Bleaching speed	Ref
MoO_3/PVP	85.8%	UV 6min	ΔT_{sol}=36.4%	60 min (80 ℃)	This work
MoO_3	N/A	UV 42min	ΔT_{sol}=9.5%	N/A	[S1]
MoO_3/PVA	$T_{750\ nm}$=70%	UV 5min	$\Delta T_{750\ nm}$=65%	30 min (H_2O_2)	[S2]
Ti doped-$W_{18}O_{49}$/PVP	87.5%	UV 10min	ΔT_{sol}=30.1%	30 min (80 ℃)	[S3]
WO_3/PU/PVP	93.7%	UV 5min	ΔT_{sol}=29.5%	60 min (60 ℃)	[S4]
WO_3/sago starch	37.8%	UV 4min	ΔT_{sol}=4.79%	50 min (dark)	[S5]
WO_3/PVP	$T_{550\ nm}$=85%	UV 1min	$\Delta T_{550\ nm}$=40%	＞2h (80 ℃)	[S6]
WO_3/MC/ EG	$T_{640\ nm}$=85%	UV 10min	N/A	3 days (dark)	[S7]

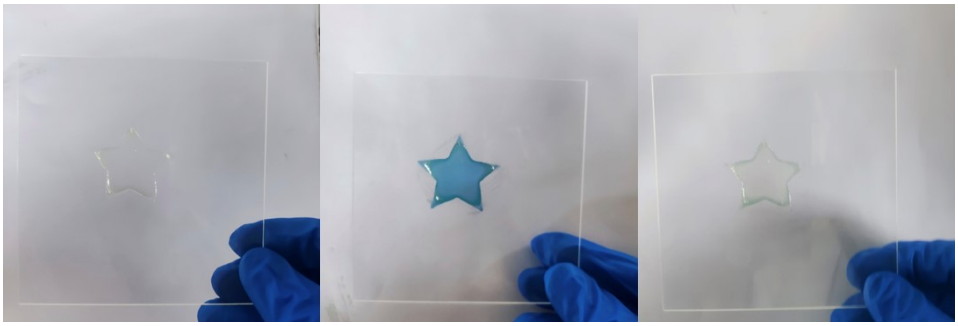

Figure S12. MoO_3 nanosheets applied as optical display medium application

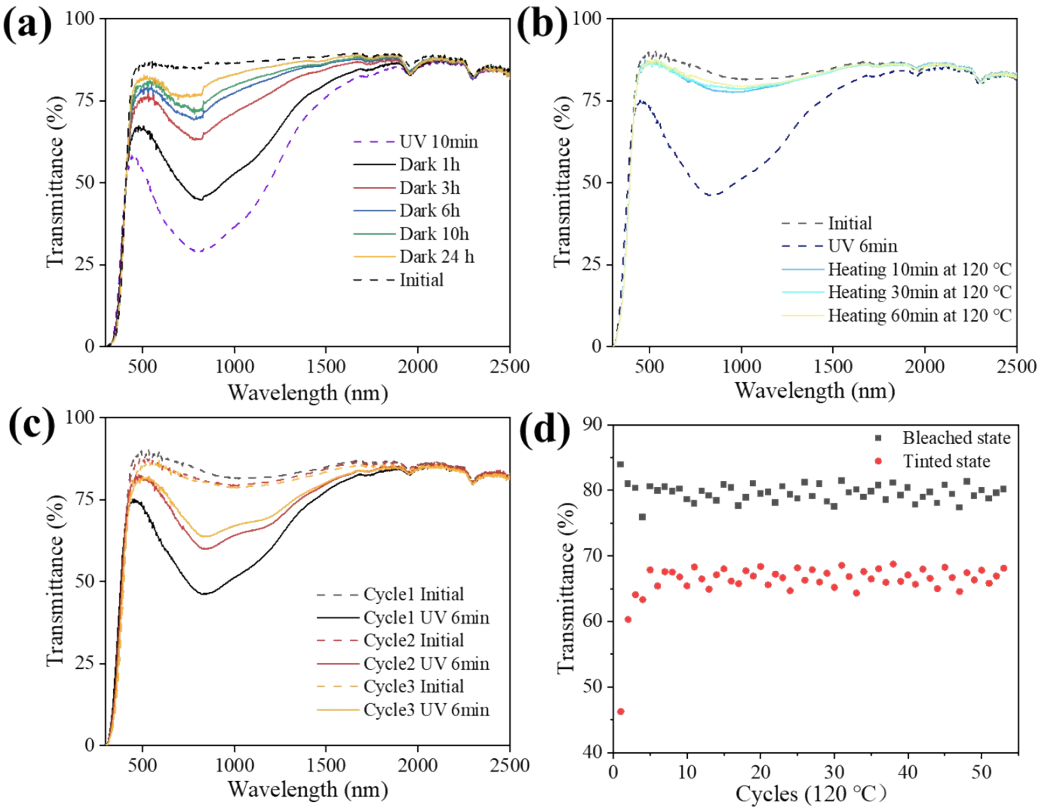

Figure S13. MoO_3 nanosheets film's transmittance spectra at different time under bleaching process at (a) room temperature (25 ℃) and (b) 120 ℃. (c) Second and third cycles of such film heated at 120 ℃. (d) Cyclical performance of the MoO_3 nanosheets film heated at 120 ℃.

Reference

[S1] Samad BA, The effect of coloration on optical properties of molybdenum trioxide thin films prepared by thermal evaporation technique. 2020 Photonics North (PN); 2020: IEEE.

[S2] Cheng C, Zheng Z, Wang A. Fabrication of novel MoO_x/PVA hydrogel nanocomposite for photochromic smart window. Optical Materials. 2024;157:116293.

[S3] Ma T, Li B, Tian S, Qian J, Zhou L, Liu Q, et al. Reversible photochromic $W_{18}O_{49}$: Mechanism revealing and performance improvement for smart windows. Chemical Engineering Journal. 2023;468:143587.

[S4] Li R, Zhou Y, Shao Z, Zhao S, Chang T, Huang A, et al. Enhanced coloration/bleaching photochromic performance of WO_3 based on PVP/PU composite matrix. ChemistrySelect. 2019;4(33):9817-21.

[S5] Kaur J, Kaur N, Sharma A. Enhanced photochromic properties of 1D h-WO_3 embedded in bio-degradable polymer for fabrication of smart windows. Materials Science and Engineering: B. 2024;299:116931.

[S6] Zhou Y, Huang A, Ji S, Zhou H, Jin P, Li R. Scalable preparation of photochromic composite foils with excellent reversibility for light printing. Chemistry–An Asian Journal. 2018;13(4):457-62.

[S7] Yamazaki S, Isoyama K, Shimizu D. Visualization of ultraviolet irradiation using WO_3-cellulose derivatives composite film. Optical Materials. 2020;106:109929.