Photoswitchable WO_{3-x} QDs/Cu NCs Composite Films for Efficient UV Detection and Dual-Mode Anticounterfeiting

Qingmiao Mu, [a] Jia Li, [a] Hongxi Gu,*[a] Lijun Ren, [a] Juan Du,*[a] Hualei Cheng [a] and Dengwei Hu. [a]

AUTHOR ADDRESS

[a.] *Engineering Research Center for Titanium Based Functional Materials and Devices in Universities of Shaanxi Province, Faculty of Chemistry and Chemical Engineering, Baoji University of Arts and Sciences, Baoji 721013 Shaanxi, China.*

Corresponding authors

***E-mail: hello1207@163.com (H. X. Gu); bwldj2010@163.com (J. Du)**

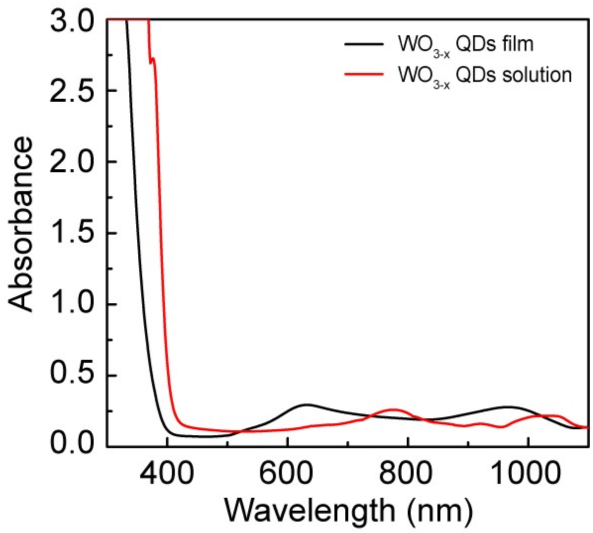

Fig. S1 The UV-Vis absorption spectra of WO_{3-x} QDs films and WO_{3-x} QDs solution.

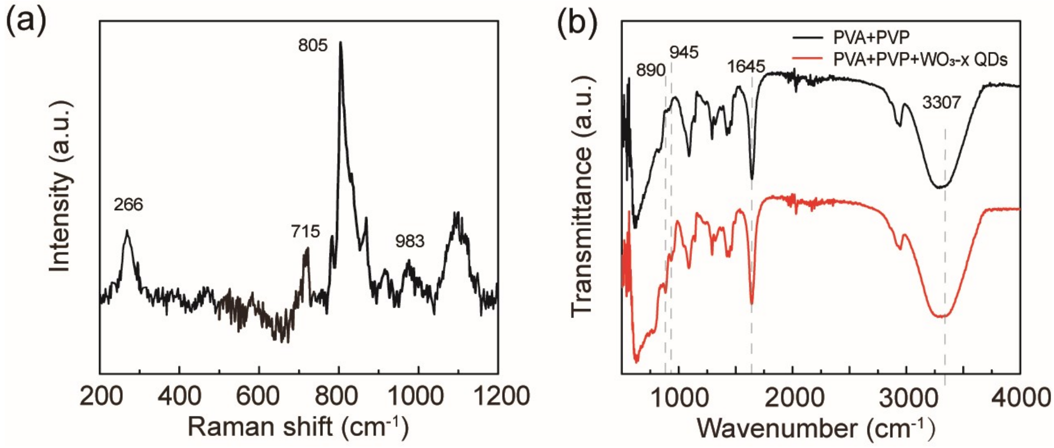

Fig. S2 a) Raman spectrum and b) FTIR spectrum of WO_{3-x} QDs film.

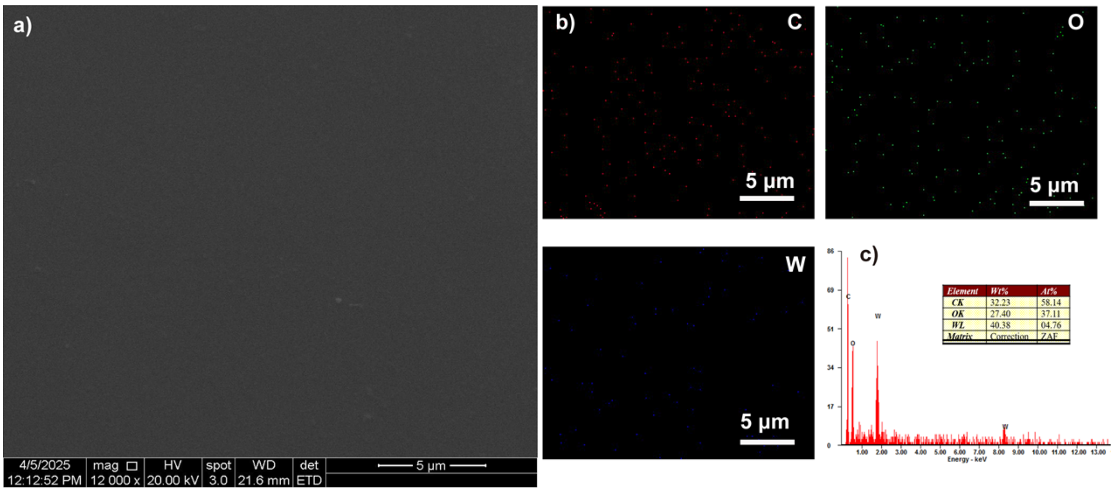

Fig. S3 SEM image and SEM-EDS elemental mapping of WO_{3-x} QDs film
(a) SEM image, (b) elemental mapping, (c) area EDS spectrum and right table for the atomic and weight percentage of various elements.

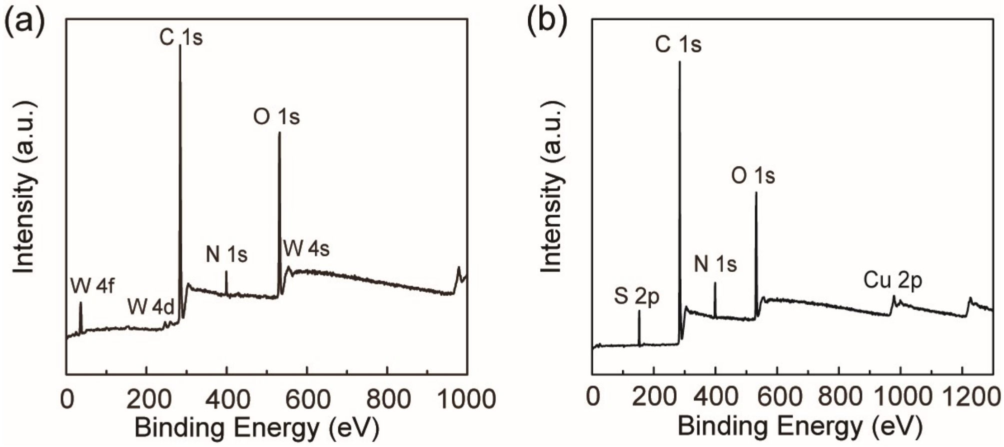

Fig. S4 Full XPS spectrum of a) WO_{3-x} QDs film and b) Cu NCs film.

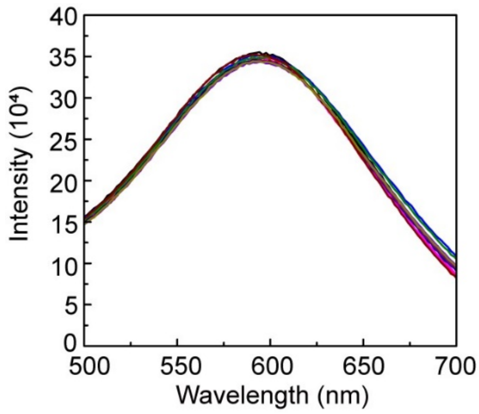

Fig. S5 PL spectrum of Cu NCs film when UV irradiation from 6 min to 60 min.

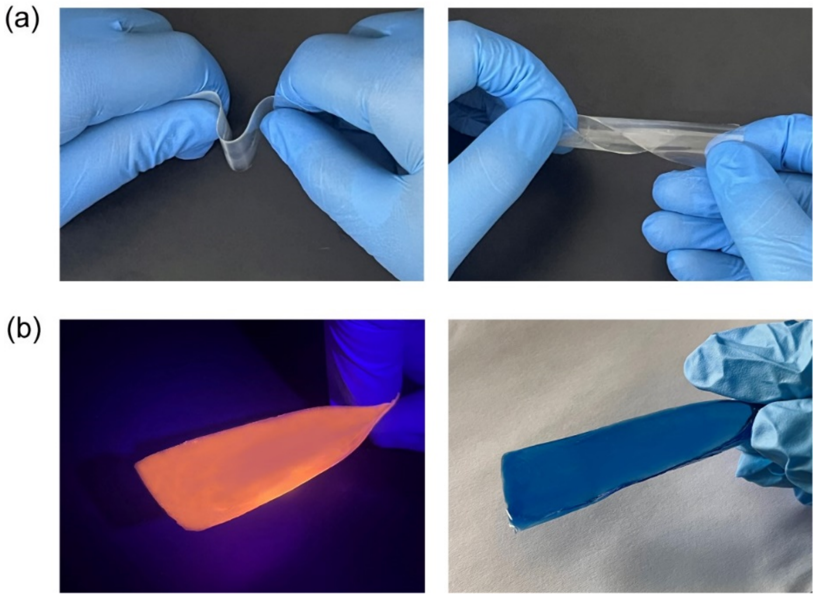

Fig. S6 a) Transparent composite film with flexibility. b) Fluorescence and photochromic pictures of composite film.

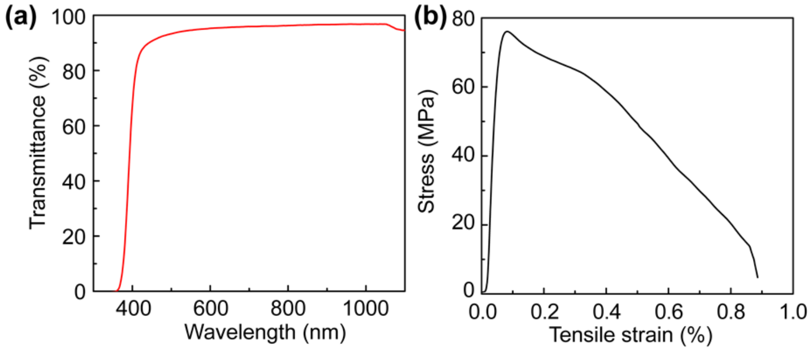

Fig. S7 Transmittance spectra and mechanical property test of the WO_{3-x} QDs/Cu NCs composite film

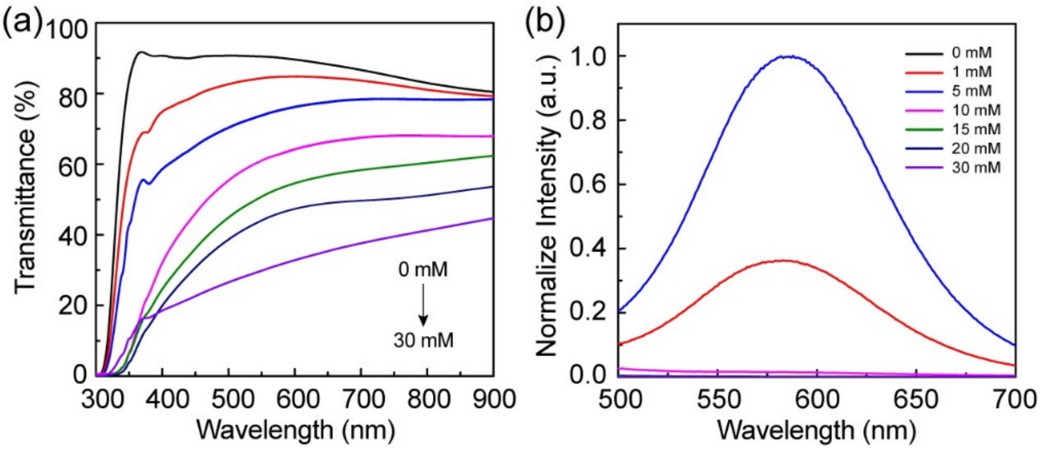

Fig. S8 a) Transmittance spectra and b) PL spectra of the composite film produced by using different amounts of Cu^{2+}, varying from 0 mM (which corresponds to the bare PVA/PVP film) to 1, 5, 10, 15, 20 and 30 mM, respectively.

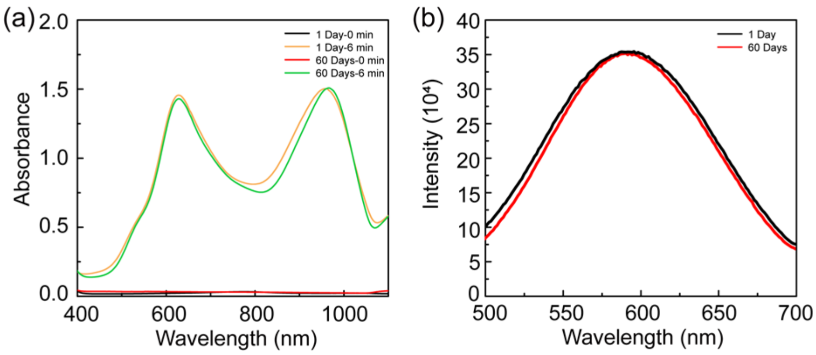

Fig. S9 UV-visible absorption spectra (a) and PL spectra (b) of the composite film before and after 365 nm irradiation under ambient condition for 1 day and 60 days.

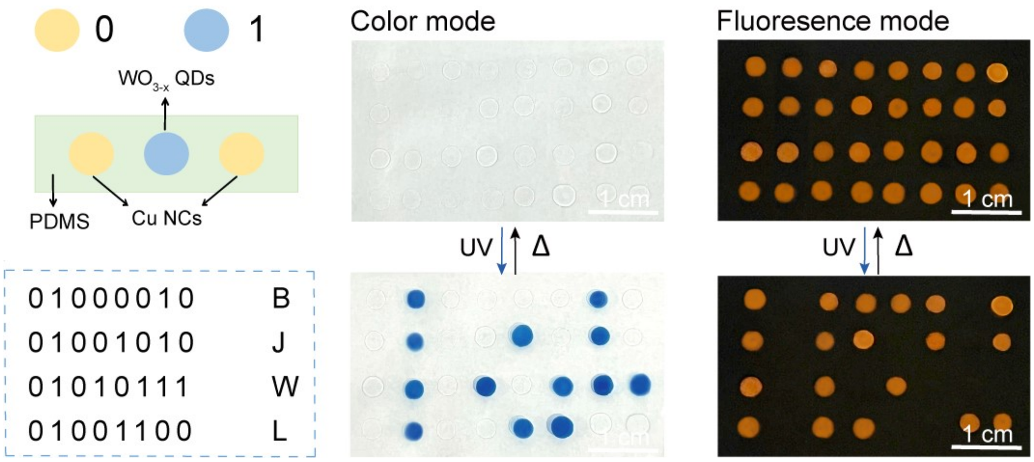

Fig. S10 Schematic diagram of information encryption and the graphs of the fluorescent switches using the binary codes for security data recording.

Table S1. The performance comparison with other similar works

Materials	Wavelength	Sensitivity(J/m^2)	dual-mode	Reference
phosphomolybdic acid/citric acid	UVC	50	Color mode	[S1]
inorganic–organic complex	UVB	50	Color mode	[S2]
phosphomolybdic acid/lactic acid	UVC	25	Color mode	[S3]
3,3′,5,5′-tetramethylbenzidine	UVB	40	Color mode	[S4]
ZnO quantum dots-diacetylenes-zinc(II) nanocomposites	UVB	300	Color mode	[S5]
diarylethene	UVB	>100	Color mode	[S6]
gold-cationic surfactant complexes	UVC	200	Color mode	[S7]
$Ba_{2.99}Eu_{0.01}(PO_4)_2$	UVA	100	Fluorescence mode	[S8]
This work	UVB	50	Fluorescence mode/ Color mode	

References

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