

Supporting Information

Near-infrared light-induced photoisomerization and photodissociation of chiral fluorescent photoswitch in cholesteric liquid crystals assisted by upconversion nanoparticles

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1. General information

All the materials, solvents and reagents were obtained from commercial sources and used as purchased. Column chromatography was carried out on silica gel (200–300 mesh). ^1H -NMR and ^{13}C -NMR spectra were recorded on a Bruker AVANCE III (400 MHz ^1H ; 100 MHz ^{13}C) spectrometer. High-resolution mass spectra (HR-MS) were obtained with XEVO-G2QTOF (ESI) (Waters, USA) in positive ion mode.

2. Characterizations of UCNPs

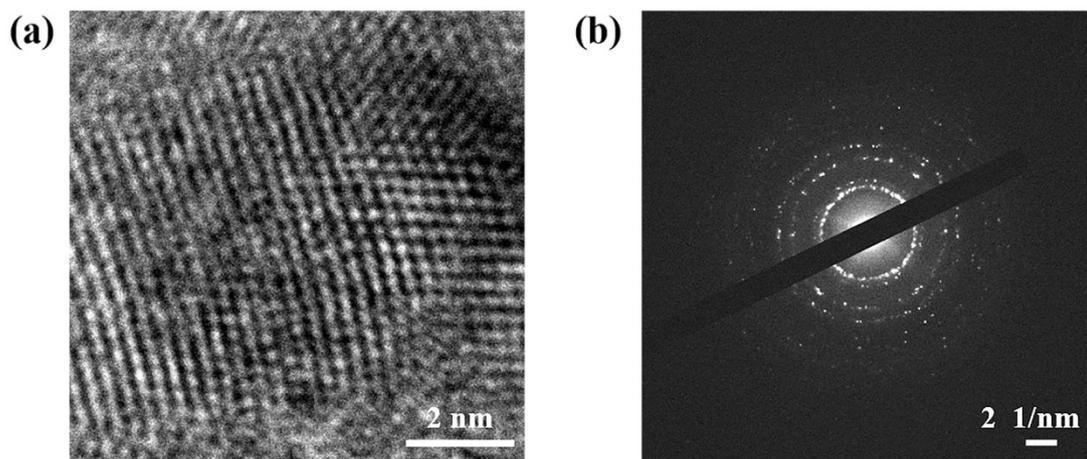


Figure S1. High-resolution transmission electron microscopy (HRTEM) image and selected area electron diffraction (SAED) of UCNPs.

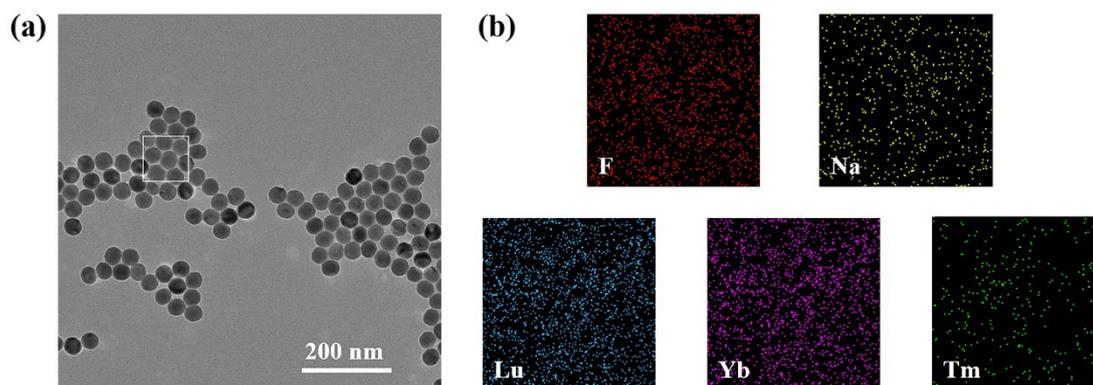


Figure S2. Element mapping of UCNPs.

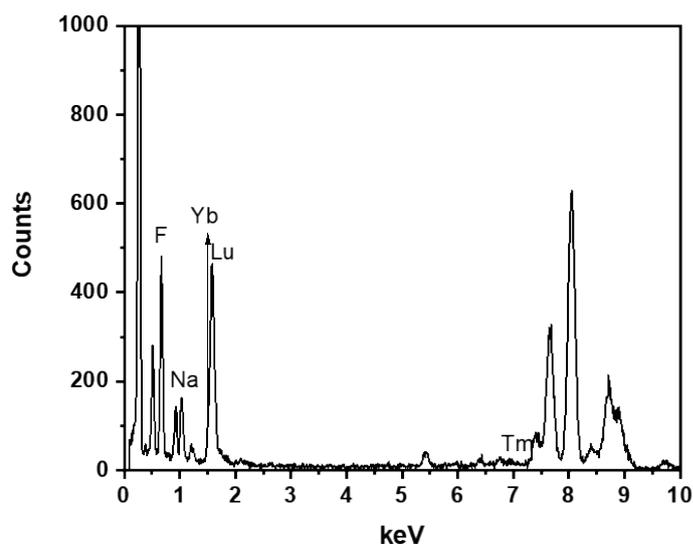


Figure S3. Energy dispersive spectrum (EDS) of UCNPs.

Table S1. Element quantitative analysis of UCNPs

Element	(keV)	Atom%
F	0.677	58.86
Na	1.041	15.79
Lu	1.581	19.45
Yb	1.521	3.82
Tm	7.179	2.08

3. Synthesis of switch 5

The switch **5** were synthesized according to the procedure in our previous report.¹

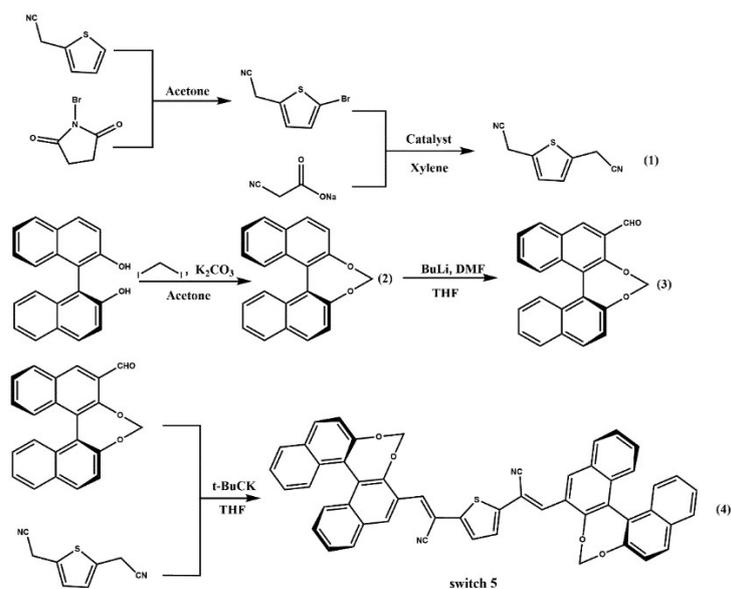


Figure S4. Synthetic procedure of switch **5**.

Characterization data for switch **5**:

$^1\text{H-NMR}$ (400 MHz, Chloroform- d) δ 8.92 (s, 2H; Ar H), 8.10 -7.92 (m, 8H; Ar H), 7.55-7.42 (m, 12H; Ar H), 7.41-7.29 (m, 4H; Ar H), 5.76 (d, $J = 3.4$ Hz, 2H; CH_2), 5.67 (d, $J = 3.4$ Hz, 2H; CH_2).

$^{13}\text{C-NMR}$ (100 MHz, Chloroform- d) δ 151.18, 148.75, 140.21, 134.37, 133.16, 132.05, 131.82, 131.10, 130.80, 129.56, 129.36, 128.51, 128.31, 127.87, 126.85, 126.62, 126.35, 126.03, 125.53, 125.45, 125.24, 120.68, 116.34, 107.20, 103.10, 58.50.

HR-MS (ESI) m/z : $[\text{M}+\text{Na}]^+$ calculated for $[\text{C}_{52}\text{H}_{30}\text{N}_2\text{O}_4\text{SNa}]^+$, 801.1798; found, 801.1808.

4. Characterizations of switch **5**

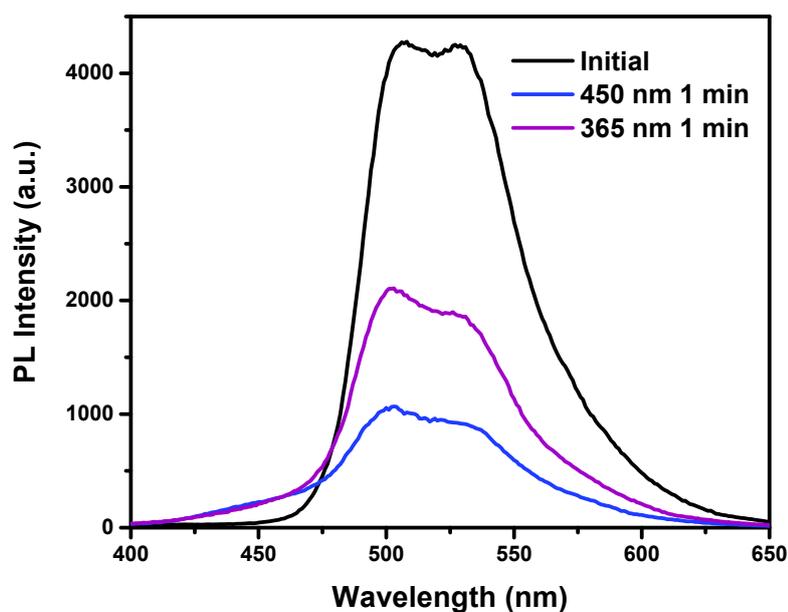


Figure S5. Fluorescence spectra of switch **5** in dichloromethane upon irradiation with 450 nm blue light and 365 nm UV light.

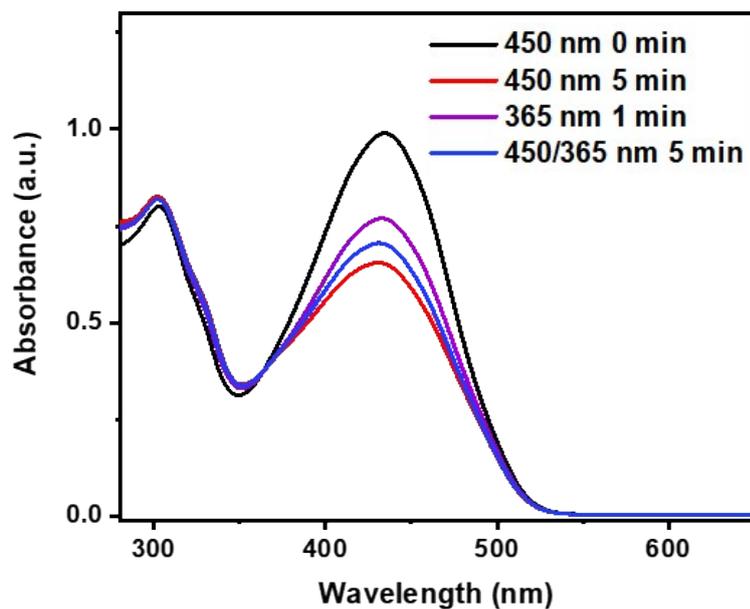


Figure S6. Absorption spectra of switch **5** in dichloromethane upon irradiation with the same intensity of 450 nm blue light and 365 nm UV light.

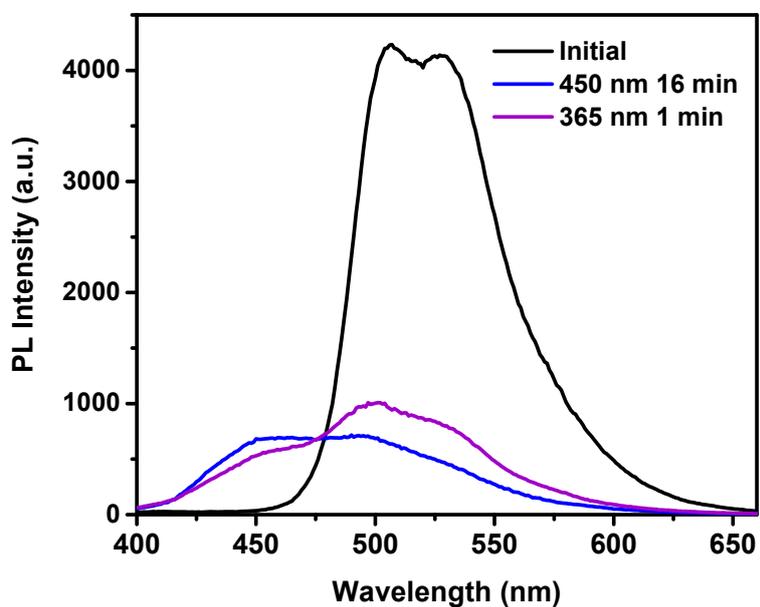


Figure S7. Fluorescence spectra of switch **5** in dichloromethane in different conditions: irradiation with 450 nm blue light for 16 min and then with 365 nm UV light for 1 min.

5. Chirality changes of switch 5/UCNPs in DCM

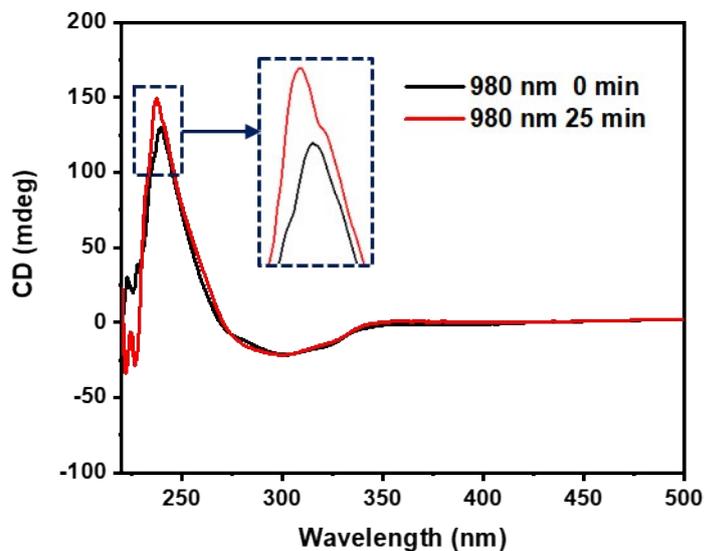


Figure S8. Circular dichroism (CD) spectra of switch 5/UCNPs in DCM upon irradiation with 980 nm NIR light.

6. Phototuning of fluorescent single-mode CLC cell with 1.0 wt% switch 5 and UCNPs

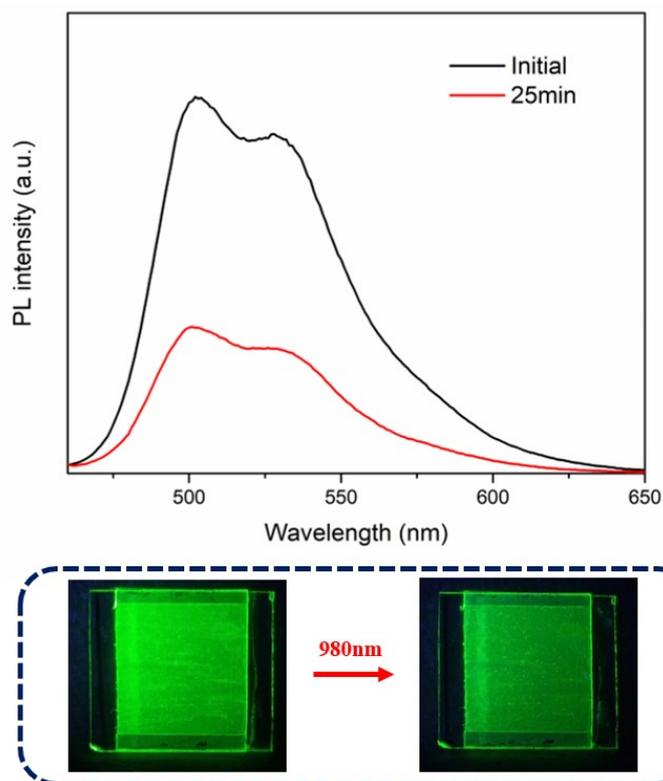
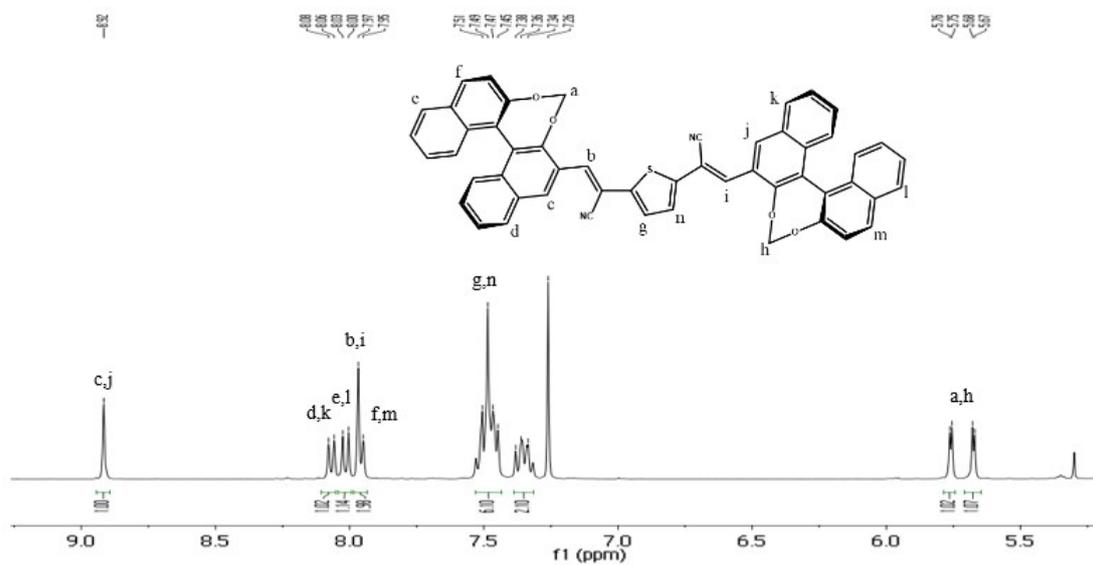


Figure S9. Fluorescence spectra and images of 1.0 wt% switch 5/UCNPs co-doping

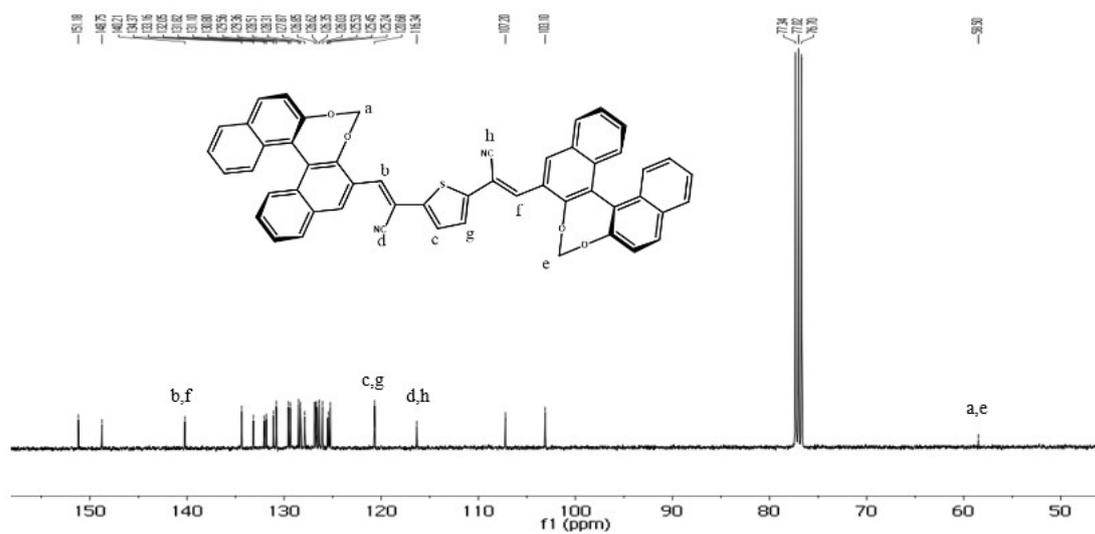
CLC cell.

7. $^1\text{H-NMR}$ and $^{13}\text{C-NMR}$ spectra of switch **5**

$^1\text{H-NMR}$ spectrum of switch **5**



$^{13}\text{C-NMR}$ spectrum of switch **5**



References:

- [1] S. Lin, J. Li, H. K. Bisoyi, A. Juan, J. Guo and Q. Li, *ChemPhotoChem*, 2019, **3**, 480-486.