Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Photocontrolled reversible modulation of lanthanide luminescence in mesoporous silica nanospheres by photochromic diarylethenes

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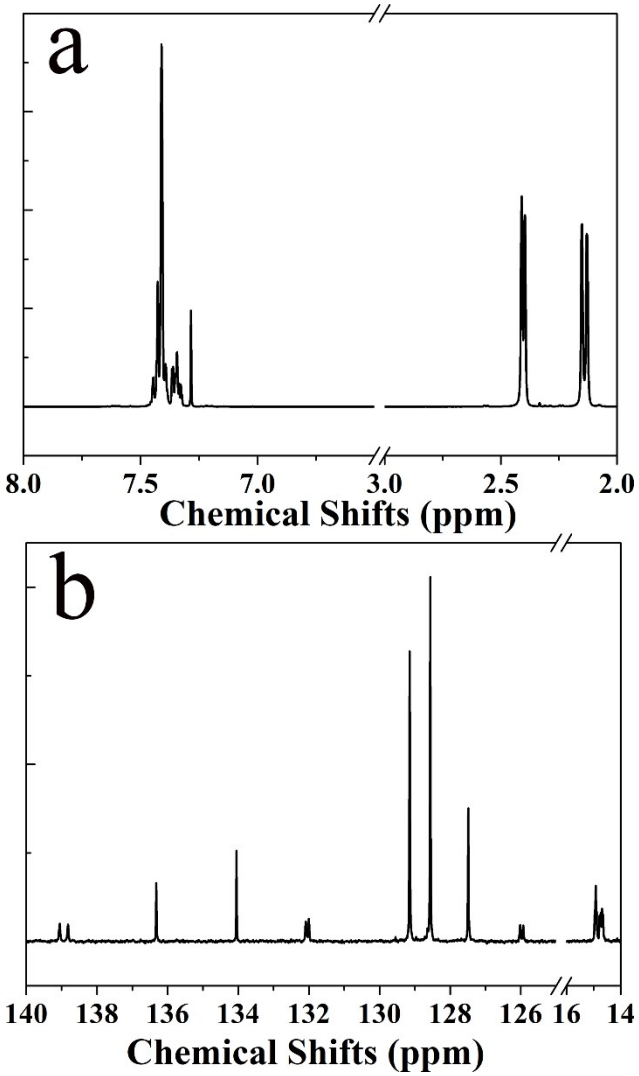

Fig. S1 ^{1}H-NMR (a) and ^{13}C-NMR (b) of open-form BTHFC. ^{1}H-NMR (400MHz, $CDCl_3$) δ ppm: 7.45-7.30 (10H, m), 2.40 (6H, d), 2.15 (6H, d). ^{13}C-NMR (100MHz, $CDCl_3$) δ ppm: 139.0, 138.8, 136.2, 134.0, 132.1,132.0, 129.1, 128.5, 127.5, 126.0, 125.9, 14.9, 14.7.

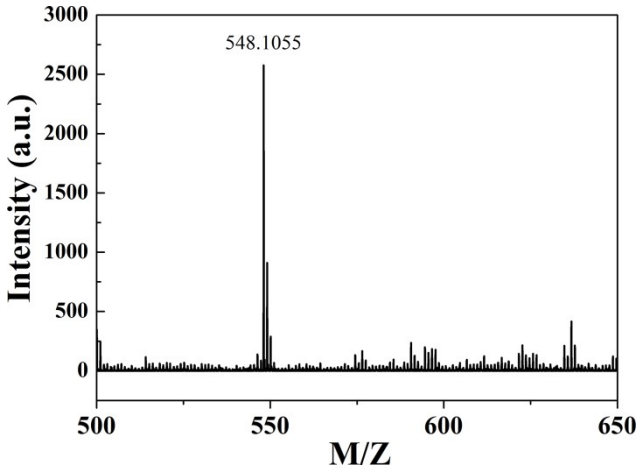

Fig. S2 High resolution mass spectrum (HR-MS) of open-form BTHFC. (M^{+}=548.1055)

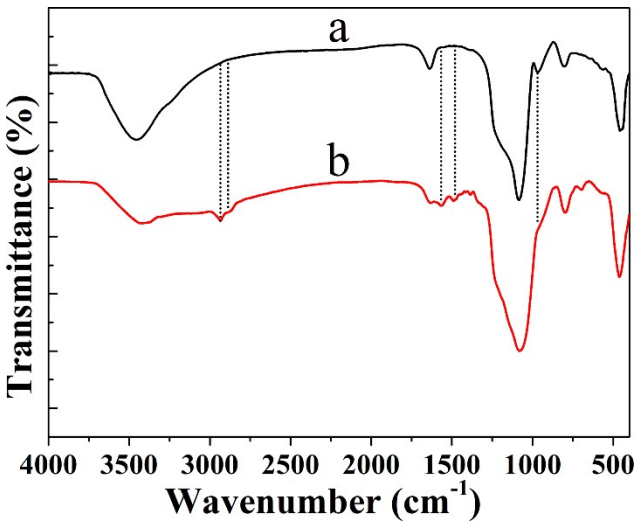

Fig. S3 FT-IR spectra of MSNs (black line) and NH_2-MSNs (red line). The peak near 3420 cm^{-1} and 1630 cm^{-1} can be assigned to the stretching vibration of O-H and bending vibration of H-O-H, respectively (Fig. S3a and b). The results indicate the presence of adsorbed water molecules in the samples. The peak located at 1485 cm^{-1} is ascribed to the scissoring vibrations of CH_2- (Fig. S3b).[1] Moreover, the stretching of Si-C is also observed at 695 cm^{-1} (Fig. S3b).[2]

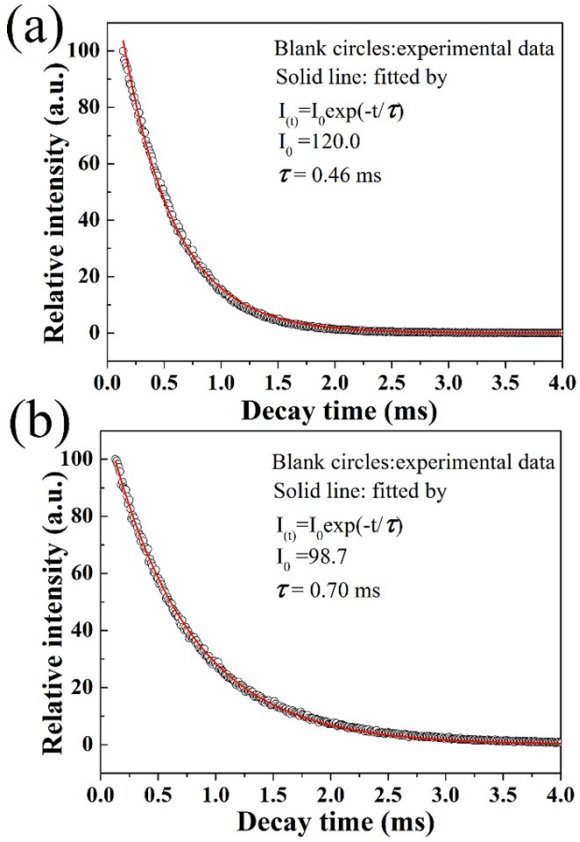

Fig. S4 The luminescence lifetime curves of $Eu(DBM)_3 \cdot phen$(a) and NH_2-MSNs@$Eu(DBM)_3 \cdot phen$ (b).

Table S1 The lifetimes and quantum yields of $Eu(DBM)_3$·phen and NH_2-MSNs@$Eu(DBM)_3$·phen.

Samples	Lifetimes (ms)	Quantum yields (%)
$Eu(DBM)_3$·phen	0.46	32.7
NH_2-MSNs@$Eu(DBM)_3$·phen	0.70	12.5
NH_2-MSNs@BTHFC/$Eu(DBM)_3$·phen	0.69	12.2

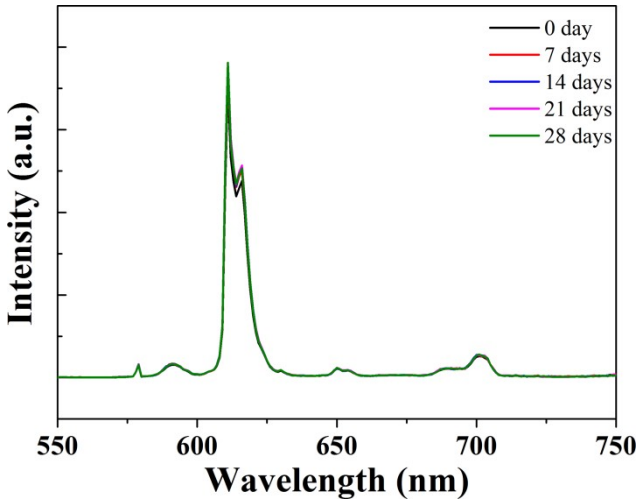

Fig. S5 The luminescence intensity changes of NH_2-MSNs@$Eu(DBM)_3$·phen within 4 weeks.

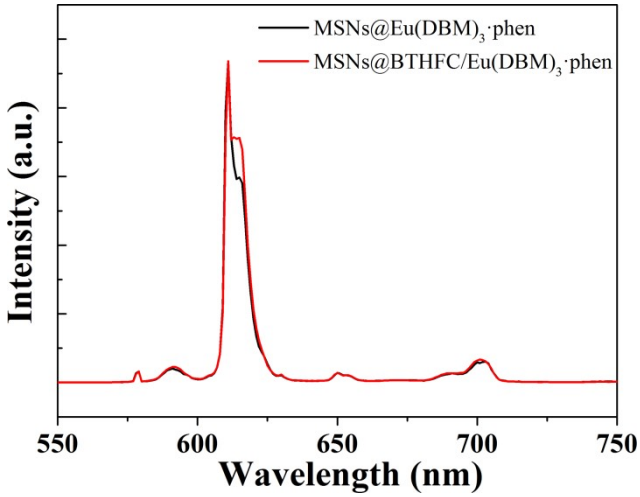

Fig. S6 Emission spectra of NH_2-MSNs@$Eu(DBM)_3$·phen and NH_2-MSNs@BTHFC/$Eu(DBM)_3$·phen.

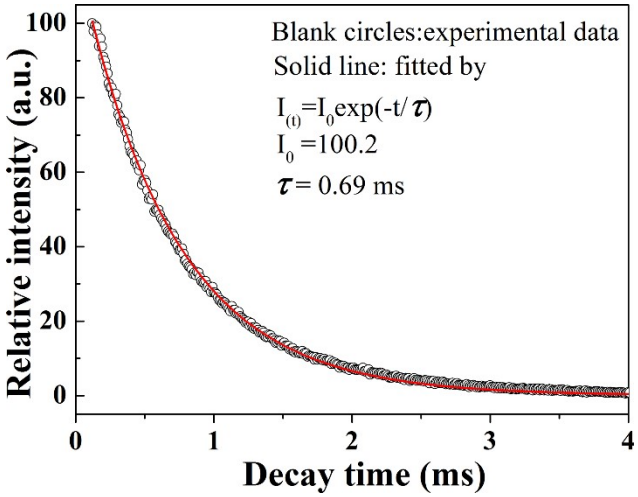

Fig. S7 The luminescence lifetime curves of NH_2-MSNs@BTHFC/Eu(DBM)$_3$·phen.

Table S2 The size of pores, BET surface area and total volume of pores of MSNs, NH_2-MSNs and NH_2-MSNs@BTHFC/Eu(DBM)$_3$·phen.

Sample	Size of pores (nm)	BET surface area (m^2 g^{-1})	Total volume of pores (cm^3 g^{-1})
MSNs	22.5	452	2.54
NH_2-MSNs	21.4	366	1.96
NH_2-MSNs@BTHFC/Eu(DBM)$_3$·phen	21.0	319	1.67

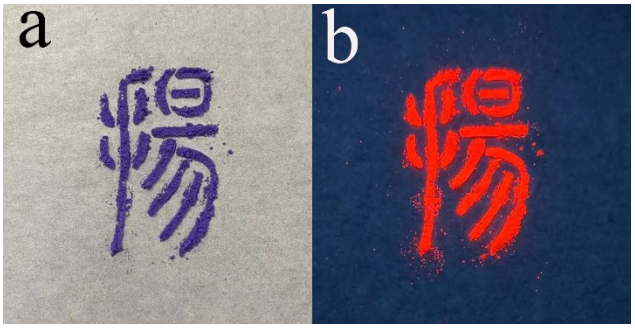

Fig. S8 The photographic images of NH_2-MSNs@BTHFC/Eu(DBM)$_3$·phen after irradiation with the 254 nm UV lamp (a), The luminescence images of NH_2-MSNs@BTHFC/Eu(DBM)$_3$·phen under the 365 nm UV lamp (b).

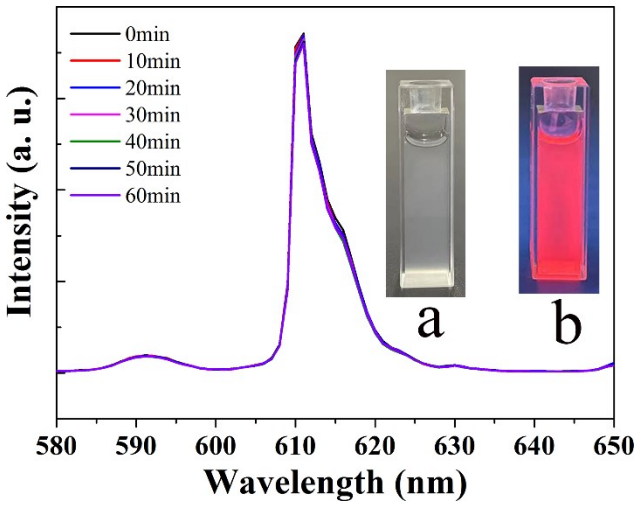

Fig. S9 The emission spectra of NH_2-MSNs@BTHFC/Eu(DBM)$_3$·phen dispersion (0.5 mg/mL) and corresponding photographic image under daylight (a) or under the 365 nm UV lamp (b). This result showed that the luminescence intensity of NH_2-MSNs@BTHFC/Eu(DBM)$_3$·phen in aqueous solution remained stable within 1 h.

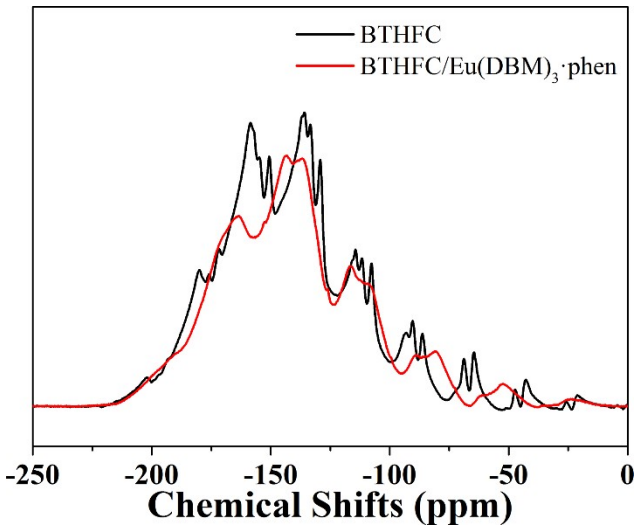

Fig. S10 Solid-state ^{19}F NMR spectra of BTHFC and BTHFC/Eu(DBM)$_3$·phen (the molar ratio of BTHFC and Eu(DBM)$_3$·phen is 1:1).

Reference

1. P. Premila, C. Subbu, S. Rajendran and K. S. Kumar, *Appl. Surf. Sci*., 2018, 449, 426-434.

2. P. G. Song, Y. Shen, B. X. Du, Z. H. Guo and Z. P. Fang, *Nanoscale*, 2009, 1, 118-121.