Supporting information

A facile electrodeposition fabricated luminescent MOF thin film for

selective and recyclable sensing of nitroaromatic explosives

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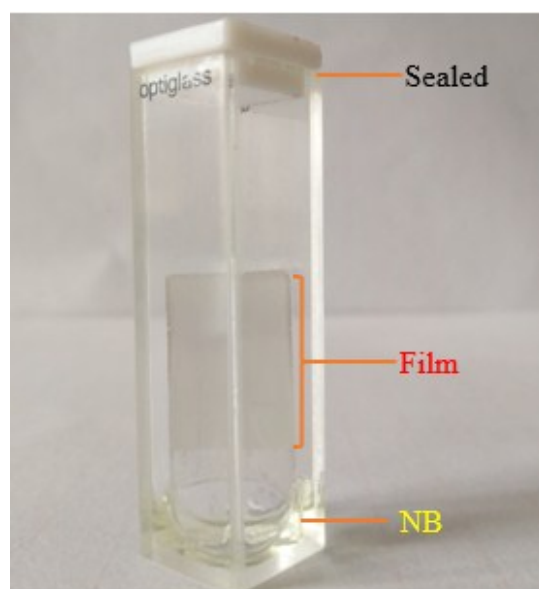
Fig. S1 The experimental setup for the solid-gas detection nitrobenzene (NB) vapor.
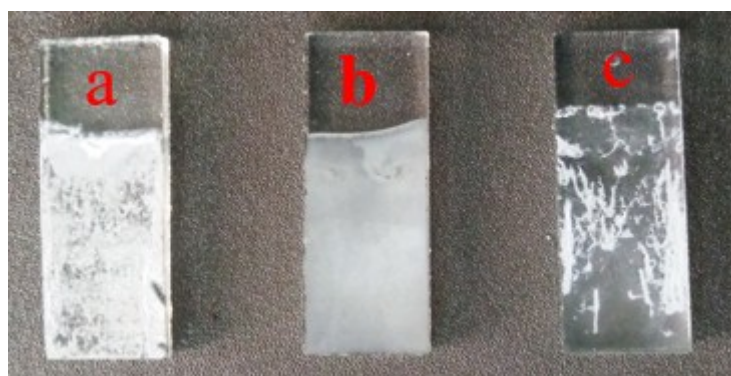

Fig. S2 The as-prepared thin films with different supporting electrolyte: (a) KCl, (b) NH_4NO_3, (c) Tetrabutylammonium hexafluorophosphate.
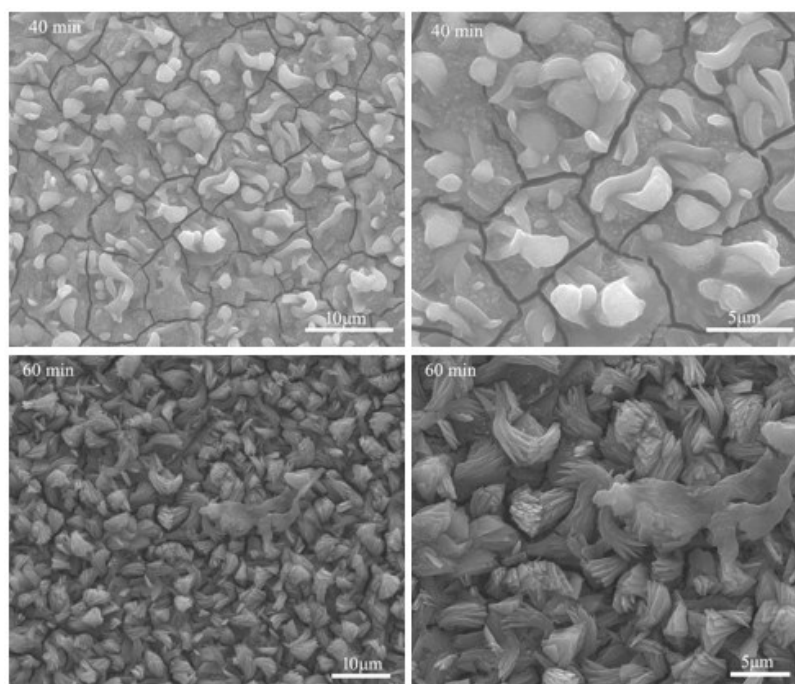
Fig. S3 Top-down SEM micrographs of the films at the time of 40 min (up) and 60 min (down).
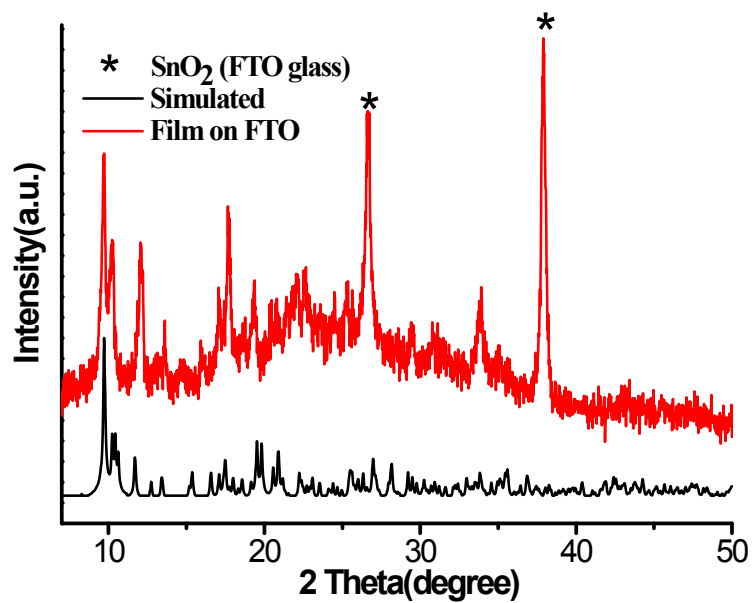

Fig. S4 Powder X-ray diffraction patterns of electrodeposited thin film.
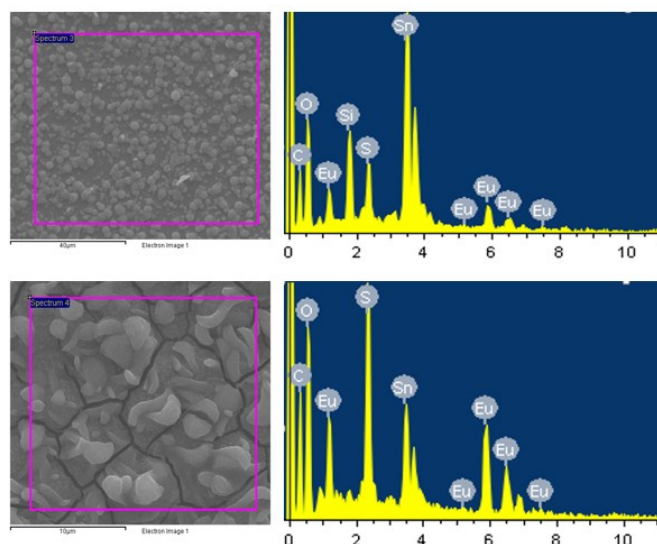
Fig. S5 The energy dispersive spectrometer (EDS) of Eu-TDC thin film.
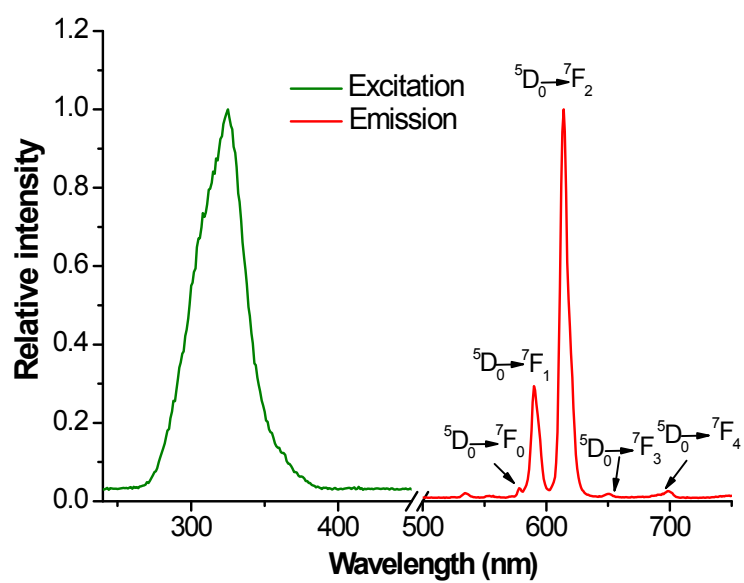

Fig. S6 Excitation and emission spectra of the Eu-TDC film in methanol.
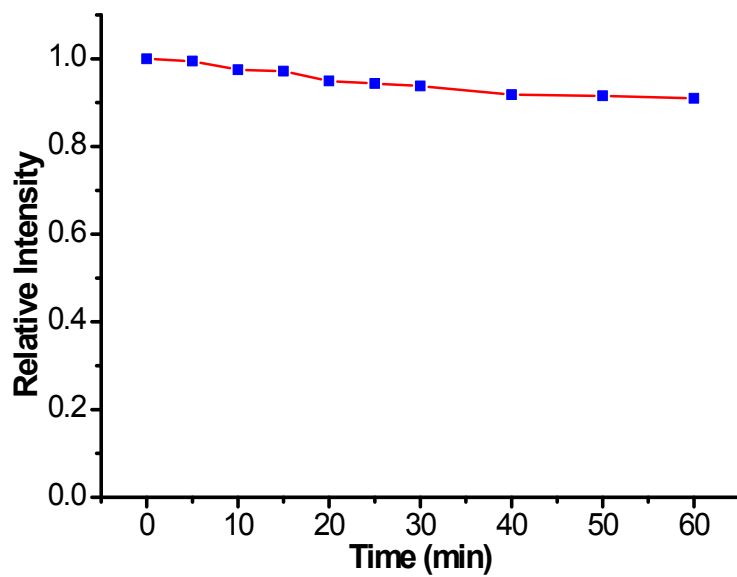
Fig. S7 Time-dependent $^5D_0{\rightarrow}^7F_2$ normalized intensities of Eu-TDC film immersed in methanol.
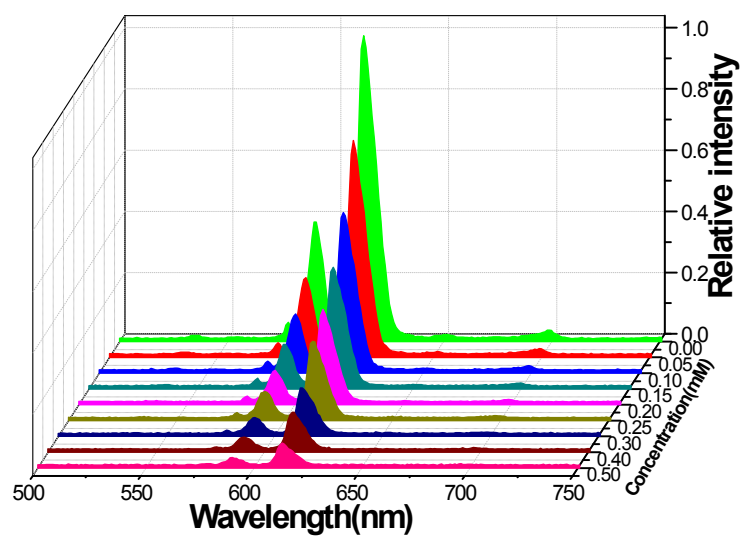

Fig. S8 Concentration-dependent fluorescence quenching of Eu-TDC thin film upon the addition of different concentrations (mM) of 2,4-DNP in methanol.

Fig. S9 Concentration-dependent fluorescence quenching of Eu-TDC thin film upon the addition of different concentrations (mM) of 4-NP in methanol.

Fig. S10 Concentration-dependent fluorescence quenching of Eu-TDC thin film upon the addition of different concentrations (mM) of TNT in methanol.

Fig. S11 Concentration-dependent fluorescence quenching of Eu-TDC thin film upon the addition of different concentrations (mM) of 2,4-DNT in methanol.
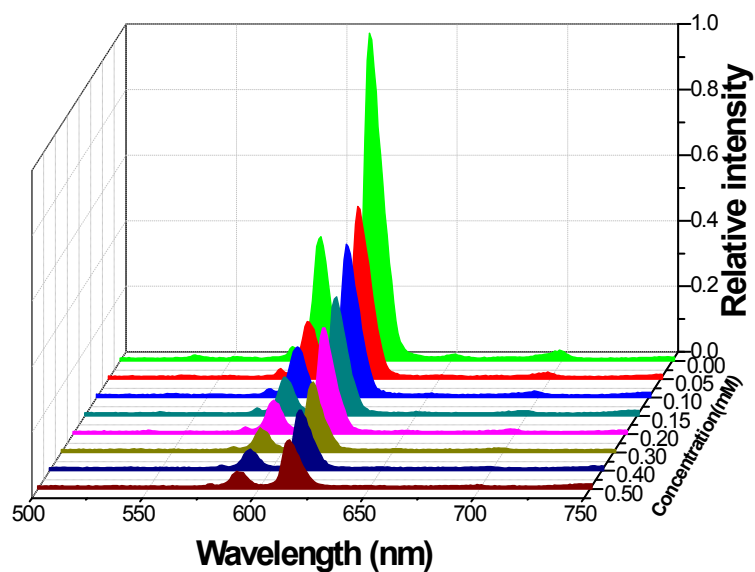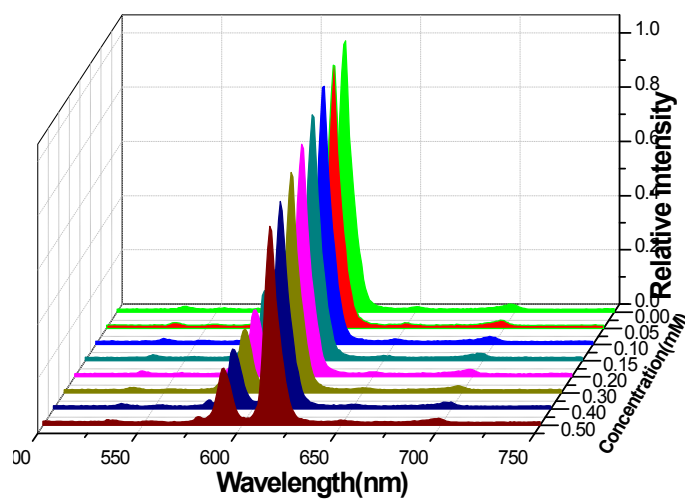

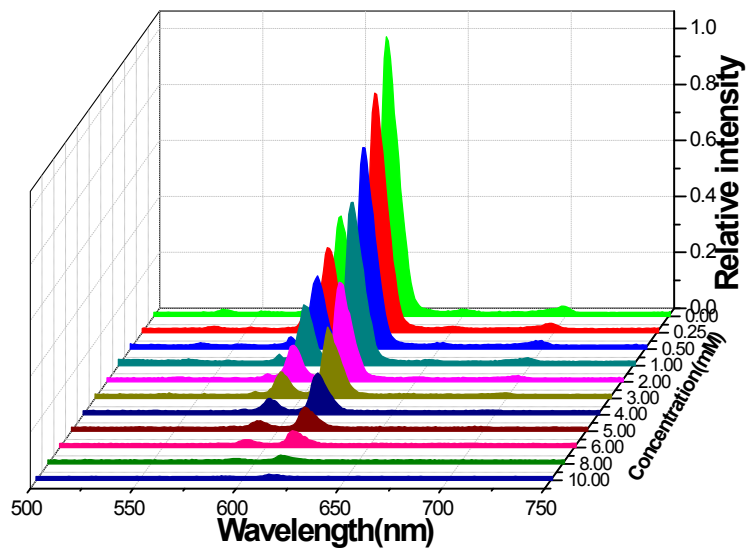**Fig. S12** Concentration-dependent fluorescence quenching of Eu-TDC thin film upon the addition of different concentrations (mM) of 4-NT in methanol.

Fig. S13 Concentration-dependent fluorescence quenching of Eu-TDC thin film upon the addition of different concentrations (mM) of NB in methanol.
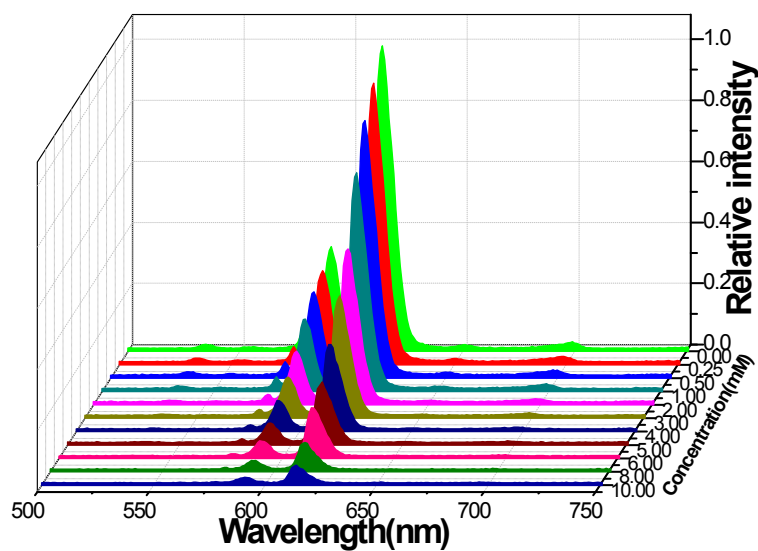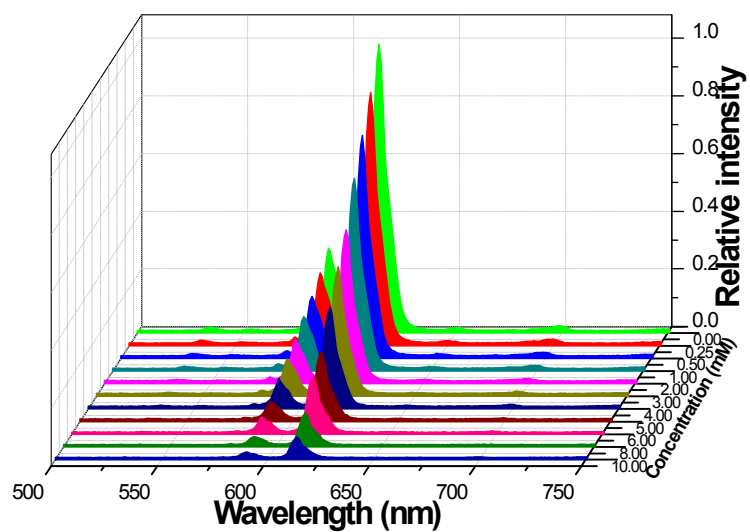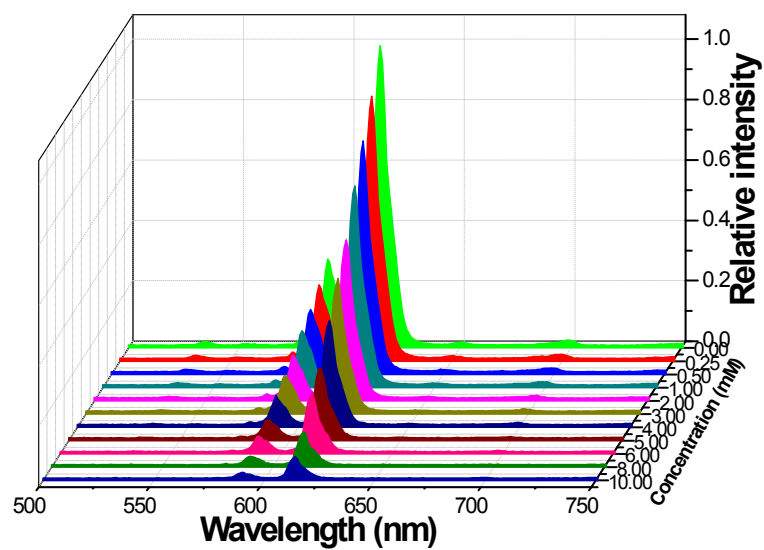

Fig. S14 Concentration-dependent fluorescence quenching of Eu-TDC thin film upon the addition of different concentrations (mM) of NB in methanol.
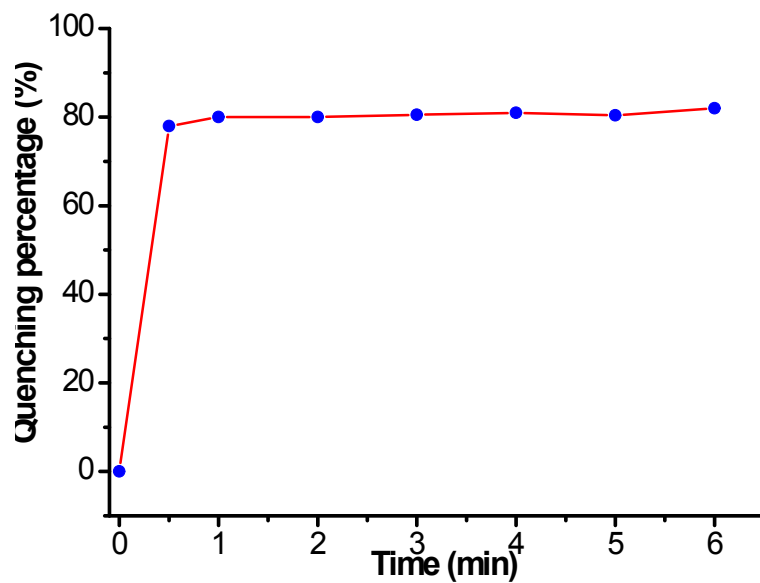
Fig. S15 Time-dependent quenching percentage of Eu-TDC film immersed in 0.2 mM TNP solution of methanol.

Fig. S16 Stern-Volmer plot in response to 2,4-DNP. Inset shows the Stern-Volmer plot in the 2,4-DNP concentration range of 0~0.25 mM at room temperature.

Fig. S17 Stern-Volmer plot in the TNT concentration range of 0~0.5 mM at room temperature.
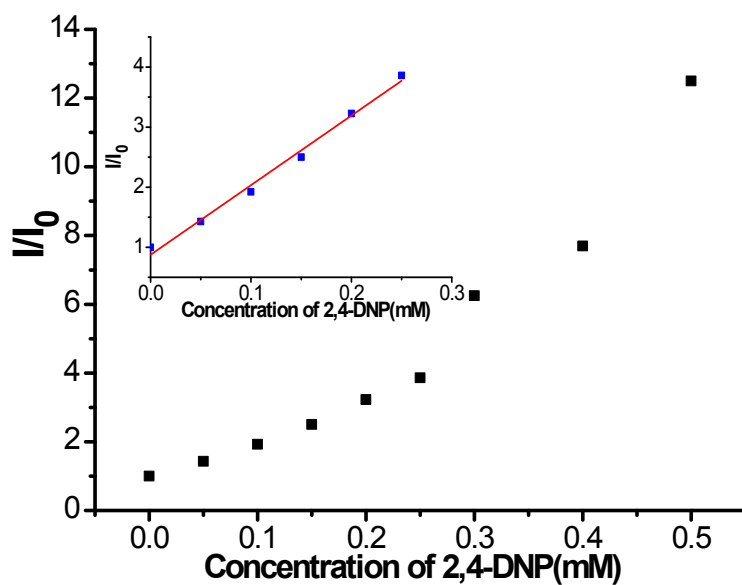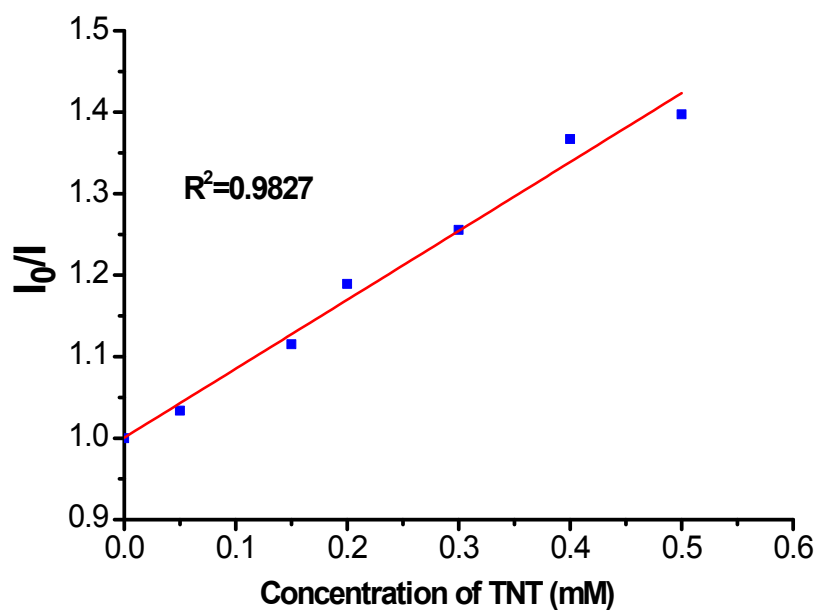

Fig. S18 Stern-Volmer plot in response to 2,4-DNT. Inset shows the Stern-Volmer plot in the 2,4-DNP concentration range of 0~3.0 mM at room temperature.

Fig. S19 Stern-Volmer plot in response to 4-NT. Inset shows the Stern-Volmer plot in the 4-NT concentration range of 0~3.0 mM at room temperature.

Fig. S20 Stern-Volmer plot in response to NB. Inset shows the Stern-Volmer plot in the NB concentration range of 0~4.0 mM at room temperature.
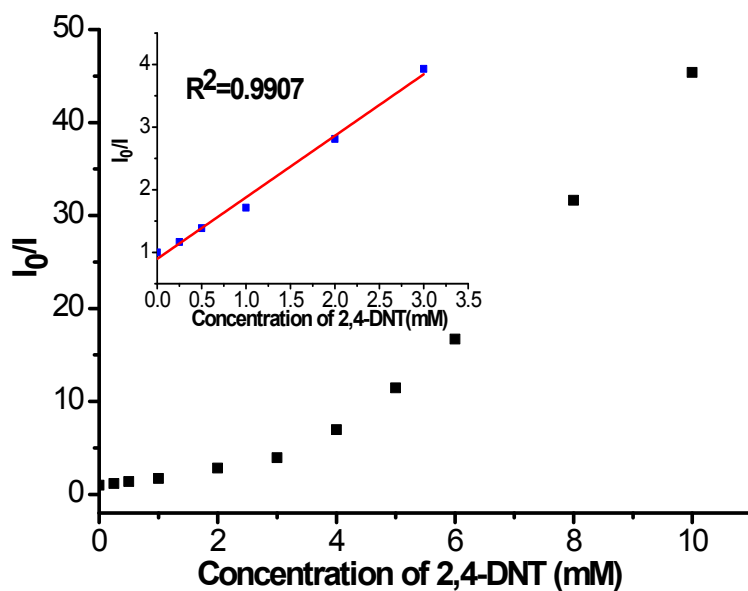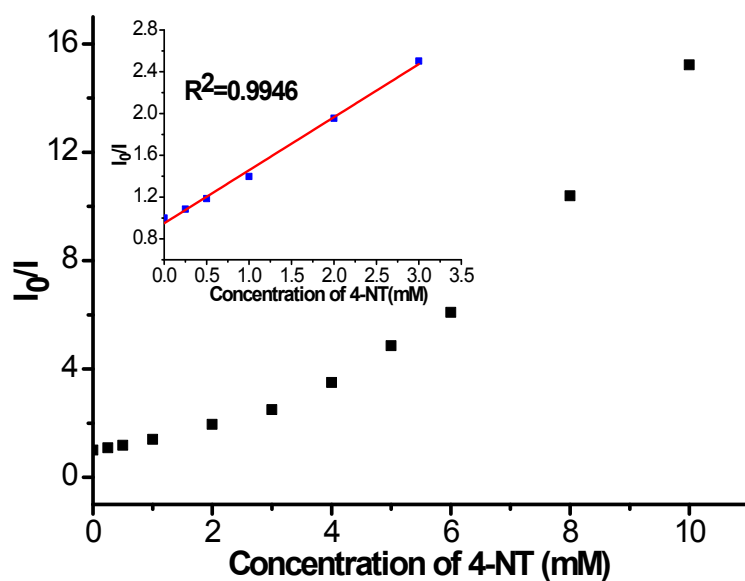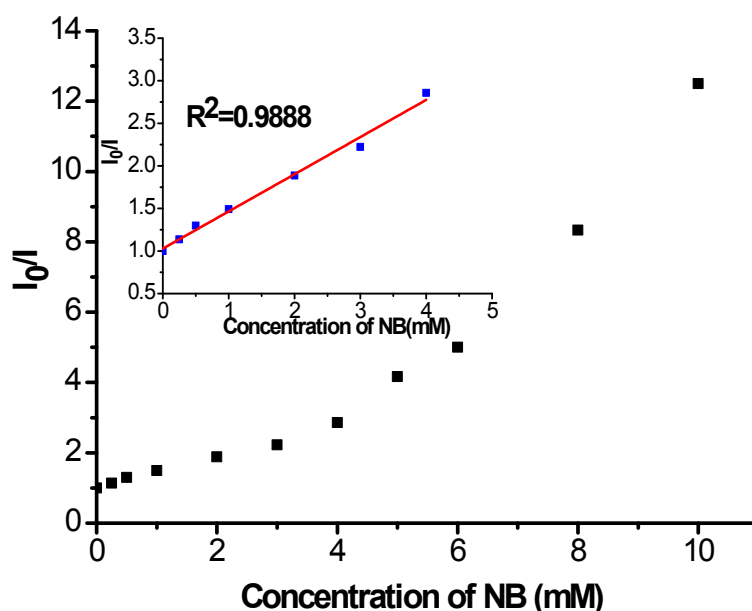
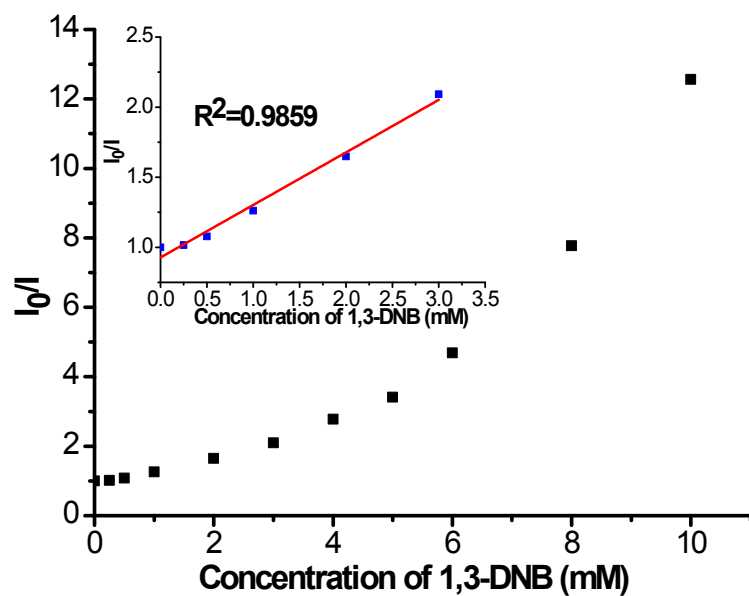**Fig. S21** Stern-Volmer plot in response to 1,3-DNB. Inset shows the Stern-Volmer plot in the 1,3-DNB concentration range of 0~3.0 mM at room temperature.
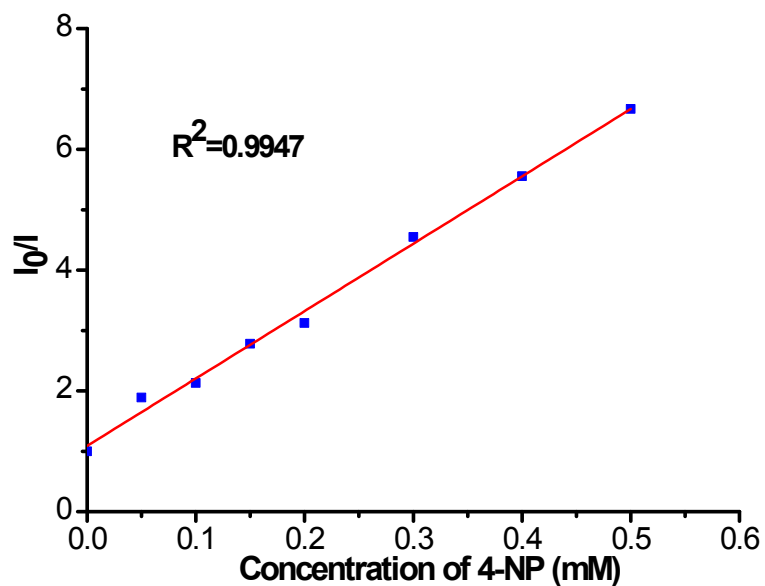

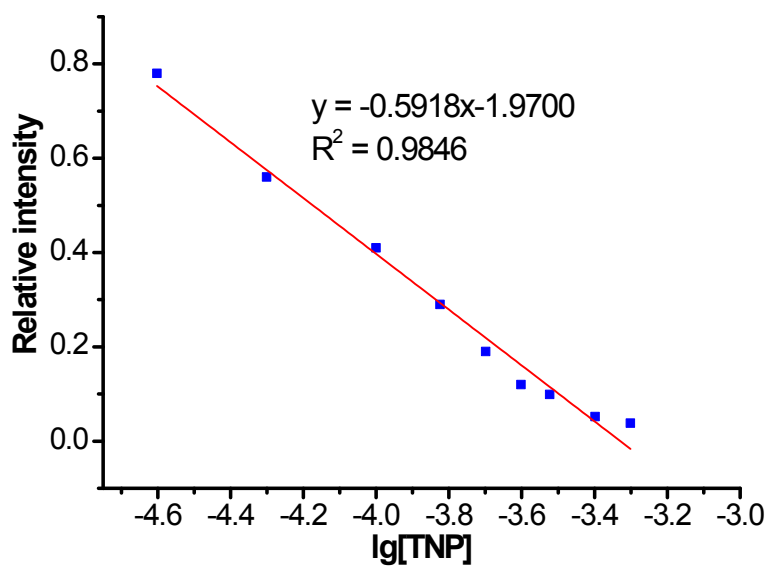**Fig. S22** Stern-Volmer plot in the 4-NP concentration range of 0~0.5 mM at room temperature.

Fig. S23 A linear relationship between I/I_0 at 615 nm of Eu-TDC thin film and lg[TNP].
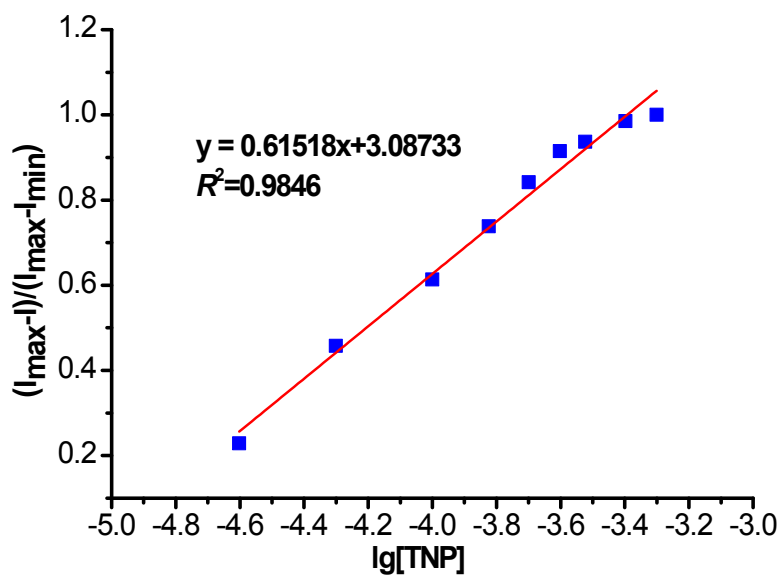
Fig. S24 Luminescence response to changing TNP concentration.
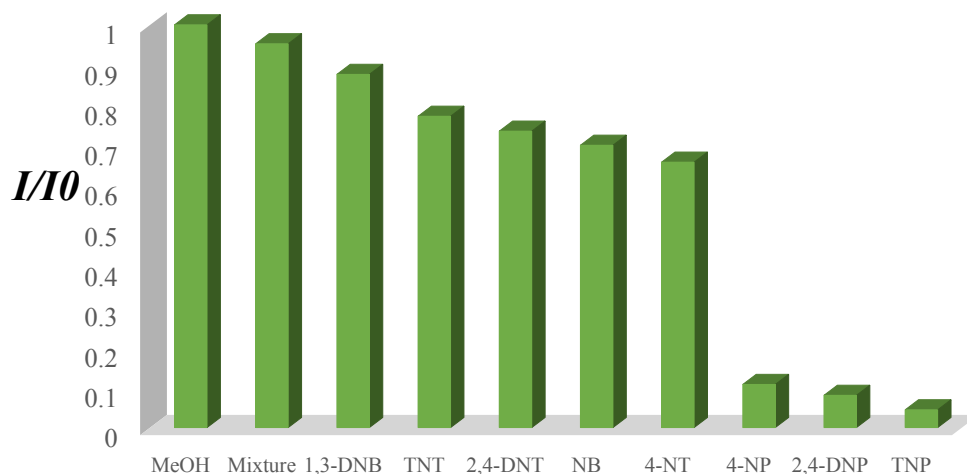
Fig. S25 Luminescence relative intensity (I/I_0) of the films immersed in the mixture solution that containing 0.5 mM different of NACs (the mixture is methanol solution containing 50 mM common solvent molecules, such as dichloromethane (DCM), *N,N*-dimethylformamide (DMF), tetrahydrofuran (THF), chloroform, acetonitrile, *m*-xylene, ethylbenzene, chlorobenzene and acetone).
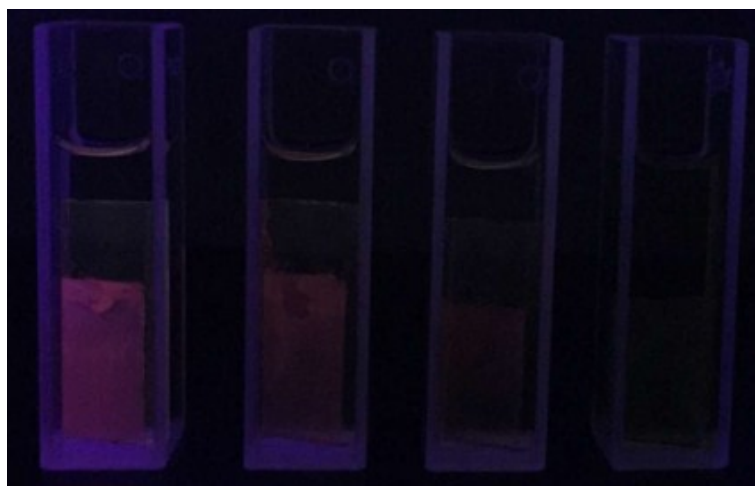
Fig. S26 Photographs of Eu-TDC thin films under UV lamp excitated at 254 nm in the presence of various TNP concentrations (0, 0.05, 0.15 and 0.3 mM).
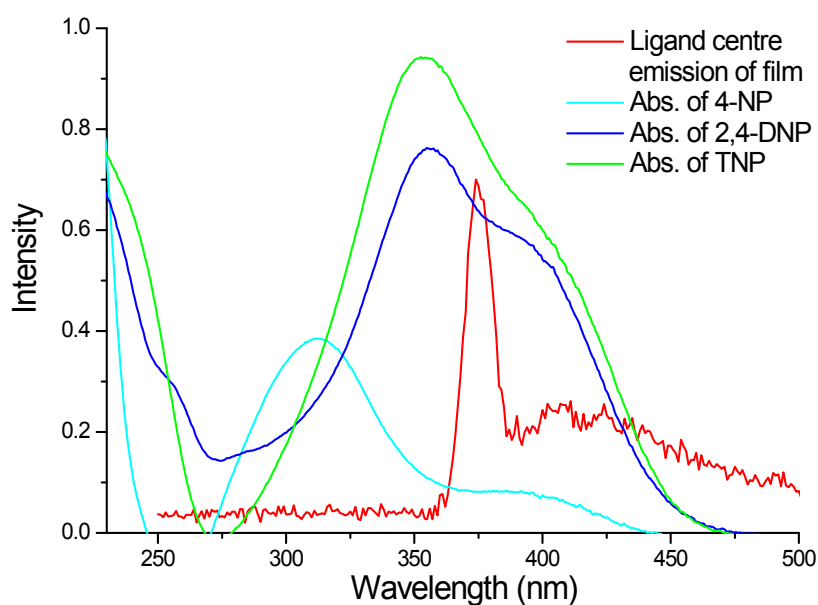
Fig. S27 Absorption spectra of nitrophenols in methanol and ligand based emission spectra of Eu-TDC thin film. Note the overlap between the emission spectrum of the film and the absorption band of nitrophenols.

Fig. S28 Luminescence decay curves of Eu-TDC thin film in the absence and presence of 2,4-DNP.

Fig. S29 Luminescence decay curves of Eu-TDC thin film in the absence and presence of 4-NP.

Fig. S30 Luminescence decay curves of Eu-TDC thin film in the absence and presence of TNT.

Fig. S31 Luminescence decay curves of Eu-TDC thin film in the absence and presence of 2,4-DNT.

Fig. S32 Luminescence decay curves of Eu-TDC thin film in the absence and presence of 4-NT.

Fig. S33 Luminescence decay curves of Eu-TDC thin film in the absence and presence of NB.
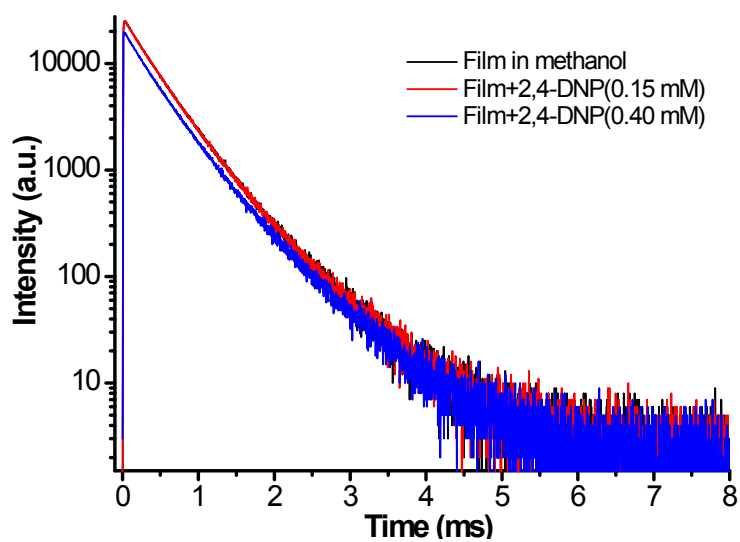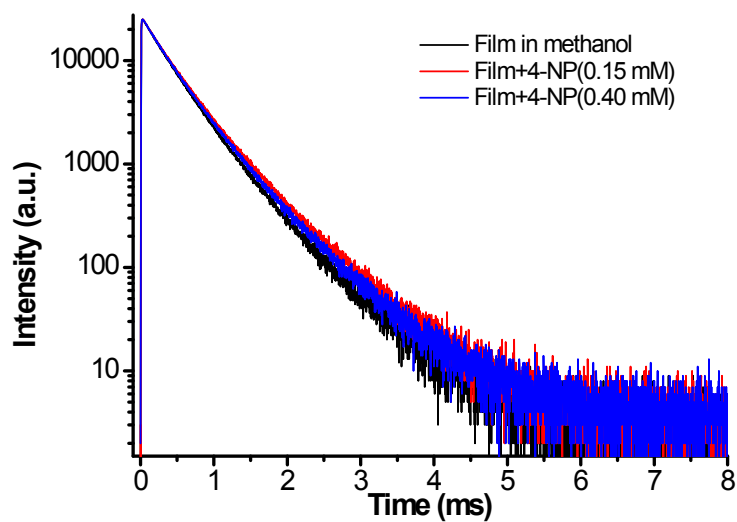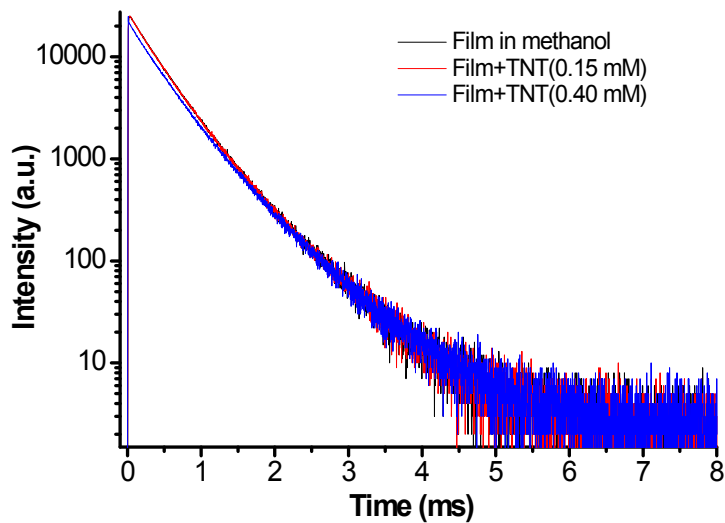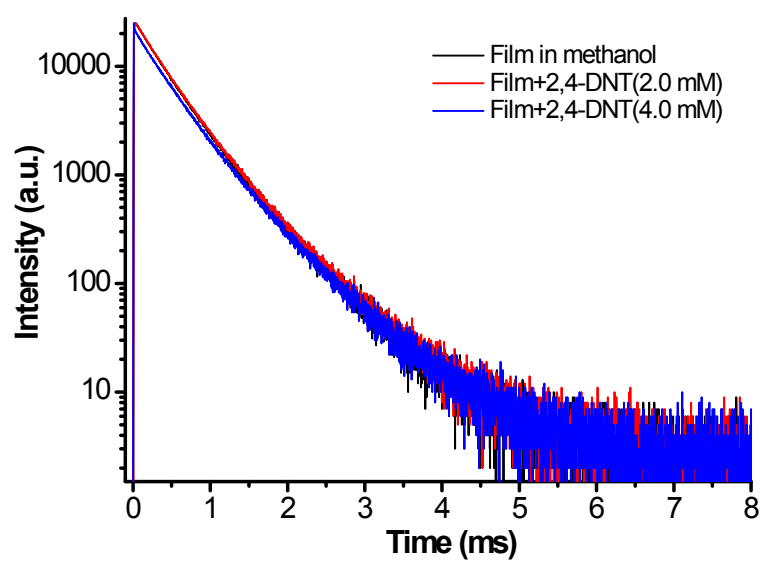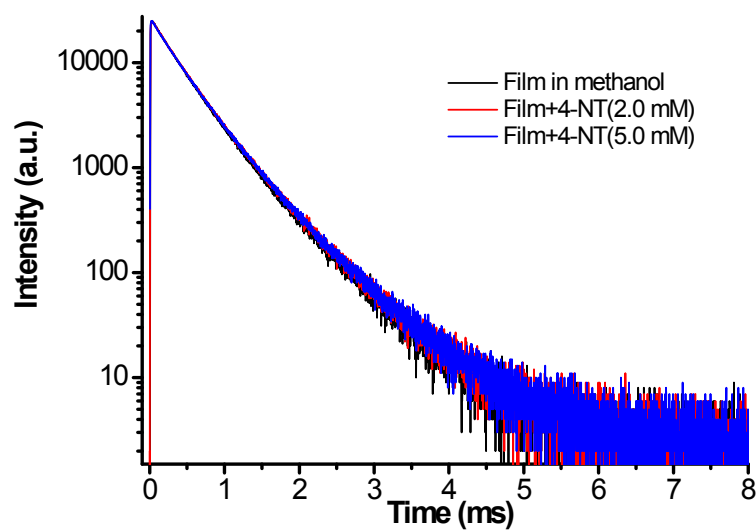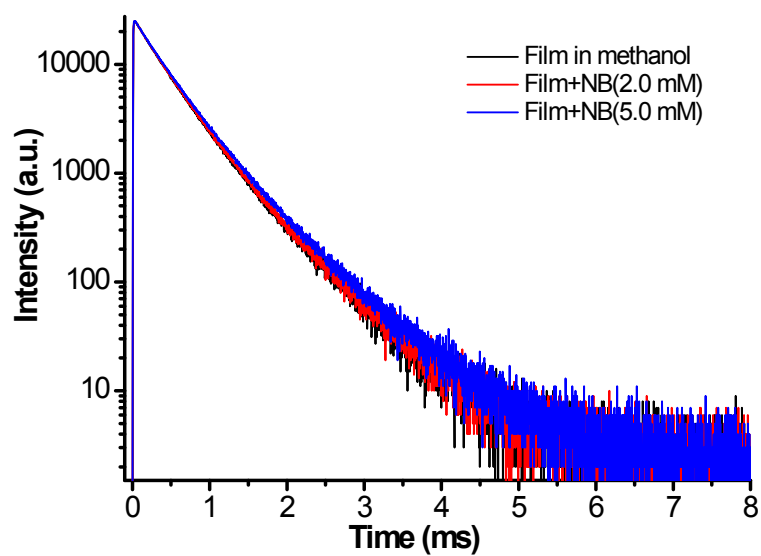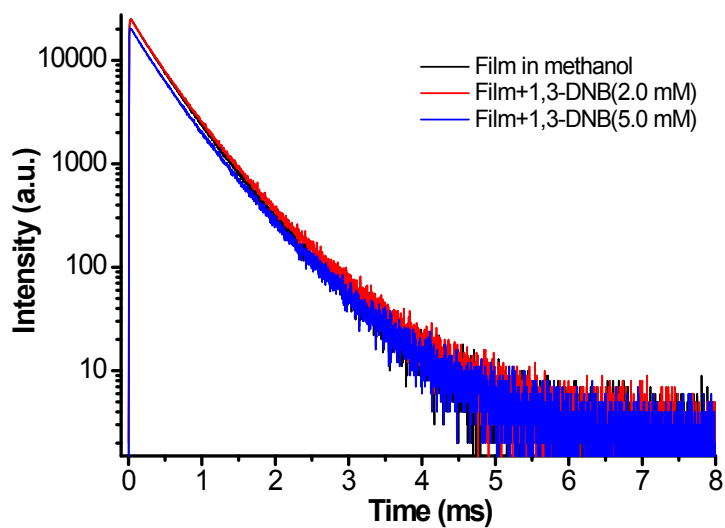

Fig. S34 Luminescence decay curves of Eu-TDC thin film in the absence and presence of 1,3-DNB.
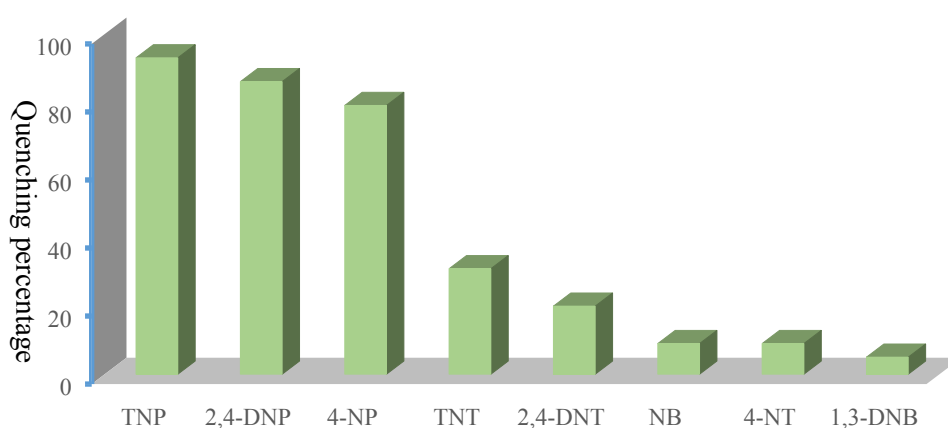
Fig. S35 Fluorescence quenching percentage of the dispersed MOF solution toward 0.5 mM of different NACs

Table S1 Luminescence lifetime parameters of the other tested NACs, τ_1, τ_2, A, B_1, B_2 and average lifetime of τ, goodness χ^2 of fits.

Sample	A	B_1	B_2	τ_1	τ_2	τ	χ^2
Film	1.54	18164.20	4602.58	0.35	0.65	0.45	1.13
Film + 2,4-DNP (0.15 mM)	1.41	18773.18	4538.15	0.35	0.66	0.45	1.10
Film + 2,4-DNP (0.40 mM)	1.22	13355.56	3333.07	0.35	0.67	0.45	1.03
Film + 4-NP (0.15 mM)	2.39	17581.98	5660.62	0.35	0.69	0.48	1.17
Film + 4-NP (0.40 mM)	2.61	16301.30	4834.22	0.35	0.67	0.47	1.21
Film + TNT (0.15 mM)	1.67	17356.23	4726.18	0.36	0.68	0.47	1.18
Film + TNT (0.40 mM)	1.53	14996.69	3912.45	0.37	0.70	0.48	1.07
Film + 2,4-DNT (2.00 mM)	1.81	18813.69	4427.98	0.35	0.68	0.45	1.14
Film + 2,4-DNT (5.00 mM)	1.84	14670.90	3821.61	0.35	0.68	0.46	1.13
Film + 4-NT (2.00 mM)	1.54	17925.15	4564.74	0.36	0.68	0.46	1.09
Film + 4-NT (5.00 mM)	1.69	18349.40	4619.73	0.36	0.68	0.46	1.10
Film + NB (2.00 mM)	1.51	17824.42	4080.54	0.36	0.68	0.46	1.10
Film + NB (5.00 mM)	1.61	14750.94	4143.30	0.37	0.70	0.48	1.14
Film + 1,3-DNB (2.00 mM)	1.69	17203.60	4687.10	0.36	0.68	0.47	1.14
Film + 1,3-DNB (5.00 mM)	1.48	14517.62	3730.29	0.35	0.67	0.46	1.09

The budget of the Eu-TDC thin film:

Price list:

FTO glass: 154.2 \$ /m^2

Thiophene-2,5-dicarboxylic acid: 1.2 \$ /g

Eu(NO$_3$)$_3$·6H$_2$O: 2.3 \$ /g

Methanol: 10.0 \$ /L

NH$_4$NO$_3$: 0.05 \$ /g

The electrodeposition solution includes: 89.2 mg (0.2 mmol) Eu(NO$_3$)$_3$·6H$_2$O, 34.4 mg (0.2 mmol) thiophene-2,5-dicarboxylic acid, 32 mg(0.4 mmol) NH$_4$NO$_3$ (support electrolyte) and 20 mL methanol. We could prepare about 16 pieces of thin film from the 20 mL of electrodeposition solution. In addition, the size of Fluorine-doped Tin Oxide conductive glass is about 2.5 × 1.0 cm^2. Therefore, the price of each piece of thin film was calculated to be 0.03 \$.