Electronic Supplementary Information (ESI)

Europium ion post-functionalized zirconium metal-organic frameworks as a luminescent probe for effectively sensing hydrazine hydrate

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Scheme S1 Diagram of gas-sensing measurements for hydrazine vapors

Fig. S1 FT-IR spectra of UiO-66-(COOH)$_2$, Eu$^{3+}$@UiO-66-(COOH)$_2$ and Eu$^{3+}$@UiO-66-(COOH)$_2$ under hydrazine treatment.
Fig. S2 PXRD patterns of the simulated UiO-66, the as-synthesized UiO-66-(COOH)$_2$ and Eu$^{3+}$@UiO-66-(COOH)$_2$.

Fig. S3 N$_2$ adsorption-desorption isotherms of UiO-66-(COOH)$_2$ and Eu$^{3+}$@UiO-66-(COOH)$_2$
**Fig. S4** The excitation ($\lambda_{\text{ex}}=321$ nm, black dotted line) and emission ($\lambda_{\text{em}}=611$ nm, red solid line) spectra of Eu$^{3+}$@UiO-66-(COOH)$_2$. 

**Fig. S5** (a) The emission intensity of Eu$^{3+}$@UiO-66-(COOH)$_2$ at 611 nm under various components. (100 mM, $\lambda_{\text{ex}} = 321$ nm) (b) Photography of the Eu$^{3+}$@UiO-66-
(COOH)$_2$ in various components under 365 nm UV irradiation.

**Fig. S6** PXRD patterns of Eu$^{3+}$@UiO-66-(COOH)$_2$ towards various analytes in ethanol solution.

**Fig. S7** (a) The emission intensity of Eu$^{3+}$@UiO-66-(COOH)$_2$ before and after hydrazine introduction. (b) Photographs of the Eu$^{3+}$@UiO-66-(COOH)$_2$ in different
hydrazine exposure time under 365 nm UV irradiation.

**Fig. S8** Fluorescent lifetime of Eu$^{3+}$@UiO-66-(COOH)$_2$ and under different concentrations of hydrazine hydrate.

**Fig. S9** UV-vis adsorption spectra of Eu$^{3+}$@UiO-66-(COOH)$_2$ before and after hydrazine treatment.
**Table S1** The ICP-MS results of Eu$^{3+}$@ UiO-66-(COOH)$_2$.

| Material                                      | Zr$^{4+}$     | Eu$^{3+}$     | Molecular ratio Zr : Eu |
|-----------------------------------------------|---------------|---------------|-------------------------|
| Eu$^{3+}$@ UiO-66-(COOH)$_2$                  | 7.532 ppb     | 27.600 ppb    | 1:2.20                  |
|                                               | 82.57 nM      | 181.62 nM     |                          |
| Eu$^{3+}$@ UiO-66-(COOH)$_2$ after N$_2$H$_4$ treatment | 6.610 ppb     | 24.336 ppb    | 1:2.21                  |
|                                               | 72.46 nM      | 160.14 nM     |                          |