

## Supporting Information

Dynamic manipulation of upconversion luminescence by constructing metal-organic framework and lanthanide-doped nanoparticles composites

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# 1. Materials and Methods

## 1.1. Materials

Oleic acid (OA, 90%), 2-aminoterephthalic acid were purchased from Sigma-Aldrich. 1,4-naphthalenedicarboxylic acid, anhydrous methanol were obtained from Energy Chemical. Terephthalic acid, zirconium chloride ( $ZrCl_4$ , >99.5%), lanthanum trichloride hexahydrate ( $LnCl_3 \cdot 6H_2O$ , 99.99%,  $Ln = Y, Yb$  and  $Er$ ), sodium hydroxide (NaOH, >98%), ammonium fluoride ( $NH_4F$ , >98%), and 1-octadecene (ODE, 90%) were purchased from Aladdin. Ethanol (EtOH, AR), methanol (MeOH, AR), N,N-dimethylformamide (DMF, AR), cyclohexane (CYH, AR), glacial acetic acid, and hydrochloric acid ( $HCl$ ,  $\geq 36.5\%$ ) were supplied by Sinopharmate Chemical Reagent Co., Ltd. In this study, all solvents and reagents were used directly without further purification without specific indication.

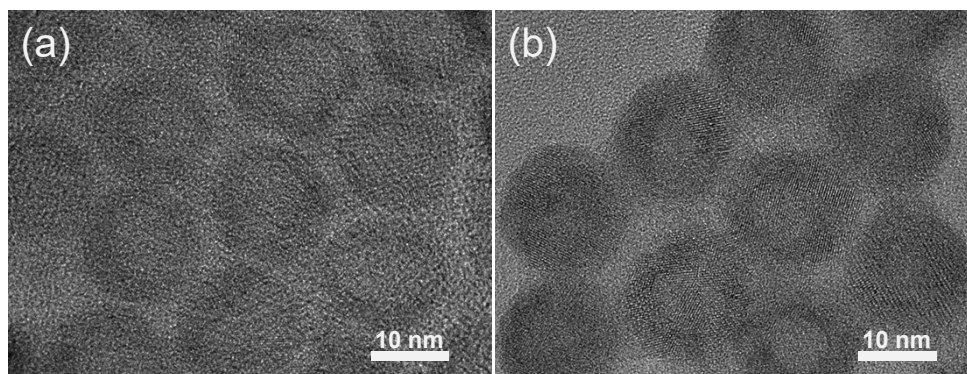
## 1.2. Characterizations

In this study, powder X-ray diffraction (PXRD) analysis was carried out on Bruker D8 Advance X-ray diffractometer using  $Cu K_\alpha$  radiation ( $\lambda = 1.5418 \text{ \AA}$ ) with a scanning range of  $5\text{-}65^\circ$ . Transmission electron microscopy (TEM), high-resolution transmission electron microscopy (HRTEM), scanning transmission electron microscopy (STEM), and energy dispersive X-ray spectroscopy (EDS) analyses were obtained using JEM-F200 transmission electron microscope. Scanning electron microscopy (SEM) images were acquired with Hitachi S-4800 scanning electron microscope. The recording of upconversion luminescence spectra was based on 980 nm external continuous laser and was carried out on a Horiba FluoroLog-3 spectrofluorometer. Fourier Transform Infrared (FTIR) Spectra was performed by mixing the samples with KBr powder and pressing them into flakes and on a Bruker Vertex 70 FTIR spectrometer.

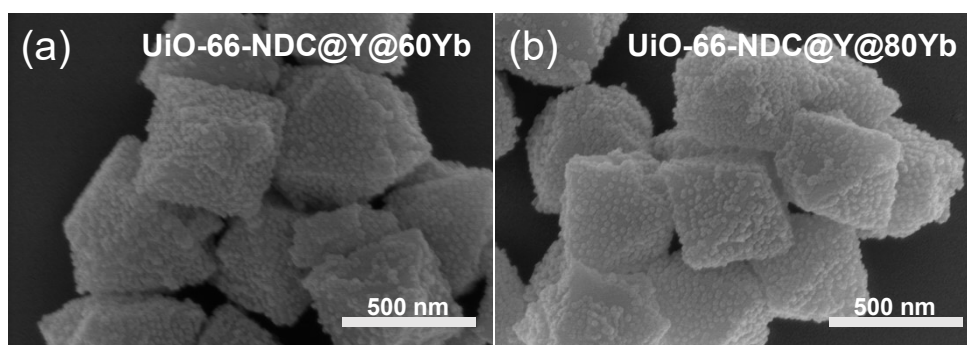
## 1.2. Synthesis of ligand-free UCNPs

First, the cyclohexane solution (1 mL) containing UCNPs (0.1 mmol) was mixed with ethanol (1 mL), followed by centrifugation to separate the UCNPs. The resulting precipitate was redispersed in ethanol (1 mL), followed by the addition of hydrochloric acid ( $HCl$ , 1 mL, 1 M). The mixture was shaken for 30 seconds and then centrifuged again. The above centrifugation and washing steps were repeated once to ensure complete removal of surface ligands. Finally, the resulting ligand-free UCNPs were washed with ethanol and redispersed in DMF for subsequent use.

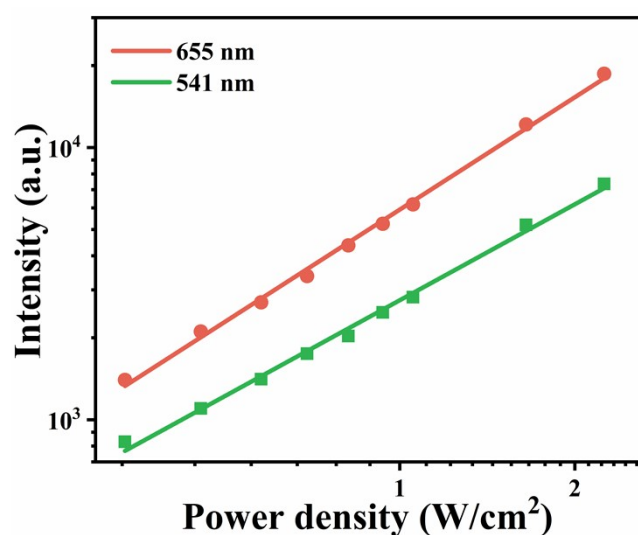
## 2. Supplementary Figures.



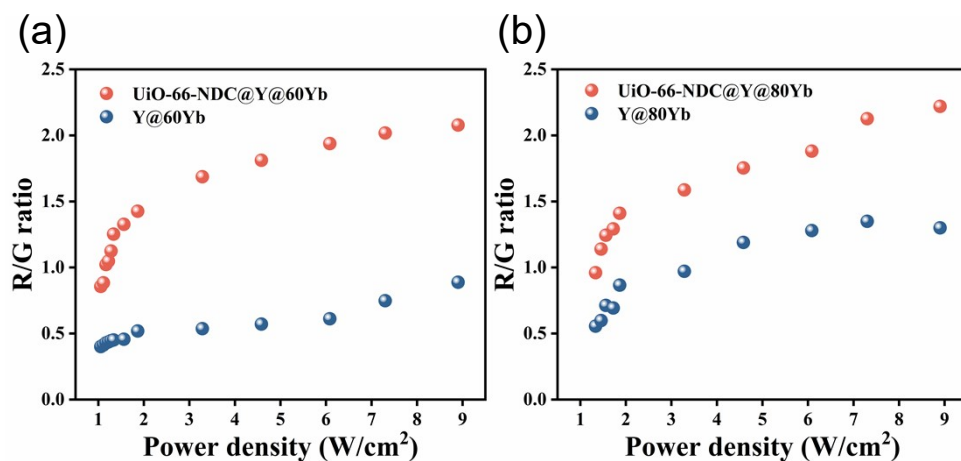
**Figure S1.** The TEM images of (a) core-shell  $\text{NaYF}_4@\text{NaYF}_4$ : 60%Yb, 2%Er NPs, (b) core-shell  $\text{NaYF}_4@\text{NaYF}_4$ : 80%Yb, 2%Er NPs.



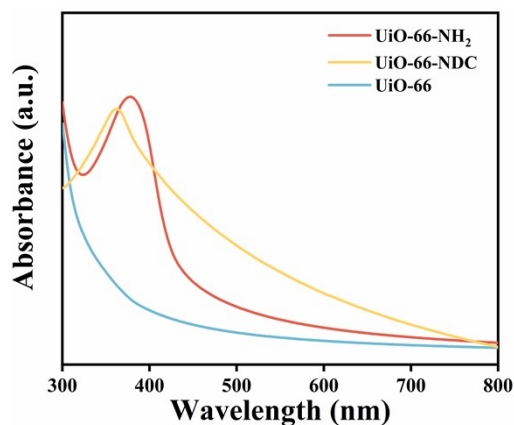
**Figure S2.** SEM images of (a)  $\text{UiO-66-NDC}@NaYF_4@NaYF_4$ : 60%Yb, 2%Er composites, (b)  $\text{UiO-66-NDC}@NaYF_4$ : 80%Yb, 2%Er composites.



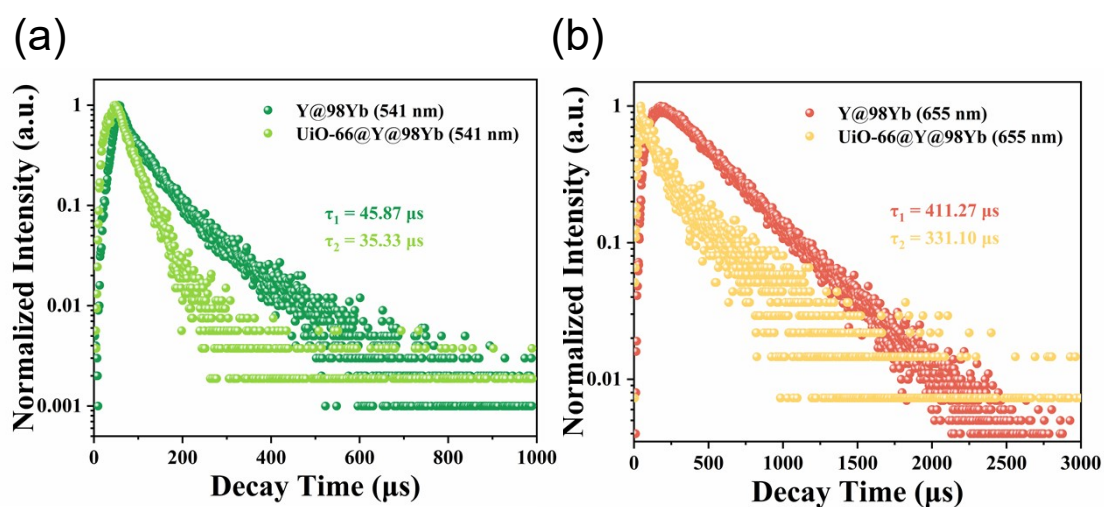
**Figure S3.** Log-log plot of the UC red and green emission intensity of the  $\text{UiO-66-NH}_2@NaYF_4@NaYF_4$ : 2%Er composites as a function of the pump power density of 980 nm.



**Figure S4.** R/G ratios of (a) NaYF<sub>4</sub>@NaYF<sub>4</sub>: 60%Yb, 2%Er and its composites with UiO-66-NDC, (b) NaYF<sub>4</sub>@NaYF<sub>4</sub>: 80%Yb, 2%Er and its composites with UiO-66-NDC at different excitation power density.



**Figure S5.** UV-Vis absorption spectra of UiO-66-type MOFs.



**Figure S6.** Lifetime decay curves of Y@98Yb and UiO-66@Y@98Yb at (a) 541 nm and (b) 655nm.

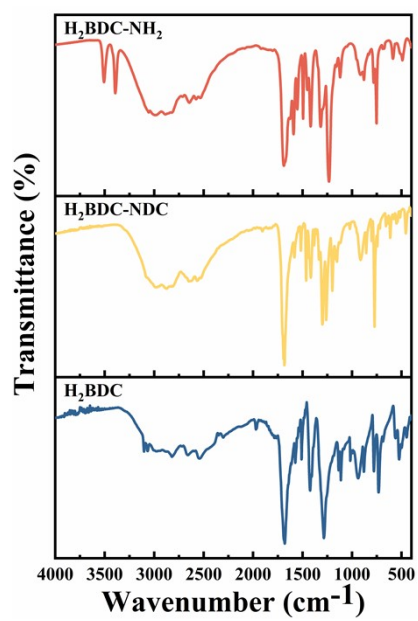


Figure S7. FTIR spectras of corresponding ligands of UiO-66-type MOFs.