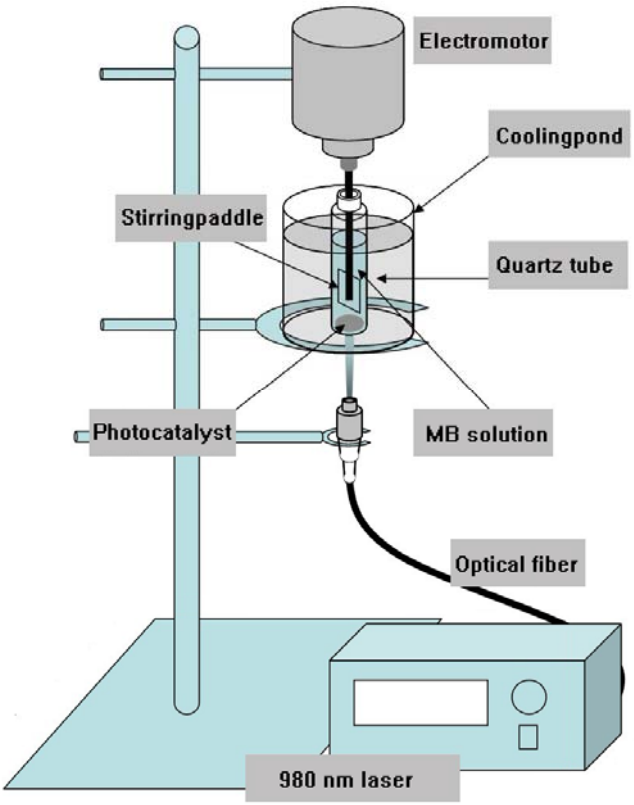
Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics

NIR photocatalysis of β-$NaYF_4$:Yb^{3+},Tm^{3+}@ ZnO composites

Xingyuan Guo [a,b], Weiye Song, [a] Changfeng Chen,[c] Weihua Di*[a], and Weiping Qin*[a]

Experimental setup for the NIR irradiation on the samples



Scheme S1. Schematic diagrams of the equipment for the photocatalytic reactions.

Size distribution of the as-synthesized $NaYF_4$:Yb,Tm nanocrystals

The average particle size of the as-synthesized $NaYF_4$:Yb,Tm was measured from 100 particles randomly selected from TEM observations. Plot of the size distribution was shown in Figure S1.

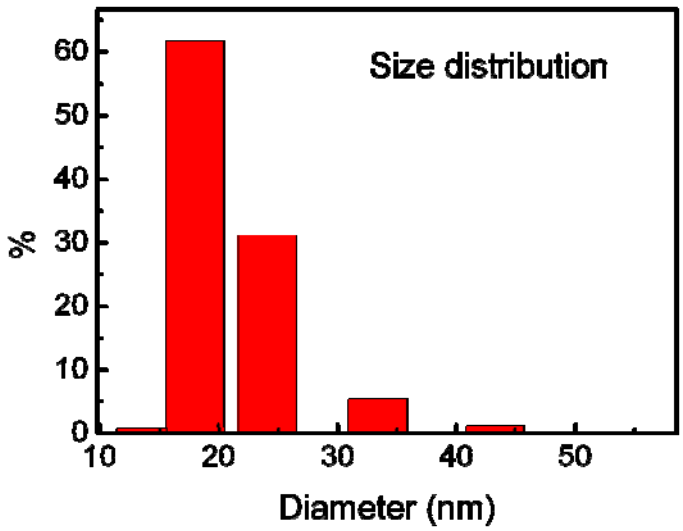


Figure S1. Size distribution diagrams of the as-synthesized $NaYF_4$:Yb,Tm.

Structure characterizations for β-$NaYF_4$:Yb^{3+},Tm^{3+}@ZnO somposite prepared with different amount of surfactants during the synthesis.

Three β-$NaYF_4$:Yb^{3+},Tm^{3+}@ZnO somposites were prepared by using three different amount of OA/ODE added in the reaction system: 6mL/6mL, 4 mL/4 mL and 2mL/2mL. the XRD patterns and EDX scan profiles were measured and the results were shown in Figure S2. As increasing the amount of OA/ODE, the intensity of the diffraction peaks of ZnO gradually decresed relative to that of $NaYF_4$ in the XRD patterns (Fig. S2, a,b,c) and the Na and Y elements due to NaYF4 become observable in the EDX spectra (Fig. S2, d,e,f).

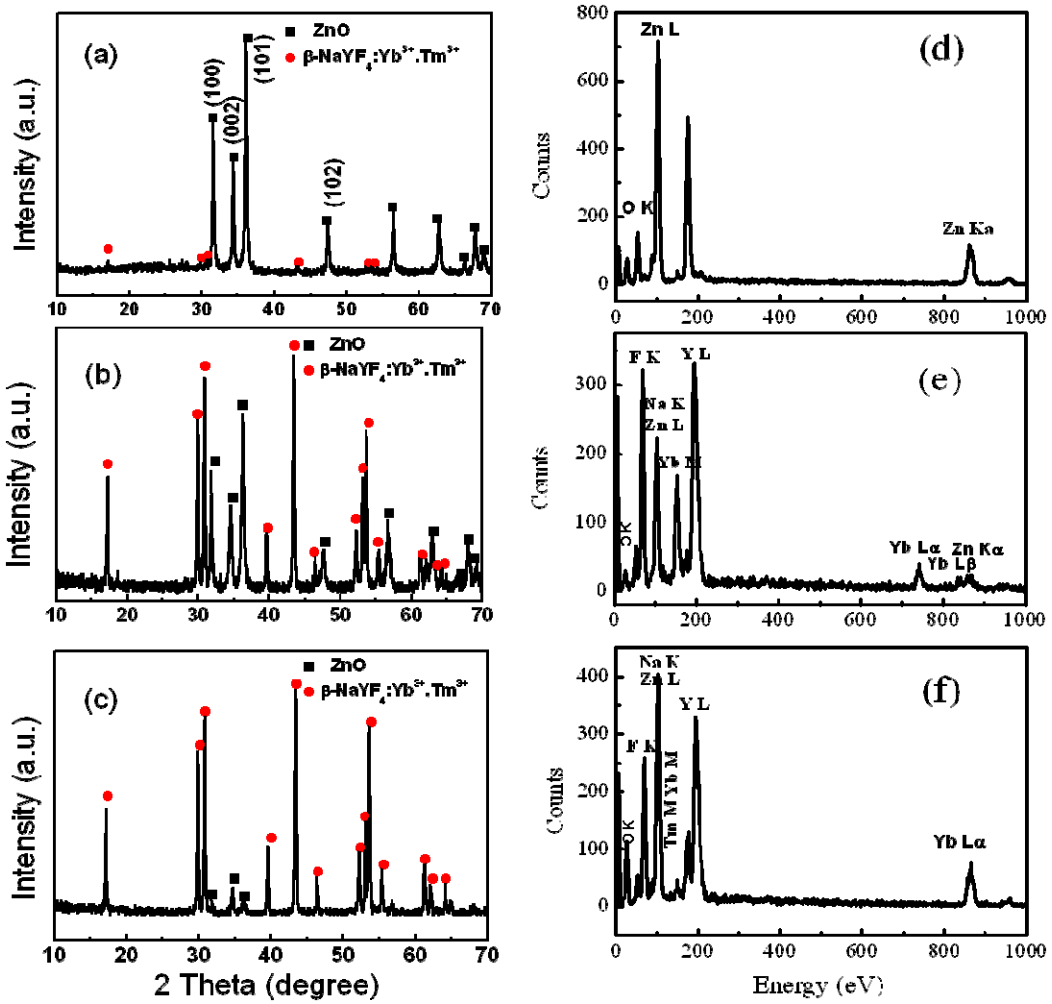


Figure S2. XRD patterns and EDX scan profiles for β-$NaYF_4$:Yb^{3+},Tm^{3+}@ZnO prepared with various amounts of OA/ODE : (a) and (d) OA/ODE = 2ml/2ml; b and e: OA/ODE =4ml/4ml; c and f: OA/ODE=6ml/6ml.

Photoluminescence spectra of ZnO nanocrystals

Room-temperature PL spectra induced by 325 nm excitation wavelength were collected in the range from 350~600 nm in Fig. S3. The PL spectra included the major emission of the ZnO bandgap at ~380 nm as well as additional broad visible emission bands ranging from 450 to 550 nm with peak emission at 485 nm, which were related to surface and defect emission. So there have energy transfer between the $^1G_4$ and ZnO.

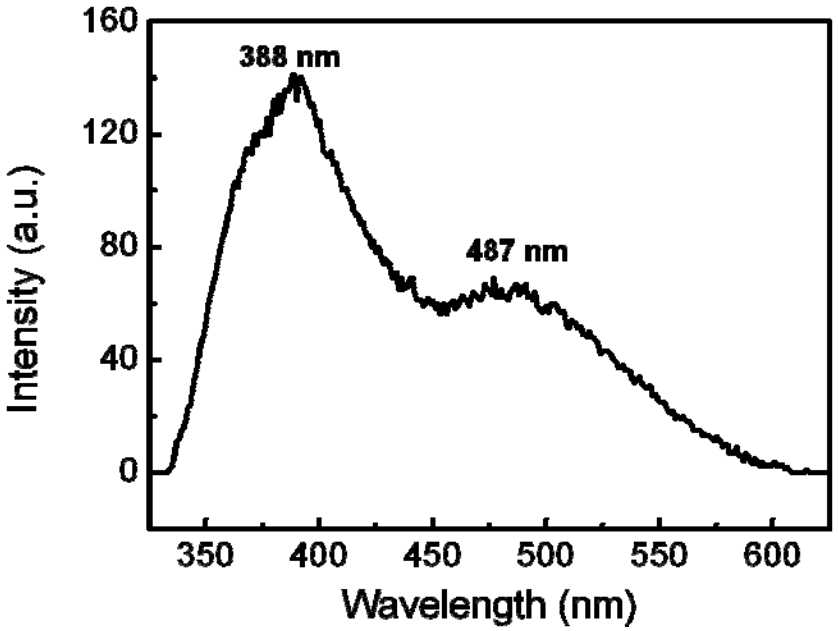


Figure S3 PL spectra of $NaYF_4$:Yb,Tm@ZnO

Thermal effect of the NIR irradiation to the solution

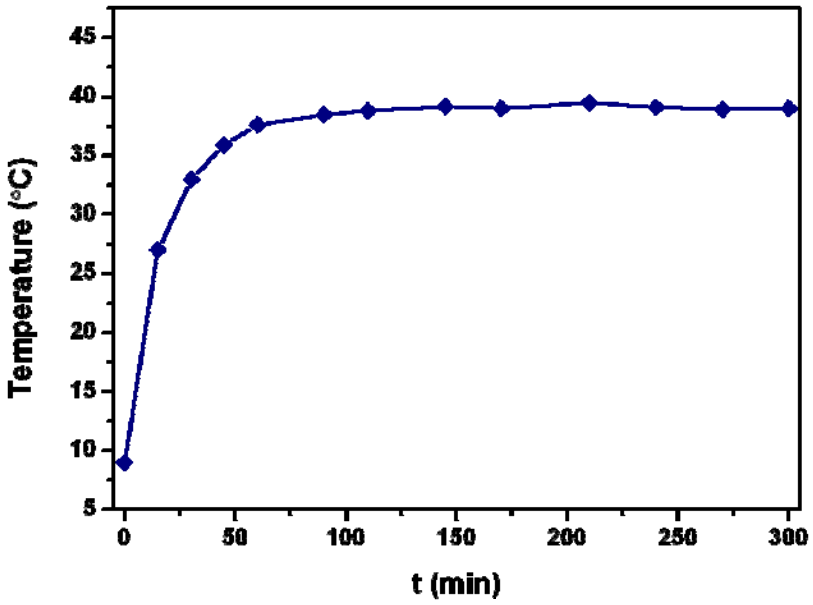


Figure S4. The temperature versus 980 nm irradiation time in the presence of only β-$NaYF_4$:Yb,Tm.