Supporting Information

Improving broadband photocatalytic performance of TiO_2 through the highly efficient optical converter

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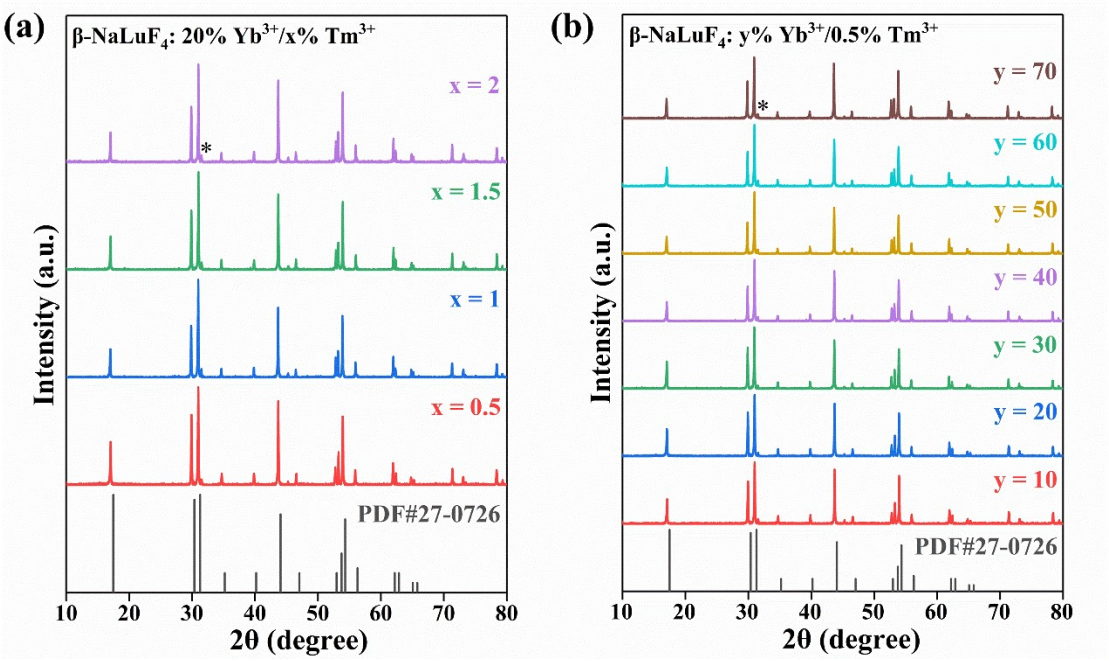

Figure S1 XRD patterns of UCNPs doped with (a) 20% Yb^{3+}/x% Tm^{3+} and (b) y% Yb^{3+}/0.5% Tm^{3+}. The impurity NaCl is marked by asterisk (*).

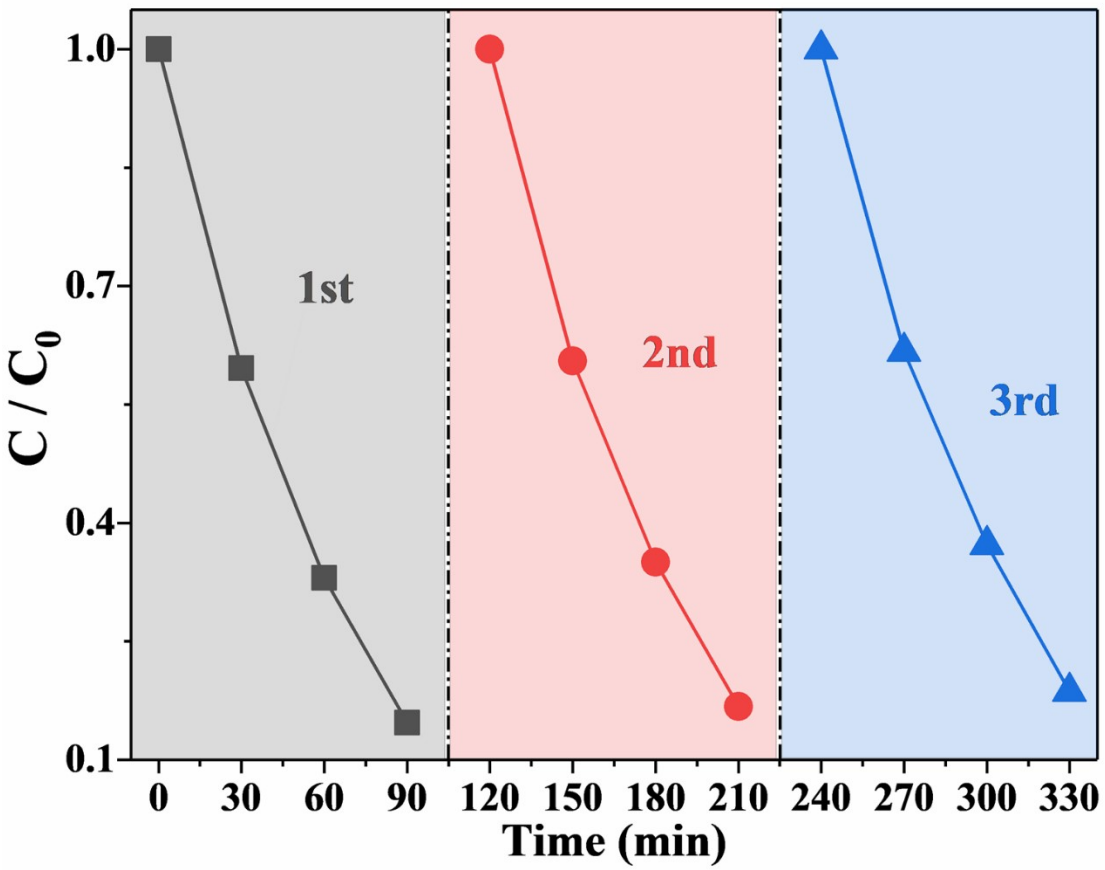

Figure S2 Cyclic degradation performance of UCNPs@TiO_2 under the irradiation of simulated sunlight.

Table S1 Key parameters of the typical NIR responsive photocatalysts driven by NIR light and simulated sunlight.

Photocatalyst	Dye, Volume	Light, Intensity	Degradation Efficiency	Degradation Rate	Ref.
Part A Photocatalysts driven by NIR light					
β-$NaLuF_4$: Yb^{3+}/Tm^{3+}@TiO_2	RhB, 10 mg·L^{-1}	980 nm, 2 W	97%@10 h	0.2356 h^{-1}	This work
β-$NaYF_4$: Yb^{3+}/Tm^{3+}@TiO_2	RhB, 10 mg·L^{-1}	980 nm, 1 W	75.75%@24 h	——	[1]
Fe_3O_4@SiO_2/β-$NaYF_4$: Yb^{3+}/Tm^{3+}@TiO_2	RhB, 10 mg·L^{-1}	980 nm, 1 W	68.48%@24 h	——	[2]
β-$NaYF_4$: Yb^{3+}/Tm^{3+}@ZnO	RhB, 20 mg·L^{-1}	980 nm, 2 W	65%@30 h	——	[3]
BiOBr: Yb^{3+}/Er^{3+}/Ho^{3+}	RhB, 10 mg L^{-1}	980 nm, 2 W	53%@6 h	0.099 h^{-1}	[4]
$NaYF_4$: Yb^{3+}/Tm^{3+}@$NaYF_4$/TiO_2	RhB, ——	980 nm, 3 W	38%@6 h	——	[5]
β-$NaYF_4$: Yb^{3+}/Tm^{3+}@SiO_2@TiO_2	RhB, ——	980 nm, 3 W	32%@6 h	0.0649 h^{-1}	[6]
Part B Photocatalysts driven by simulated sunlight					
β-$NaLuF_4$: Yb^{3+}/Tm^{3+}@TiO_2	RhB, 10 mg·L^{-1}	Xe lamp, 300 W	78%@1.5 h	0.7572 h^{-1}	This work
β-$NaYF_4$: Yb^{3+}/Tm^{3+}@$NaYF_4$: Yb^{3+}/Nd^{3+}@TiO_2	RhB, 40 mg·L^{-1}	Xe lamp, 300 W	89%@3 h	0.6900 h^{-1}	[7]
β-$NaYF_4$: Yb^{3+}/Tm^{3+}@TiO_2	RhB, 10 mg·L^{-1}	Xe lamp, 1000 W	80%@4.5 h	——	[8]
$NaBH_4$@ZrO_2-OV	RhB, 10 mg·L^{-1}	Xe lamp, 300 W	80%@5 h	——	[9]
β-$NaYF_4$: Yb^{3+}/Tm^{3+}/Gd^{3+}/NMC	RhB, 5 mg·L^{-1}	Xe lamp, 300 W	79%@1.5 h	~0.54 h^{-1}	[10]
β-$NaYF_4$: Yb^{3+}/Er^{3+}/Ag_2CrO_4	RhB, 10 mg·L^{-1}	Xe lamp, 300 W	55%@2.5 h	0.3306 h^{-1}	[11]

References

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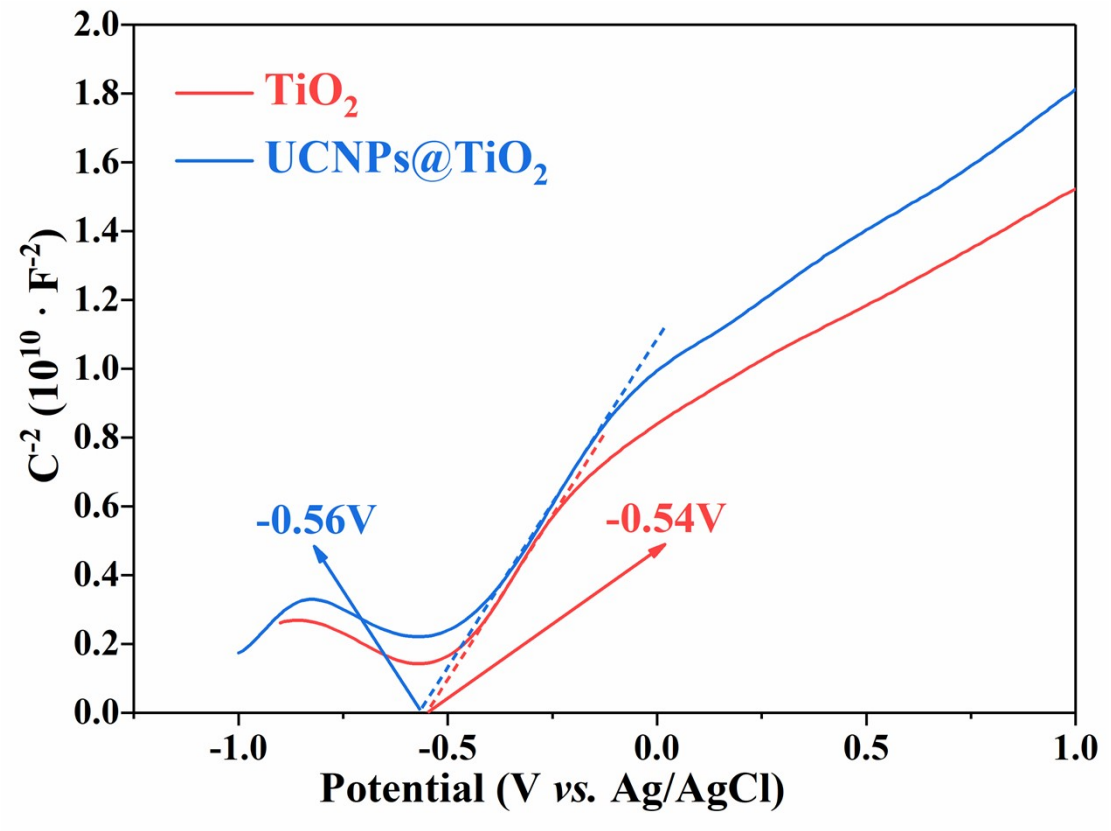

Figure S3 Mott-Schottky plots of anatase TiO_2 and UCNPs@TiO_2 *vs.* Ag/AgCl electrode.

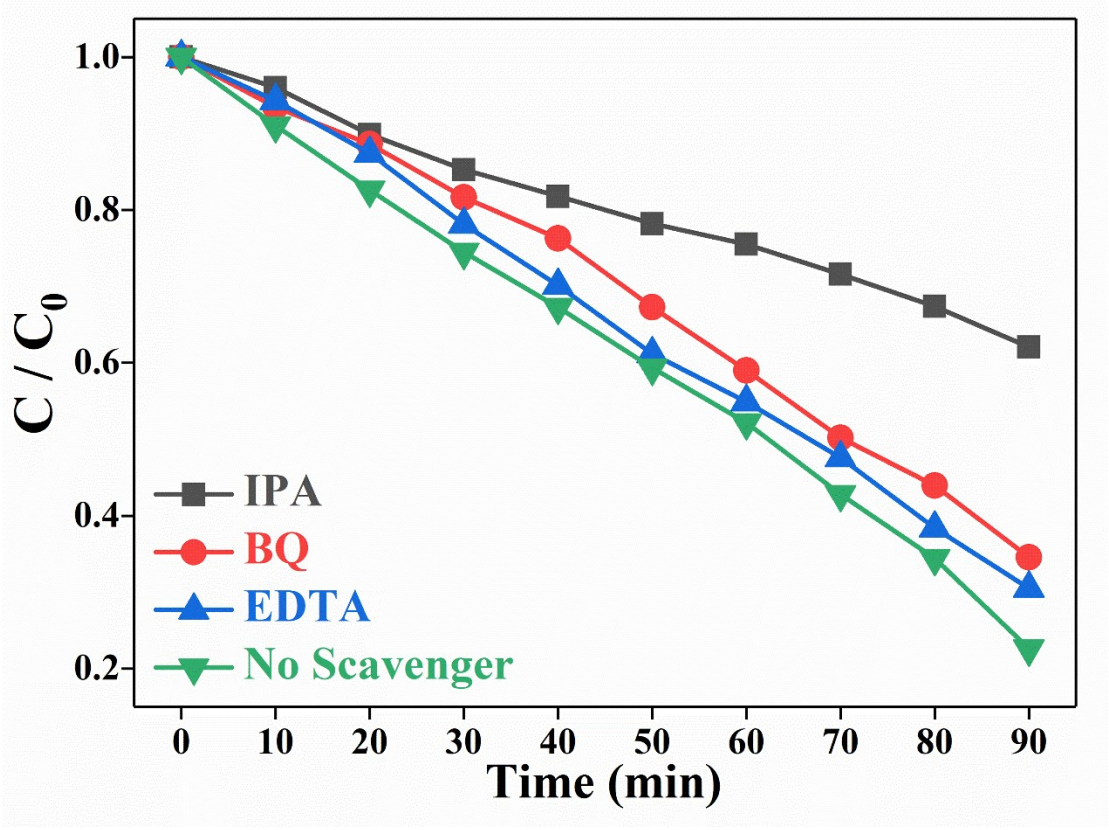

Figure S4 Photocatalytic performance of UCNPs@TiO_2 mixed with various scavenger under the irradiation of simulated sunlight.