Supporting Information

Near-infrared light triggered superior photocatalytic activity from MoS_2-$NaYF_4$:Yb^{3+}/Er^{3+} nanocomposites

Manjunath Chatti[a], Venkata N. K. B. Adusumalli[a] Sagar Ganguli[a] and Venkataramanan Mahalingam,[a]*

[a] Department of Chemical Sciences, Indian Institute of Science Education and Research (IISER), Kolkata, Mohanpur, West Bengal 741246, India.

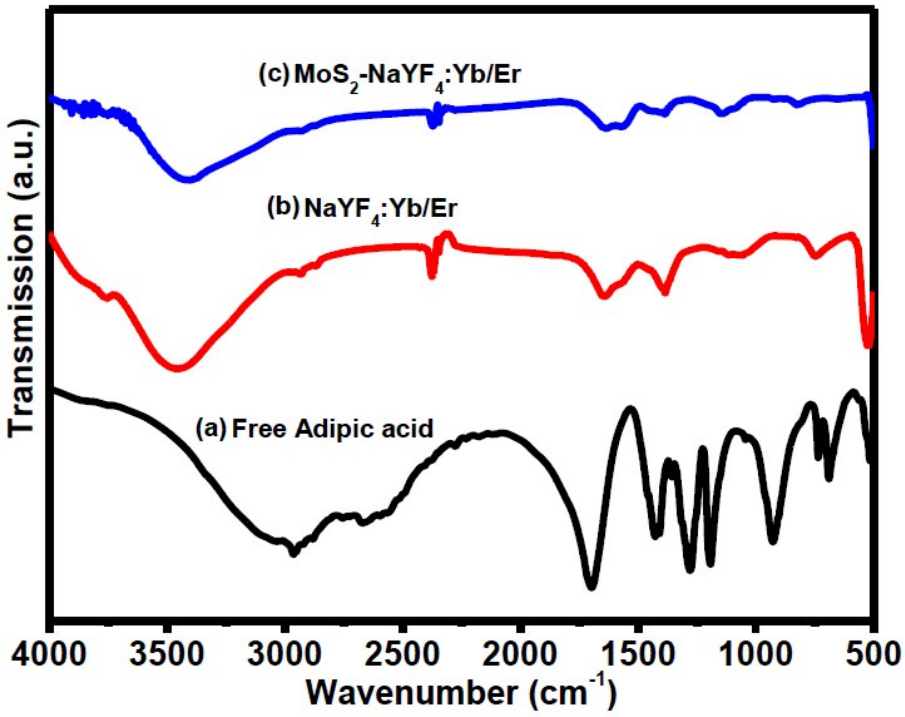

Figure S1 FTIR spectra of (a) free adipic acid (AA) molecules, AA tailored (b) $NaYF_4$:Yb^{3+}/Er^{3+} nanocrystals and (c) MoS_2-$NaYF_4$:Yb^{3+}/Er^{3+} composites.

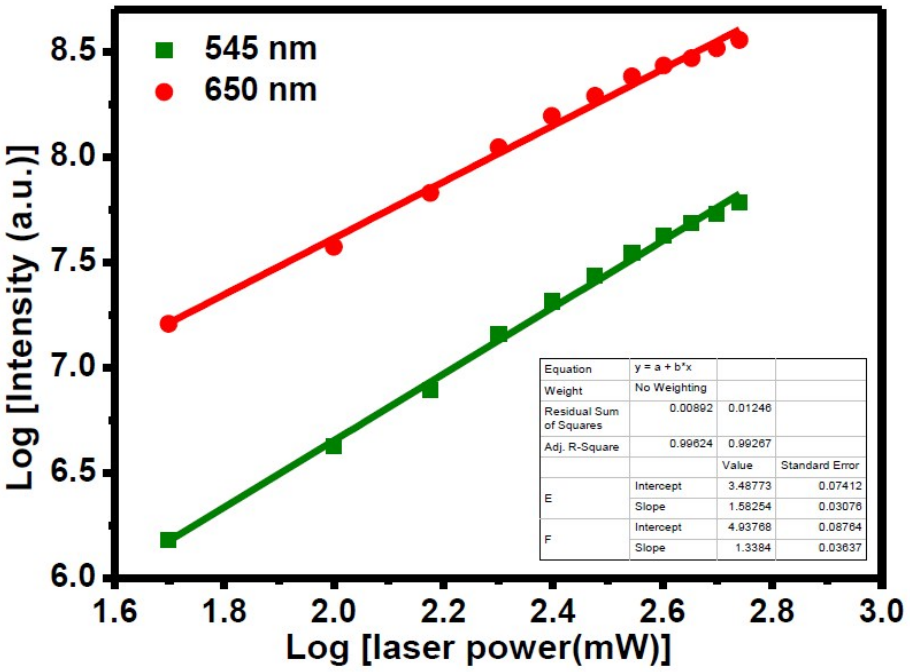

Figure S2 The logarithmic plots of upconversion emission intensity versus the laser power of Yb^{3+}(20%)/Er^{3+}(2%)-doped $NaYF_4$ nanocrystals under 980 nm excitation.

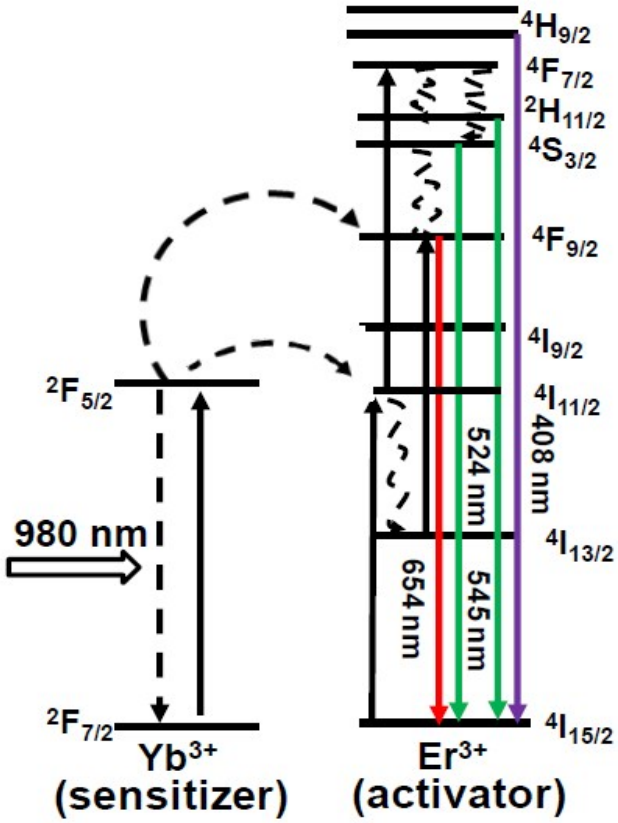

Figure S3 Energy transfer mechanism between Yb^{3+} and Er^{3+} via the upconversion processes.

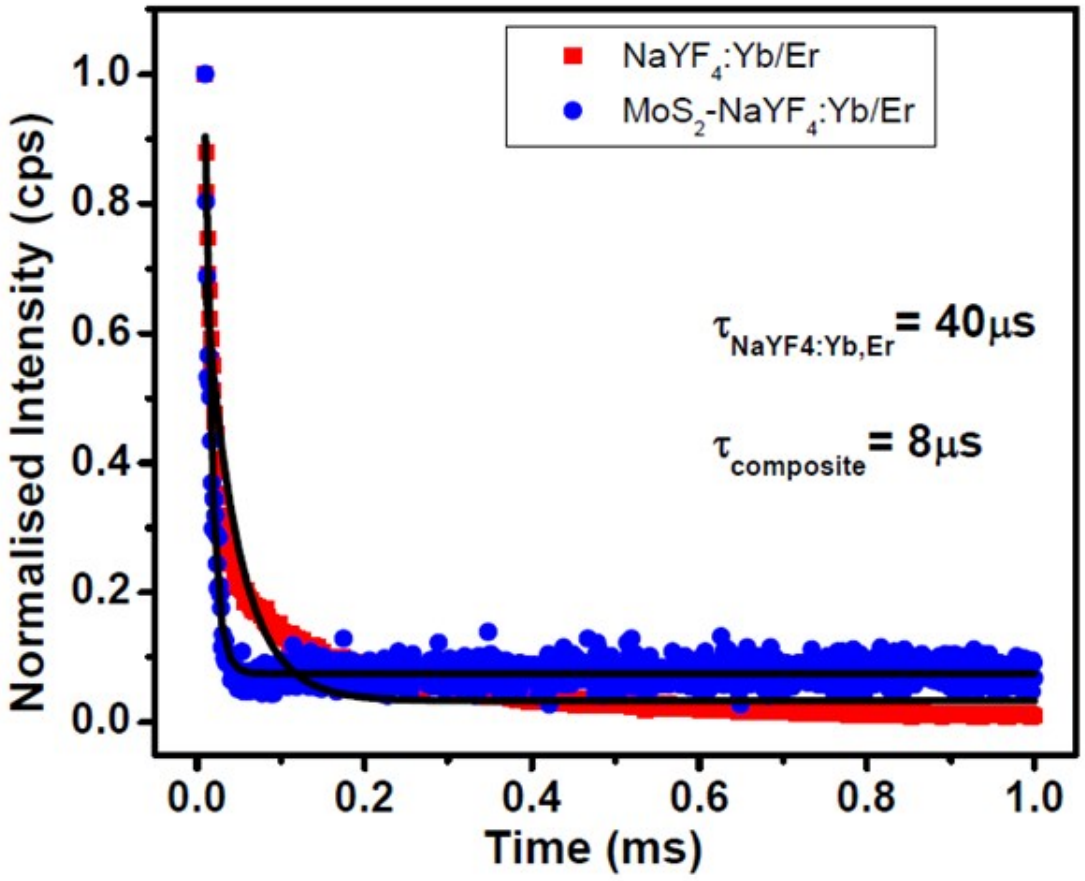

Figure S4 Lifetime decay curves of Yb^{3+}(20%)/Er^{3+}(2%)-doped $NaYF_4$ nanocrystals (red) and MoS_2-$NaYF_4$:Yb^{3+}/Er^{3+} composites (blue).

Table 1. Comparison of photocatalytic performance of various upconversion photocatalysts

Composite	Synthesis Method	Dye (Concentration) and % of degradation	Time taken in hours	Reference
YF_3:Yb/Tm/TiO_2 core/shell nanoparticles	Hydrothermal followed by hydrolysis	Methylene Blue (15 mg/L), 61 %	30	Chem. comm., 2010, 46, 2304-2306
$NaYF_4$:Yb/Tm@TiO_2 core-shell nanoparticles	Hydrothermal followed by hydrolysis	Methylene Blue (15 mg/L), 65 %	14	ACS Catalysis, 2013, 3, 405-412
$NaYF_4$:Yb/Tm@ZnO composite	Two step-high temperature thermolysis	Rhodamine B (20 mg/L) 65 %	30	PCCP, 15, 2014, 14681-14688
$BiVO_4$/CaF_2:Er/Tm/Yb	Hydrothermal followed by room temperature stirring	Methyl Orange (10 mg/L), 10 %	6	Nanoscale, 2014, 6, 1362-1368
$NaYF_4$:Yb,Tm/CdS/TiO_2	Stirring followed by heating at 160^0C for 3 hours	Methylene Blue (15 mg/L), ~95 %	50	Dalton Trans. 2014, 43, 1048-1054
$NaYF_4$:Yb^{3+},Tm^{3+}/g-C_3N_4	Calcination at 250^0C	Methylene Blue (15 mg/L), 83 %	6	J. Colloid Inter face Sci., 2015, *460*, 264-272
MoS_2-$NaYF_4$:Yb/Er	**Hydrothermal**	**Rhodamine B (25 mg/L), 61 %**	**12**	**Present work**