Electronic Supplementary Material (ESI) for CrystEngComm
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Electronic supplementary information (ESI)

Enhanced high-order ultraviolet upconversion luminescence in sub-20 nm β-$NaYbF_4$:0.5%Tm nanoparticles *via* Fe^{3+} doping

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Table S1 Refined lattice constants of as-synthesized β-$NaYbF_4$:0.5%Tm,X%Fe UCNPs.

Value	X = 0 %	X = 2.5 %	X = 5.0 %	X = 10.0%
a=b (Å)	5.92945	5.92845	5.92763	5.93015
c (Å)	3.46955	3.46911	3.46845	3.47011

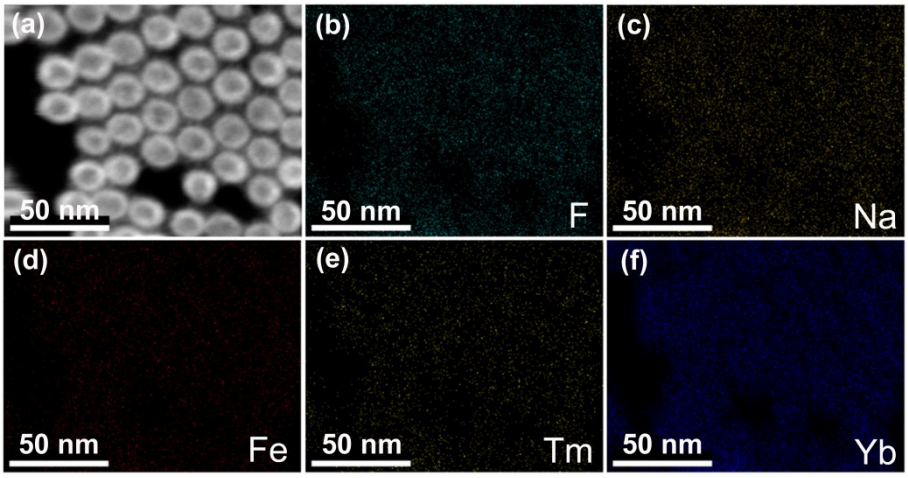

Fig. S1 (a) STEM image (b-f) EDX elemental mapping of β-$NaYbF_4$:0.5%Tm,5%Fe UCNPs and line-profile analysis of β-$NaYbF_4$:0.5%Tm,5%Fe with different elements (F, Na, Fe, Tm and Yb).

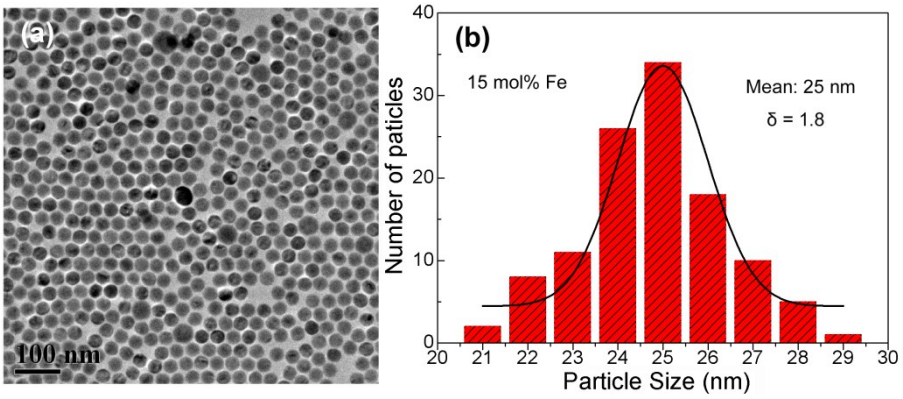

Fig. S2 (a) TEM characterization of β-$NaYbF_4$:0.5%Tm,15%Fe UCNPs and (b) corresponding histograms of size distribution.

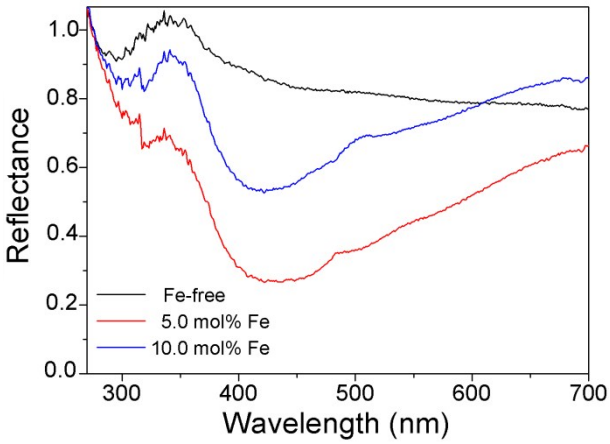

Fig. S3 Diffuse reflectance spectra for Fe^{3+}-free and X mol% Fe^{3+} codoped β-$NaYbF_4$:0.5%Tm (X = 5.0 and 10.0) NPs.

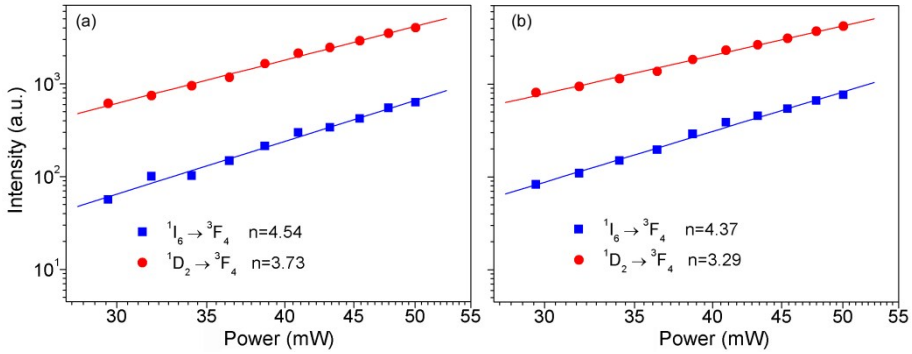

Fig. S4 Pump power dependence of the UV ($^1I_6 \rightarrow {}^3F_4$) and blue ($^1D_2 \rightarrow {}^3F_4$) UCL of Fe^{3+}-free (a) and 5 mol% Fe^{3+} (b) codoped β-$NaYbF_4$:0.5%Tm UCNPs.