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Electronic Supplementary Information:

Lanthanide Doped $Y_6O_5F_8/YF_3$ microcrystals: Phase-tunable Synthesis and Bright White Upconversion Photoluminescence Properties

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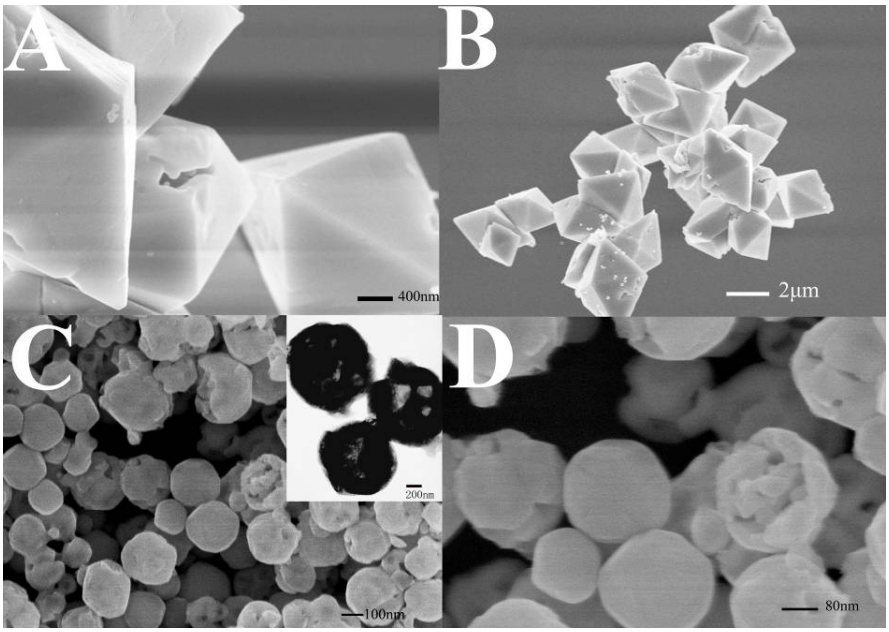

Fig. S1 (A) SEM images of enlarged view and (B) overview of the products obtained at pH= 1, (C) SEM and TEM images and (D) enlarge view of products obtained at pH= 7

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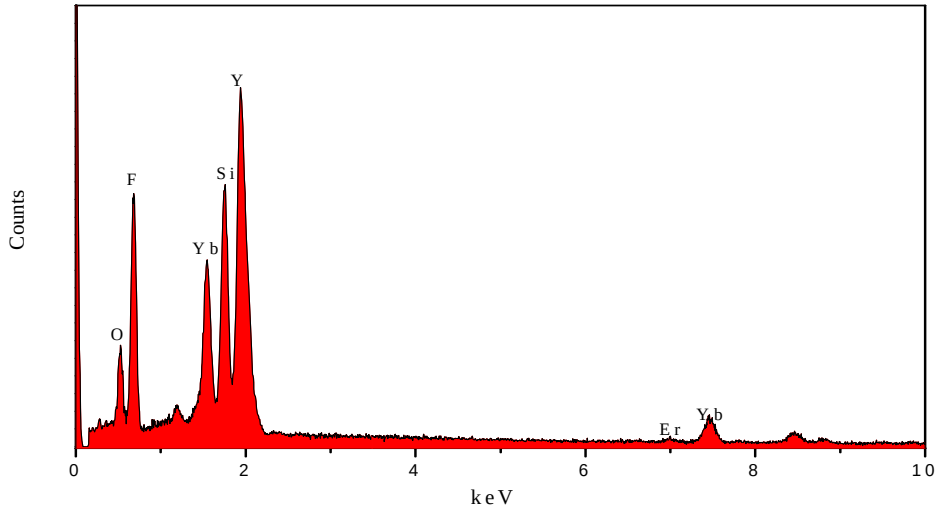

Figure S2.X-ray Energy-dispersive spectroscopy of the codoped $Y(OH)_{1.69}F_{1.31}$ microtubes.

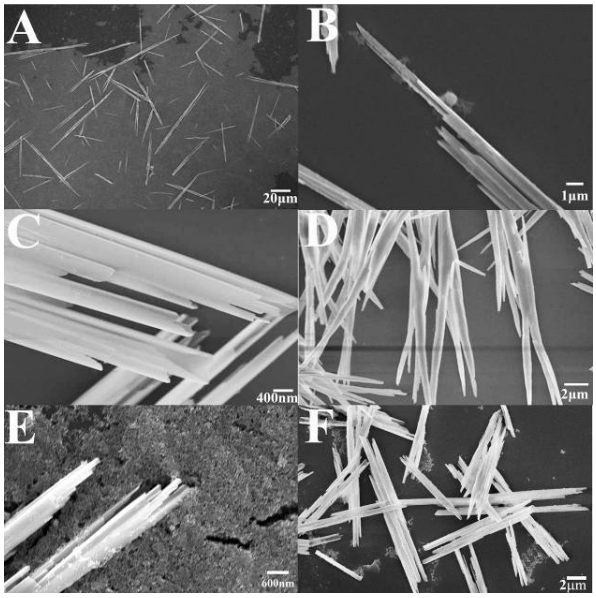

Fig. S3 (A) SEM images of $Y(OH)_{1.69}F_{1.31}$ microtubes obtained at different NH_4F concentration: (A) 0.3 mmol; (B) 0.6 mmol; (C) 2 mmol; (D) 4 mmol, and different hydrothermal temperature: (E) 80 ^{o}C and (F) 140 ^{o}C.

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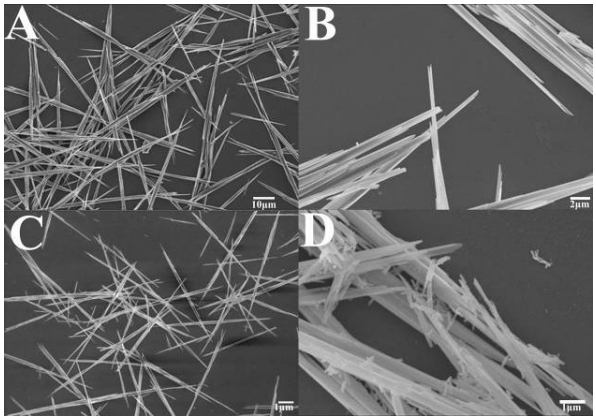

Fig. S4 (A) SEM images of $Y(OH)_{1.69}F_{1.31}$ microtubes obtained at differet Y^{3+} concentrations: (A)0.01 mmol; (B) 0.05 mmol; (C) 0.2 mmol; (D) 0.4 mmol.

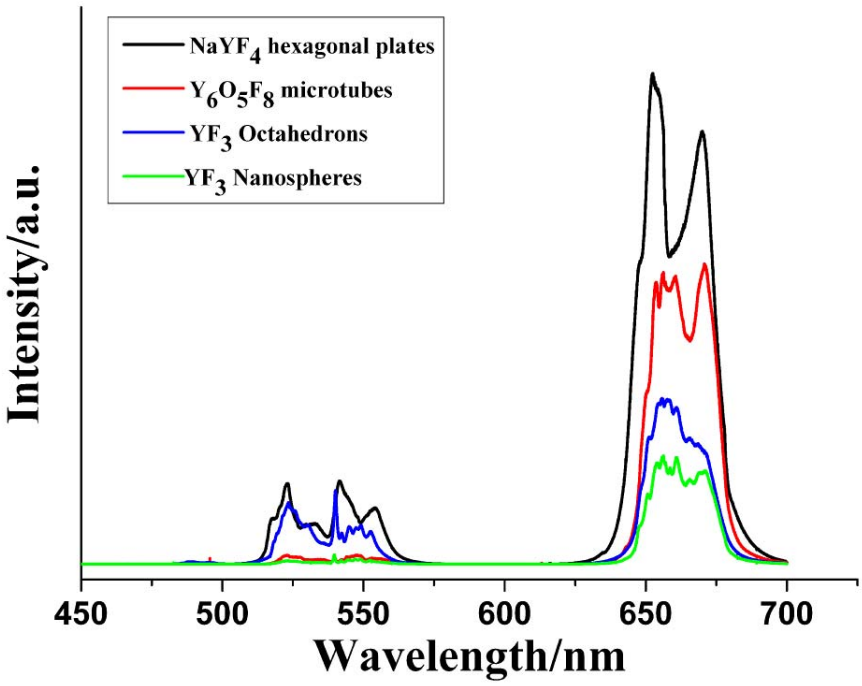

Fig. S5 UC PL emission spectra of $NaYF_4$: 20%Yb^{3+}/2%Er^{3+} hexagonal plates, $Y_6O_5F_8$: 20%Yb^{3+}/2%Er^{3+} microtubes, YF_3: 20%Yb^{3+}/2%Er^{3+} hollow octahedrons and YF_3: 20%Yb^{3+}/2%Er^{3+} nanospheres excited with a 980 nm laser.

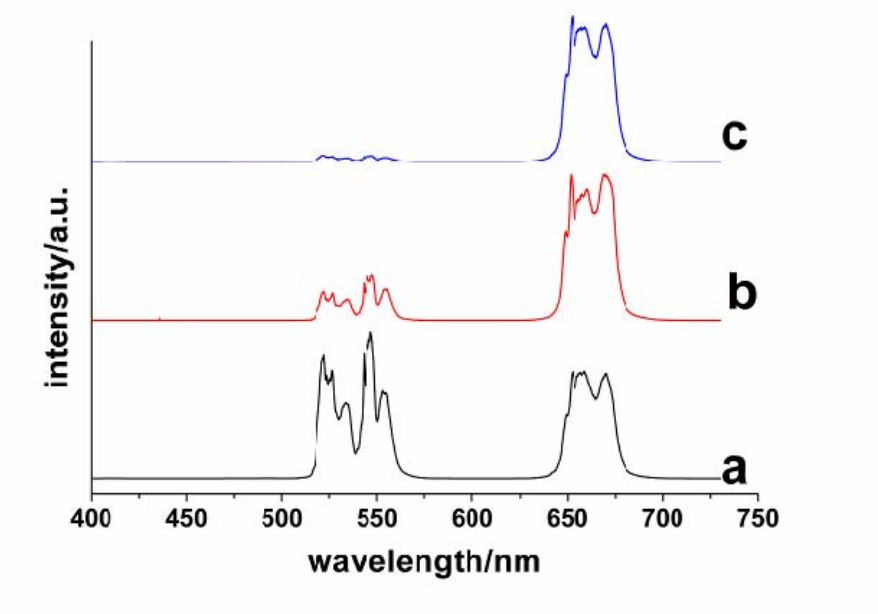

Fig. S6 UC PL emission spectra of $Y_6O_5F_8$: x%Yb^{3+}/2%Er^{3+} microtubes excited with a 980 nm laser. a)x=3, b)x=10, c)x=20.

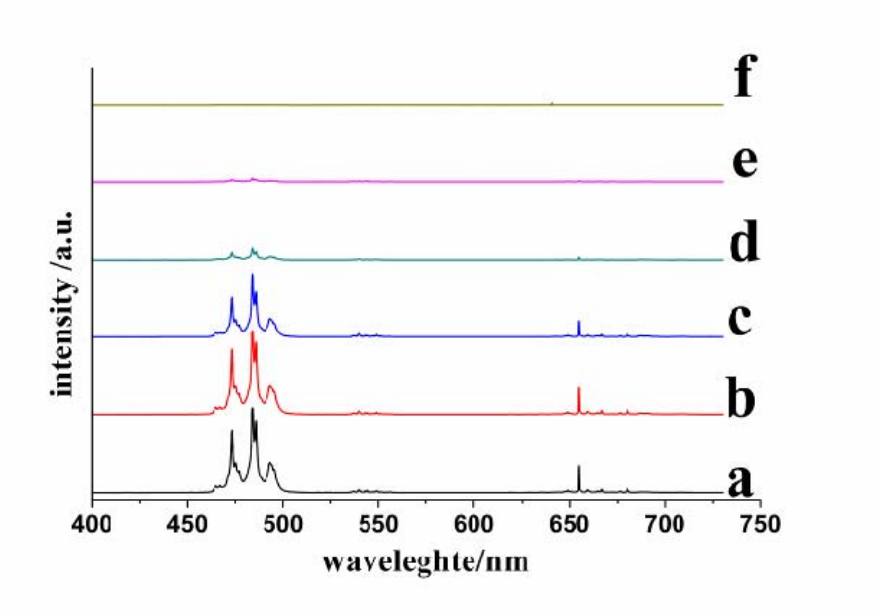

Fig. S7 UC PL emission spectra of $Y_6O_5F_8$: 3%Yb^{3+}/x%Tm^{3+} microtubes excited with a 980 nm laser. a)x=0.2, b)x=0.4, c)x=0.6, d)x=0.8, e)x=1.0, f)x=2.0

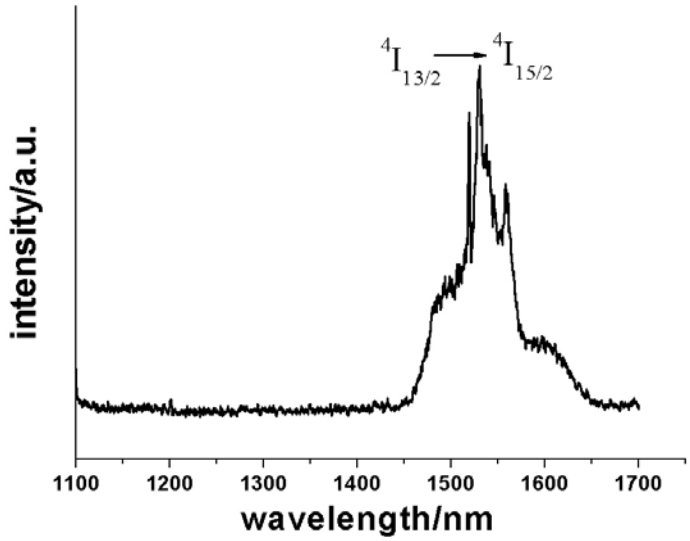

Fig. S8 Downconversion PL emission spectra of $Y_6O_5F_8$: 20%Yb^{3+}/2%Er^{3+} excited by 980 nm laser diode.

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Doping concentration/mol%			CIE	
Er^{3+}	Yb^{3+}	Tm^{3+}	x	y
0.2	5	0.4	0.26	0.33
0.2	6	0.4	0.27	0.27
0.2	7	0.4	0.28	0.33
0.4	5	0.4	0.49	0.35

Table S1. The CIE 1931 chromaticity diagram of UC spectra of different Tm^{3+}, Yb^{3+} and Er^{3+} doped $Y_6O_5F_8$ microtubes