Supplementary Information

Tuning the Crystalline Phase and Morphology of the $YF_3:Eu^{3+}$ Microcrystals through Fluoride Source

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Table S1: Lattice parameters of Eu^{3+}-doped YF_3 microcrystals.

Sample	Fluoride source	a (Å)	b (Å)	c (Å)	α (°)	β (°)	γ (°)
$YF_3:Eu^{3+}$	NaF	5.6458	5.6458	5.6458	90	90	90
$YF_3:Eu^{3+}$	$NaBF_4$	6.3530	6.8500	4.3930	90	90	90
$YF_3:Eu^{3+}$	NH_4F	6.4340	6.9430	4.4290	90	90	90

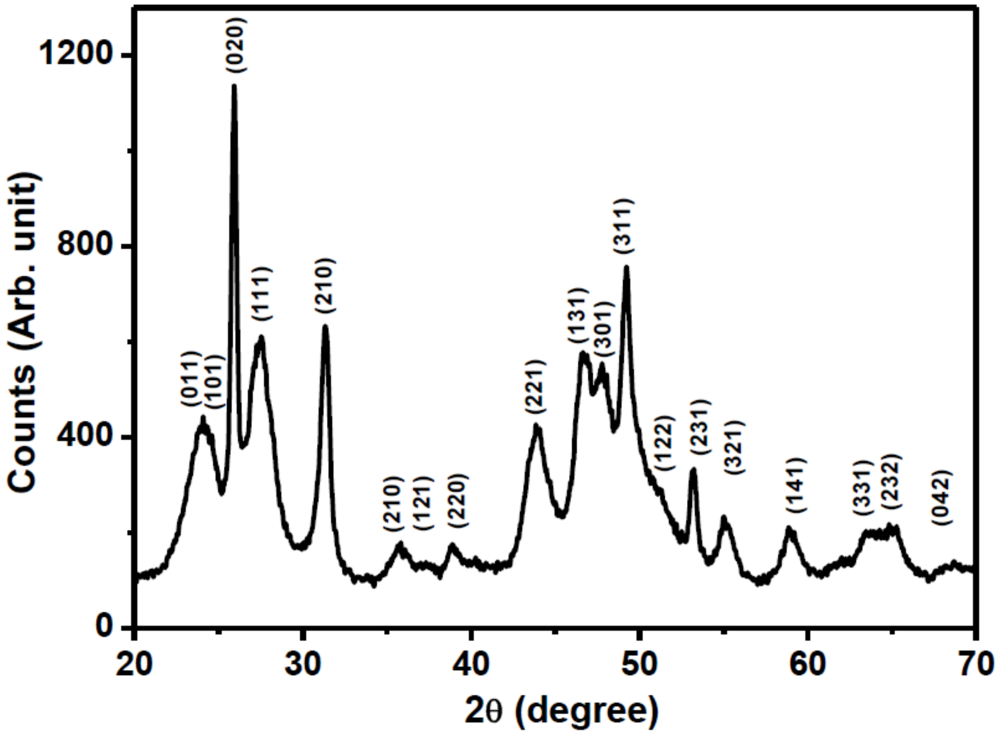

Fig. S1 Powder XRD pattern of Eu^{3+}-doped YF_3 microcrystals prepared without pyridine.

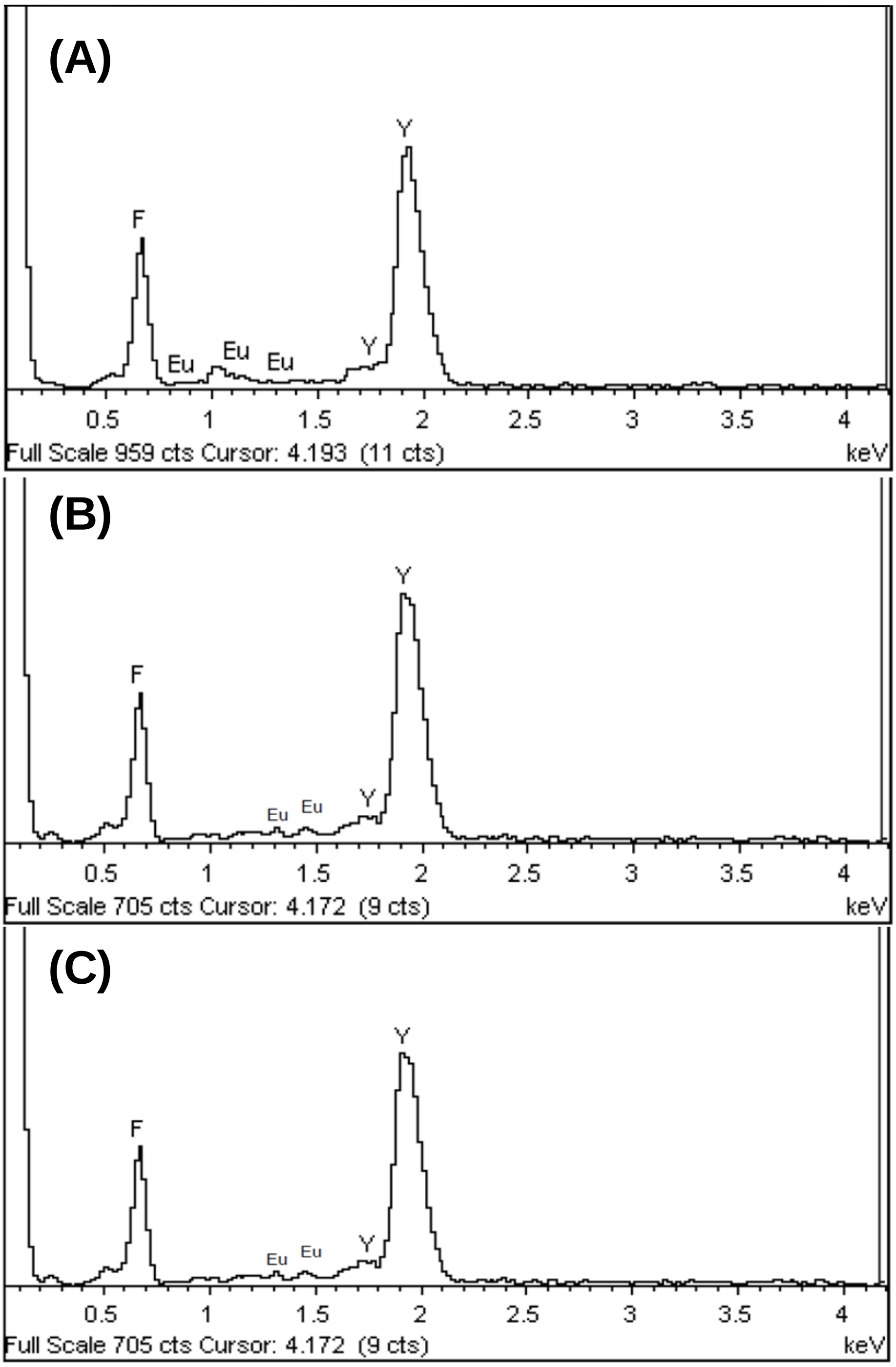

Fig. S2 EDX spectra of Eu^{3+}-doped YF_3 microcrystals prepared with (A) NaF (B) $NaBF_4$ and (C) NH_4F as fluoride sources.

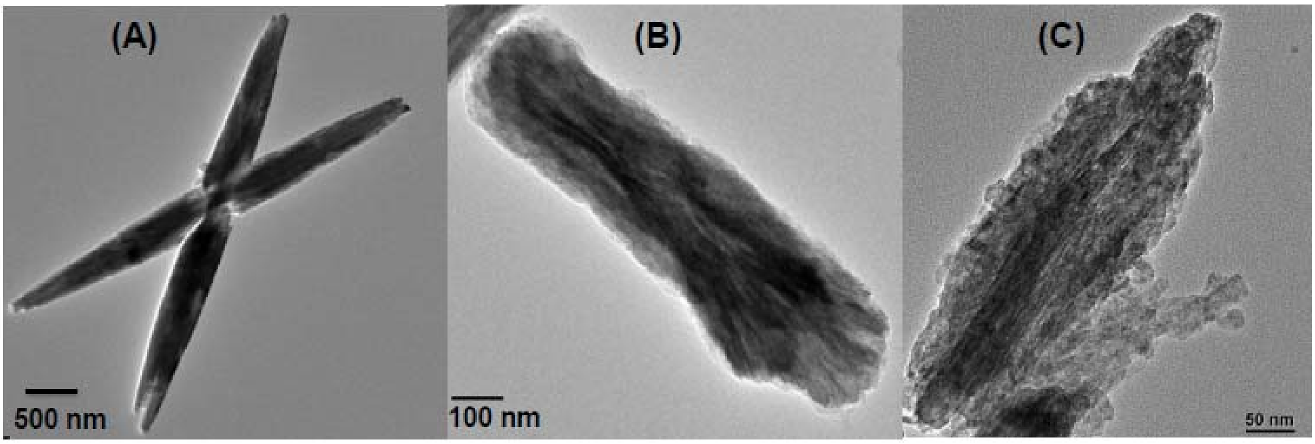

Fig. S3 HRTEM images of Eu^{3+}-doped YF_3 microcrystals prepared using different fluoride sources (A) NaF (B) $NaBF_4$ and (C) NH_4F.

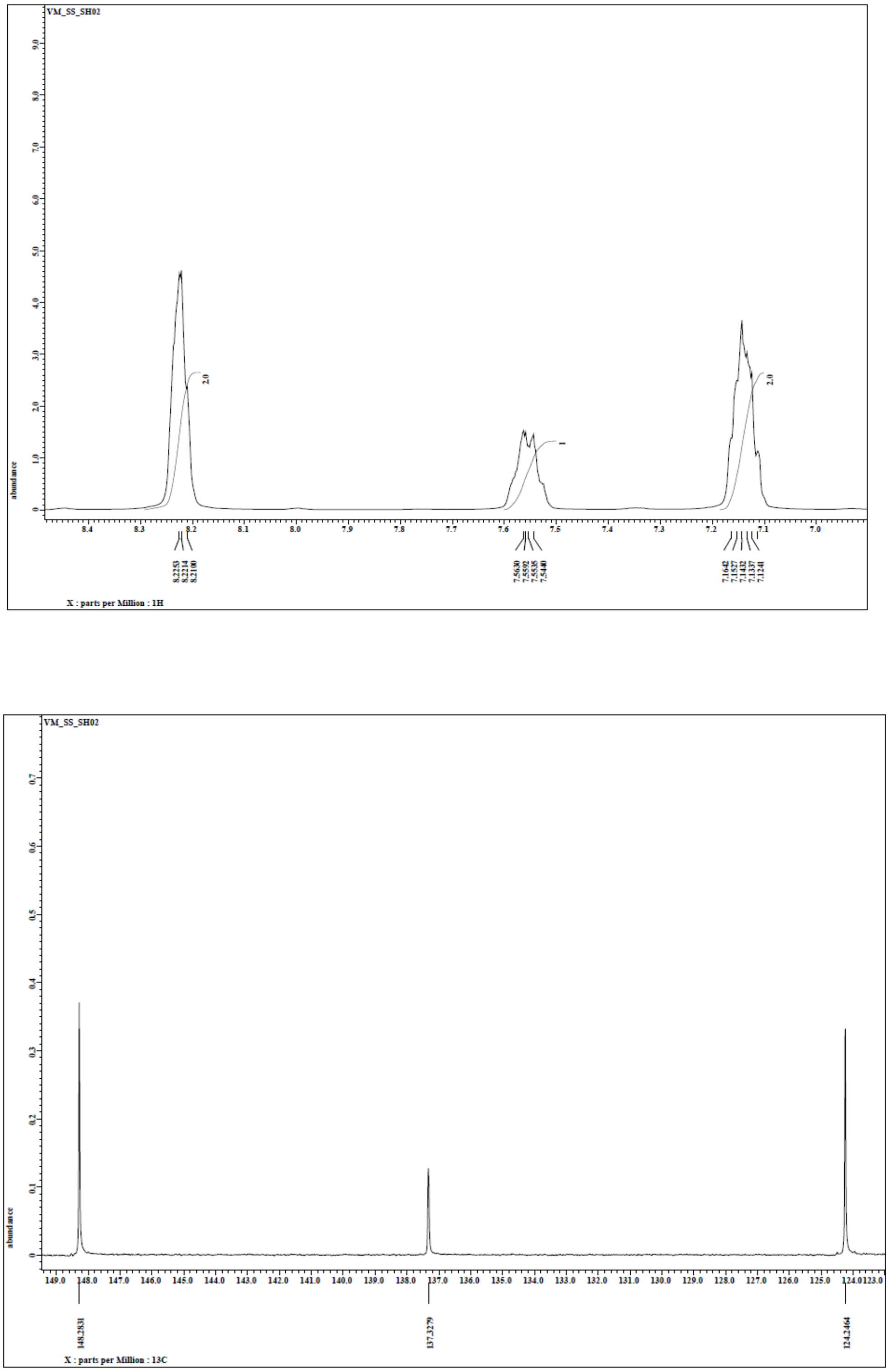

Fig. S4 (top) ^{1}H and (bottom) ^{13}C-NMR spectrum of pyridine functionalised Eu^{3+}-doped YF_3 microcrystals prepared using NaF as fluoride source.

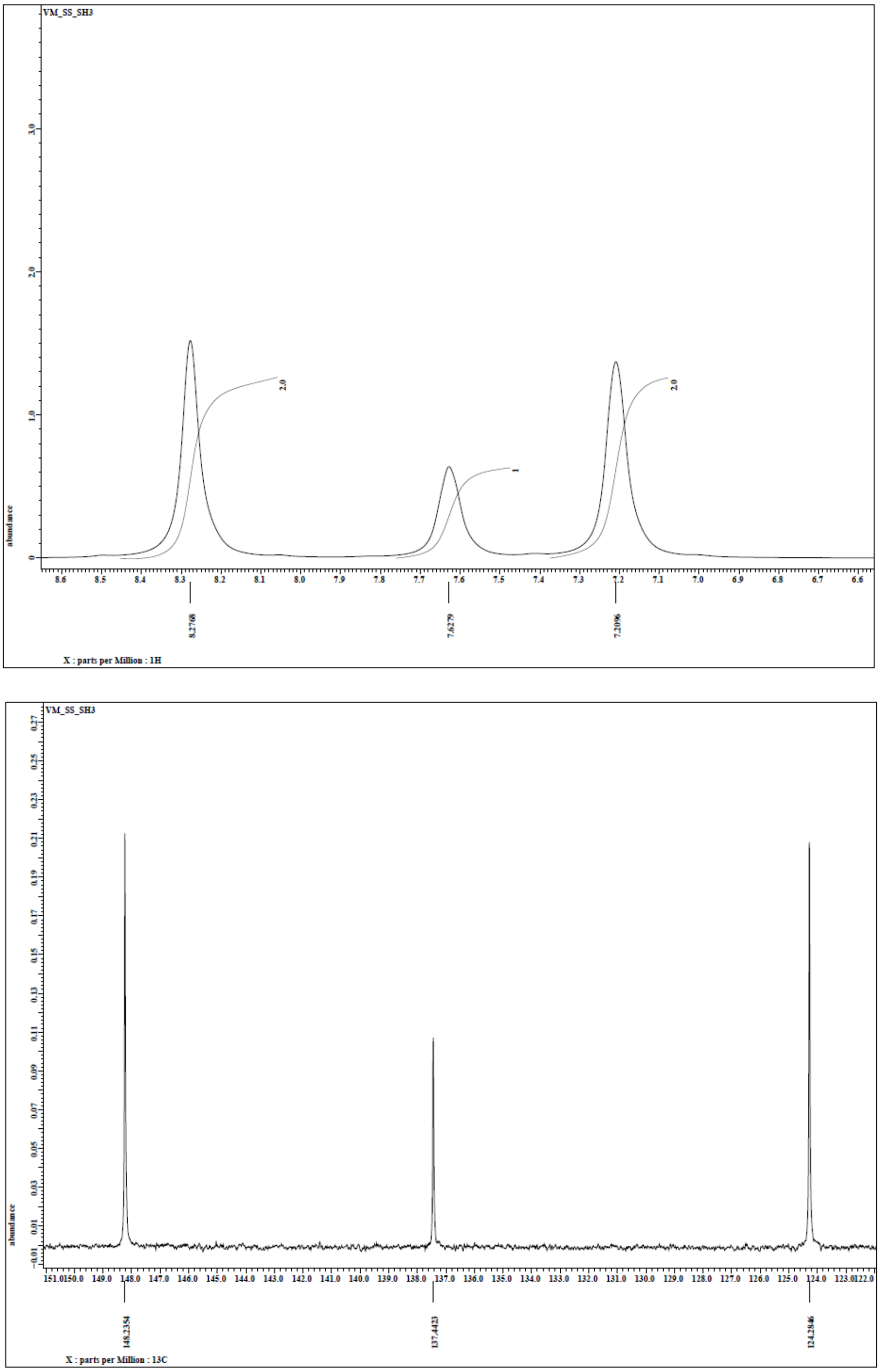

Fig. S5 (top) ^{1}H and (bottom) ^{13}C-NMR spectrum pyridine functionalised Eu^{3+}-doped YF$_3$ microcrystals prepared using NaBF$_4$ as fluoride source.

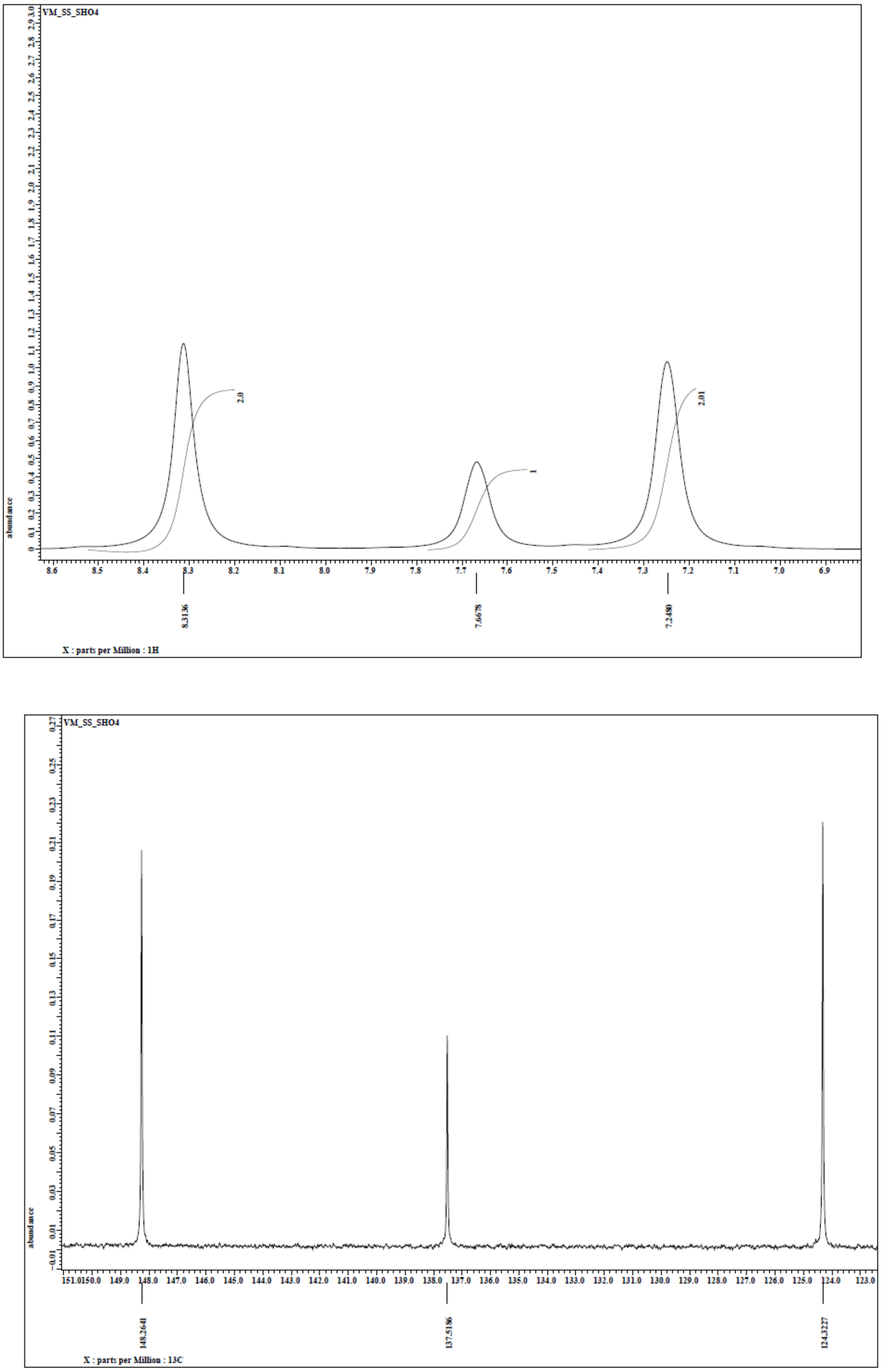

Fig. S6 (top) ^{1}H and (bottom) ^{13}C-NMR spectrum of pyridine functionalised Eu^{3+}-doped YF_3 microcrystals prepared using NH_4F as fluoride source.

[**Note:** All the ^{1}H-NMR spectra of pyridine functionalized Eu^{3+}-doped YF_3 microcrystals prepared using different fluoride sources (NaF, $NaBF_4$, and NH_4F) contains three signals with the integral intensity ratio of 2:1:2 which correspond to the three chemically different protons in the pyridine molecule. These signals originate from the α-protons (chemical shift 8.2±0.1 ppm), γ-proton (7.5±0.1 ppm) and β-protons (7.1±0.1 ppm) in D_2O solvent. Similarly, all the ^{13}C-NMR spectra of pyridine functionalized Eu^{3+}-doped YF_3 microcrystals prepared using different fluoride sources (NaF, $NaBF_4$, and NH_4F) contains three signals which correspond to the α-carbon (chemical shift 148.2±0.01 ppm), γ-carbon (chemical shift 137.4±0.1 ppm), and β-carbon (chemical shift 124.2±0.1 ppm) in D_2O solvent.

The results confirm (shown in Fig. S4-S6) the binding of the pyridine molecules to the microcrystals. While there is hardly any change in the ^{13}C NMR spectra, in the ^{1}H NMR there is a slight difference in the broadening of the peaks. We presume the difference in the broadening of the peaks between samples is likely due to the difference in the morphology. This causes a change in the orientation of the pyridine molecules thus affecting the rotational freedom.

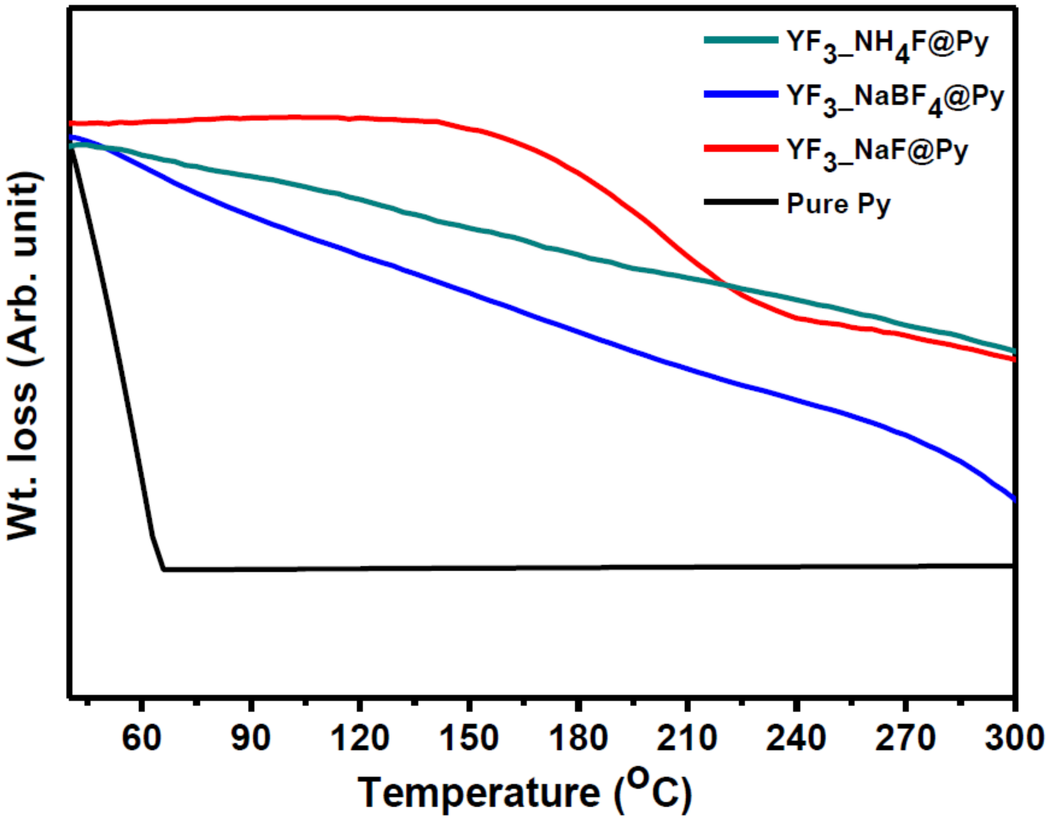

Fig. S7 TGA patterns for Eu^{3+}-doped YF_3 microcrystals prepared using NaF, $NaBF_4$ and NH_4F as fluoride source.

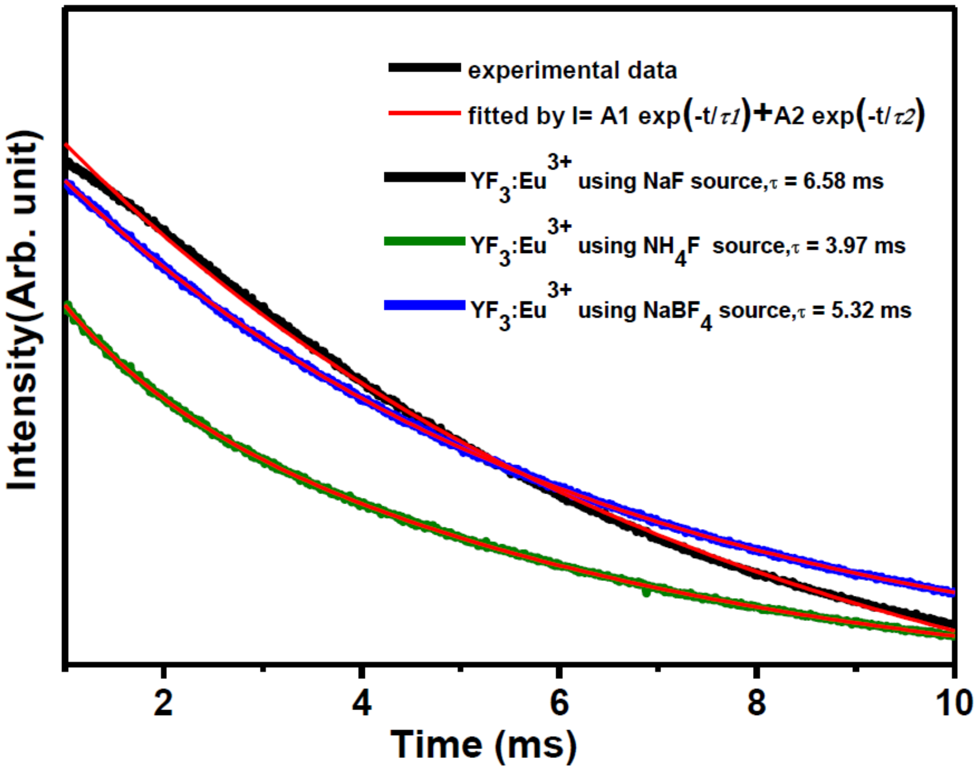

Fig. S8 Photoluminescence decay curves of 5 mol% Eu^{3+}-doped YF_3 microcrystals prepared using NaF, $NaBF_4$ and NH_4F as fluoride source.

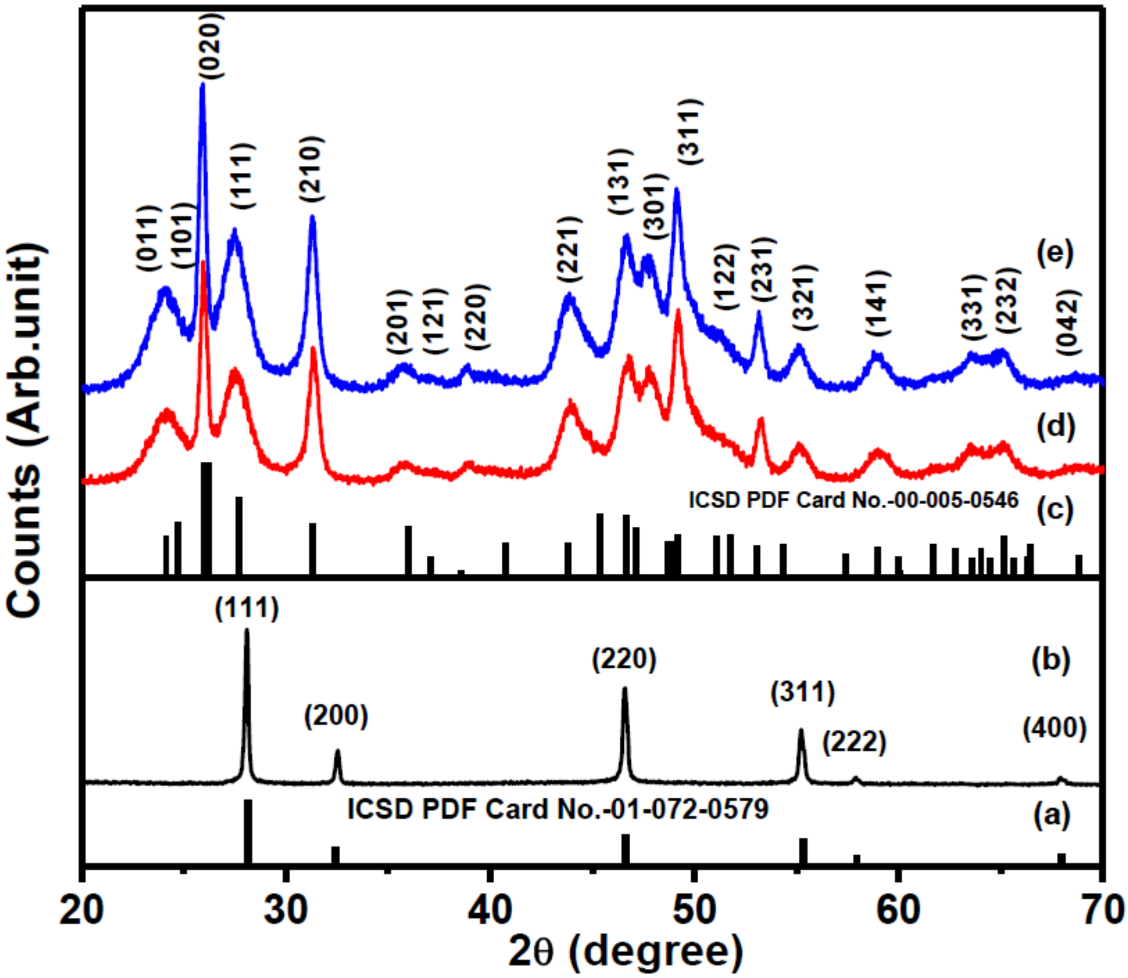

Fig. S9 XRD patterns of Eu^{3+}-doped YF_3 microcrystals prepared without capping ligands using (b) NaF, (d) $NaBF_4$ and (e) NH_4F as fluoride precursors. The corresponding standard patterns are (a) and (c).

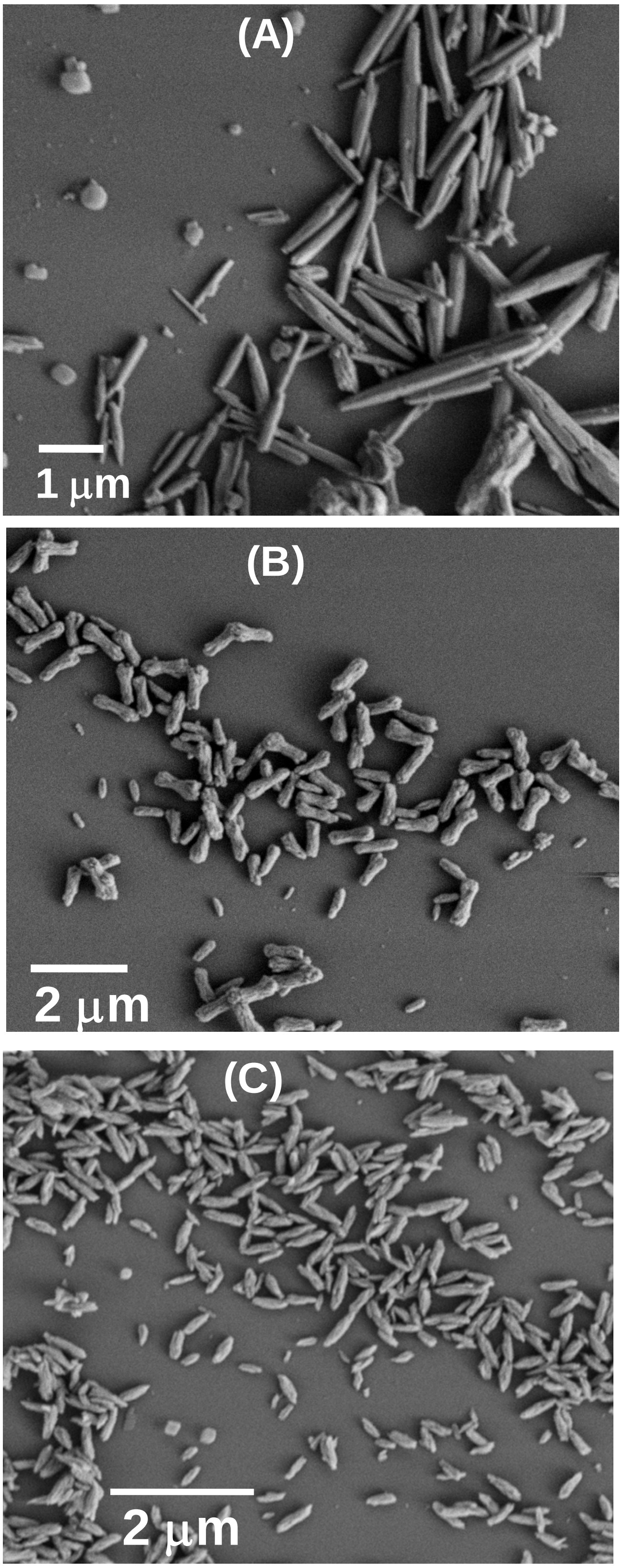

Fig. S10. SEM images of Eu^{3+}-doped YF_3 microcrystals prepared using (A) NaF, (b) $NaBF_4$ and (c) NH_4F without the capping ligands pyridine.