

Supporting Information

Annealing-induced ultra-efficient NIR-to-VIS upconversion of nano-/micro-scale α and β NaYF₄:Er³⁺,Yb³⁺ crystals

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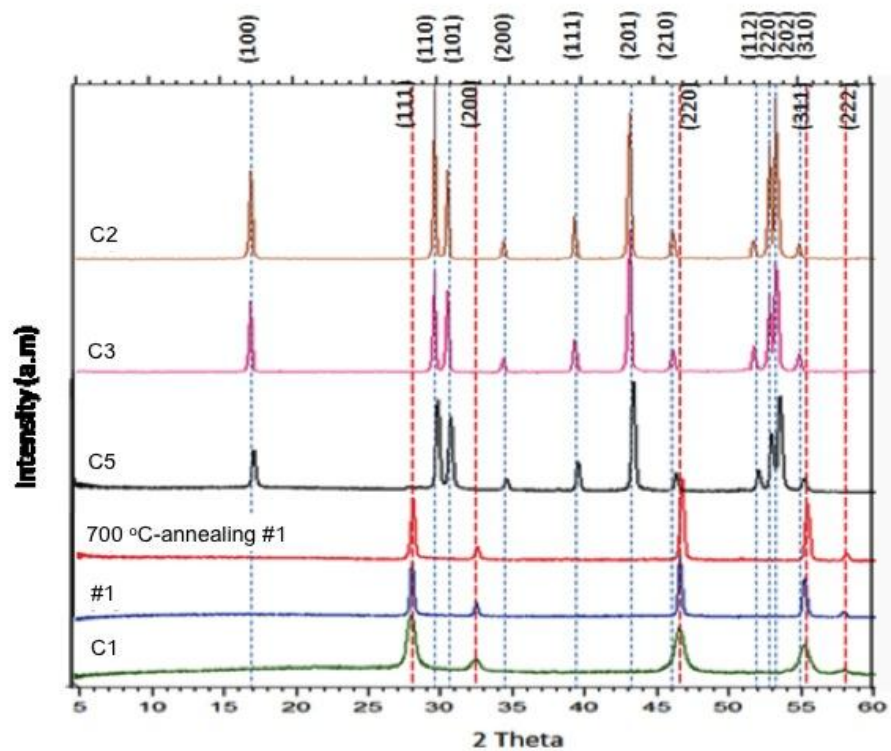


Fig.S1 XRD patterns of α - NaYF_4 : Er^{3+} , Yb^{3+} (C1, green; #1, blue) and β - NaYF_4 : Er^{3+} , Yb^{3+} (C2, yellow; C3, pink; C5, black), and 700 °C-annealed α - NaYF_4 : Er^{3+} , Yb^{3+} (#1, red)

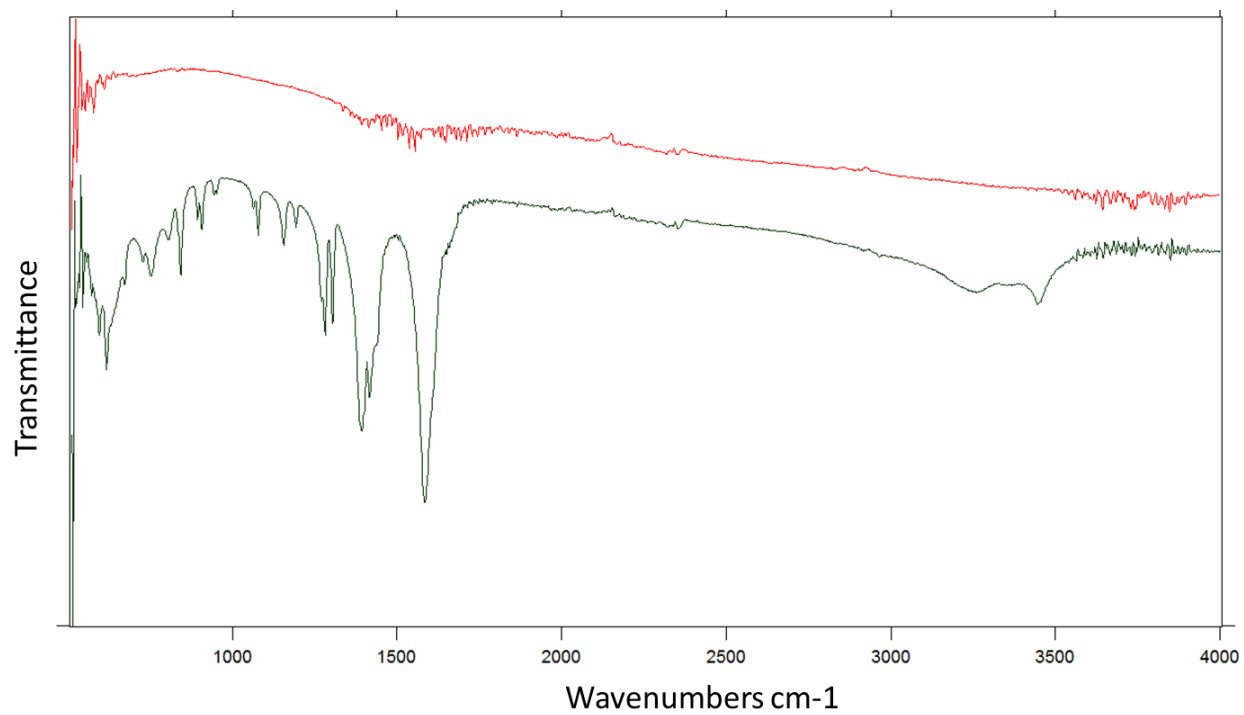


Fig.S2. FTIR spectra of citrate-modified NaYF₄:Er³⁺, Yb³⁺ crystals (sample C5) **and its annealed product at 700°C.**

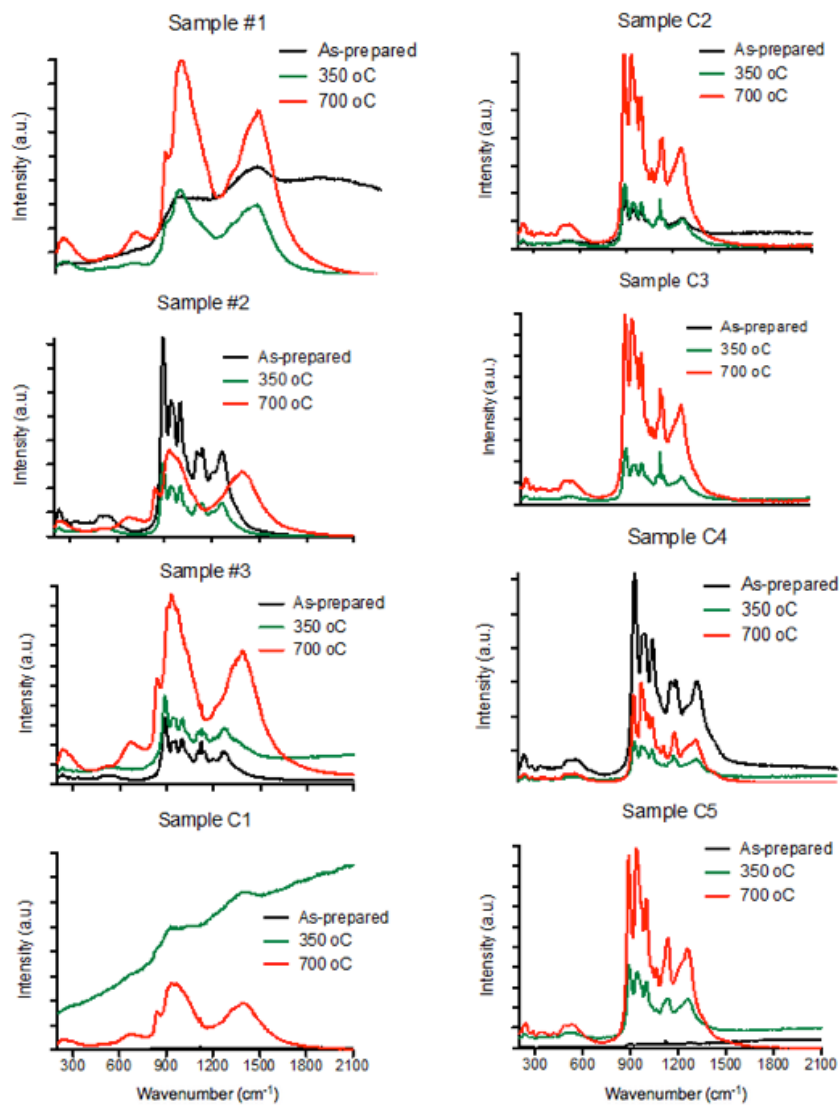


Fig.S3 Raman spectra of various NaYF₄:Er³⁺, Yb³⁺ crystals before (as-prepared, black) and after annealing at 350 °C (green) and 700 °C (red)

Table S1. Raman spectra data (cm⁻¹) of doped α- and β-NaYF₄:Er³⁺, Yb³⁺ crystals

#1			#2			#3			C1			C2			C3			C4			C5			
Amb.	350°	700°	Amb.	350°	700°	Amb.	350°	700°	Amb.	350°	700°	Amb.	350°	700°	Amb.	350°	700°	Amb.	350°	700°	Amb.	350°	700°	
α	α	α	β	β	α	β	β	α	α	α	α	β	β	β	β	β	β	β	β	β	β	β	β	β
1416	1384	1390			1402			1392	1400	1431	1411													
			1274	1271		1273	1273					1265	1270	1265	1276	1262	1259	1273	1267	1267	1285	1267	1267	
			1230	1232		1229									1240		1137	1228sh		1229			1240	
			1144	1144		1144	1143					1148	1138	1138	1145	1124		1143	1141	1135			1138	1137
			1135	1132		1137						1122.6			1122			1138	1045		1122	1114	1038	
									1041					1069	1119		1068			1065			1092	
														1030sh						1038			1038	
1003			1001	1003		1003	1004		979	979		1001.5	1003	1000	1000	1000	1000	1001	1001	1000	1001	1000	1000	
	932	937	945	948	932	956	960	939				958.6	955	935	961	960	997	955	940	972	985	951	971	
		871	893	893	849	895	891	875			844	893	893	888	890	895	939	895	891	935	896	899	938	
	687	701	552	575	699	555	580	703		714		550	572	555	565	565	888	548br	567	888	587w	560	888	
				516												533	548	359	506	559		521	558	
													512	516			506			506	518		458	505
			362vw			357						350			367			315	314	436		363	311	
			313vw			314								291	291	288	288			292				
	279	265	230vw	244	261	242	240	260		266		242	242	245	244	240	244	233	244	253	249	247	249	
	179	170			163			170		175				126			126			128			150	147

B: broad, Amb.: ambient, w: weak intensity, vw: very weak, sh: shoulder, br: broad band

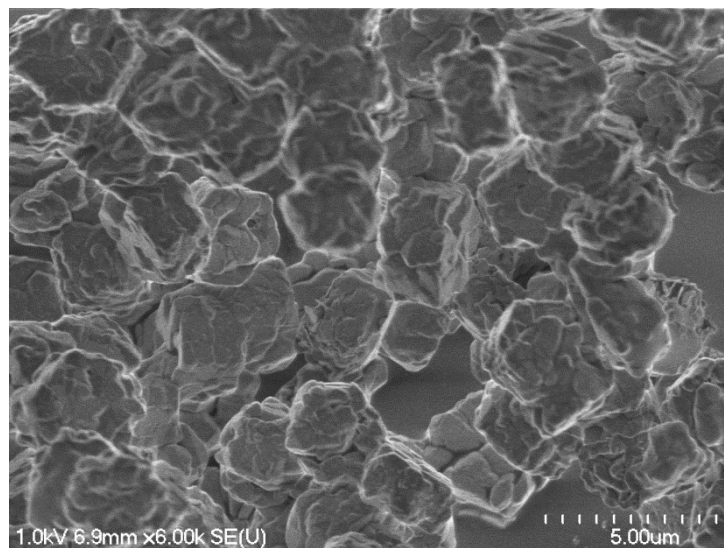


Fig. S4. Typical SEM image of 700°C annealed β -NaYF₄:Er³⁺, Yb³⁺ crystals (sample C3). The annealed crystals were ground before their fluorescence was measured (Figure 5).