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Supplementary Materials

Effect of Gd^{3+}, La^{3+}, Lu^{3+} Co-Doping on the Morphology and Luminescent Properties of $NaYF_4:Sm^{3+}$ Phosphors

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The supplementary materials contain unit cell parameters, refined from XRD patterns, pre-exponential constants, fitting lifetimes and average luminescence lifetimes of the synthesized samples.

Table S1. Unit cell parameters of the $NaY_{(1-x)}Sm_xF_4$ samples.

X (Sm^{3+})	a, Å	c, Å	V, $Å^3$
0	5.9900(5)	3.5268(3)	109.589(19)
0.02	5.9904(6)	3.5281(4)	109.64(2)
0.05	5.9939(5)	3.5325(3)	109.91(2)
0.1	5.9973(5)	3.5368(3)	110.17(2)
0.2	6.0048(5)	3.5469(3)	110.76(2)
0.3	6.0138(4)	3.5583(3)	111.447(17)
0.4	6.0233(4)	3.5704(3)	112.178(18)
0.5	6.0326(4)	3.5839(3)	112.953(19)

Table S2. Unit cell parameters of the $NaY_{(0.98-x)}Sm_{0.02}La_xF_4$ samples.

X (La^{3+})	a, Å	c, Å	V, $Å^3$
0.005	5.9911(5)	3.5310(3)	109.756(19)
0.02	5.9955(4)	3.5352(2)	110.050(17)
0.05	6.00170(16)	3.54401(19)	110.554(8)
0.1	6.0128(5)	3.5604(3)	111.47(2)
0.2	6.0340(5)	3.5917(3)	113.25(2)
0.4			
0.6			

Table S3. Unit cell parameters of the $NaY_{(0.98-x)}Sm_{0.02}Gd_xF_4$ samples.

X (Gd^{3+})	a, Å	c, Å	V, $Å^3$
0.005	5.9917(4)	3.5290(3)	109.719(17)
0.02	5.9914(4)	3.5290(3)	109.708(18)
0.05	5.9942(5)	3.5320(3)	109.902(19)
0.1	5.9949(5)	3.5360(3)	110.05(2)
0.2	6.0008(5)	3.5424(3)	110.47(2)
0.4	6.0117(4)	3.5571(2)	111.333(17)
0.6	6.0240(4)	3.5734(2)	112.299(16)

Table S4. Unit cell parameters of the $NaY_{(0.98-x)}Sm_{0.02}Lu_xF_4$ samples.

X (Lu^{3+})	a, Å	c, Å	V, $Å^3$
0.005	5.9944(3)	3.52989(18)	109.847(11)
0.02	5.9951(3)	3.52818(17)	109.819(11)
0.05	5.9966(4)	3.5296(3)	109.918(17)
0.1	5.9862(7)	3.5219(4)	109.30(3)
0.2	5.98301(15)	3.51629(10)	109.007(6)
0.4	5.97266(10)	3.50358(6)	108.237(4)
0.6	5.95889(9)	3.48396(5)	107.136(4)

Table S5. Pre-exponential constants, fitting lifetimes and average luminescence lifetimes of $NaY_{(1-x)}Sm_xF_4$ powders.

X (Sm^{3+})	t_1, ms	A_1	t_2, ms	A_2	t_{av}, ms
0.005	0.49585	0.36133	4.52447	0.67952	4.30263
0.01	0.69825	0.23256	4.44964	0.79106	4.28421
0.02	0.58935	0.32768	3.7595	0.70596	3.54448
0.03	0.60009	0.41627	3.538	0.62408	3.23940
0.05	0.30837	0.49036	2.2279	0.59149	2.03031
0.1	0.24629	0.78663	1.3877	0.36752	1.07347
0.2	0.13878	1.10607	0.67055	0.24386	0.41307

Table S6. Pre-exponential constants, fitting lifetimes and average luminescence lifetimes of $NaY_{(0.98-x)}Sm_{0.02}Gd_xF_4$ powders.

X (Gd^{3+})	t_1, ms	A_1	t_2, ms	A_2	t_{av}, ms
0	0.58935	0.32768	3.7595	0.70596	3.54448
0.0025	0.58007	0.34455	3.73643	0.69077	3.50958
0.005	0.60648	0.34961	3.74336	0.68448	3.50362
0.01	0.61335	0.35128	3.71315	0.68324	3.47050
0.07	0.60558	0.35478	3.70736	0.67945	3.46359
0.6	0.65792	0.32904	3.81826	0.70232	3.58219

Table S7. Pre-exponential constants, fitting lifetimes and average luminescence lifetimes of $NaY_{(0.98-x)}Sm_{0.02}Lu_xF_4$ powders.

X (Lu^{3+})	t_1, ms	A_1	t_2, ms	A_2	t_{av}, ms
0	0.58935	0.32768	3.7595	0.70596	3.54448
0.0025	0.65557	0.3448	3.82723	0.68725	3.57623
0.005	0.61999	0.36009	3.71785	0.67513	3.46482
0.01	0.59521	0.3532	3.6604	0.68179	3.42225
0.07	0.58935	0.34112	3.68533	0.69298	3.45940
0.6	0.58524	0.34268	3.67685	0.69221	3.45103

Table S8. Pre-exponential constants, fitting lifetimes and average luminescence lifetimes of $NaY_{(0.98-x)}Sm_{0.02}La_xF_4$ powders.

X (La^{3+})	t_1, ms	A_1	t_2, ms	A_2	t_{av}, ms
0	0.58935	0.32768	3.7595	0.70596	3.54448
0.0025	0.58503	0.34648	3.68518	0.68894	3.45597
0.005	0.60215	0.33958	3.78063	0.69506	3.55115
0.01	0.5846	0.34412	3.68805	0.69116	3.46104
0.07	0.59006	0.3325	3.69152	0.70171	3.47315
0.6	0.6829	0.3456	3.78738	0.68578	3.52878