

SUPPLEMENTARY INFORMATION

Eu³⁺:YF₃ and Eu³⁺, Nd³⁺:YF₃ nanoparticles for optical temperature sensing: the influence of annealing on temperature dependence of the spectral-kinetic characteristics

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Keywords

Lifetime thermometry, Nd³⁺/Yb³⁺, Nd³⁺/Yb³⁺:YF₃, down-conversion, optical temperature sensors, thermal expansion

YF₃: Eu³⁺

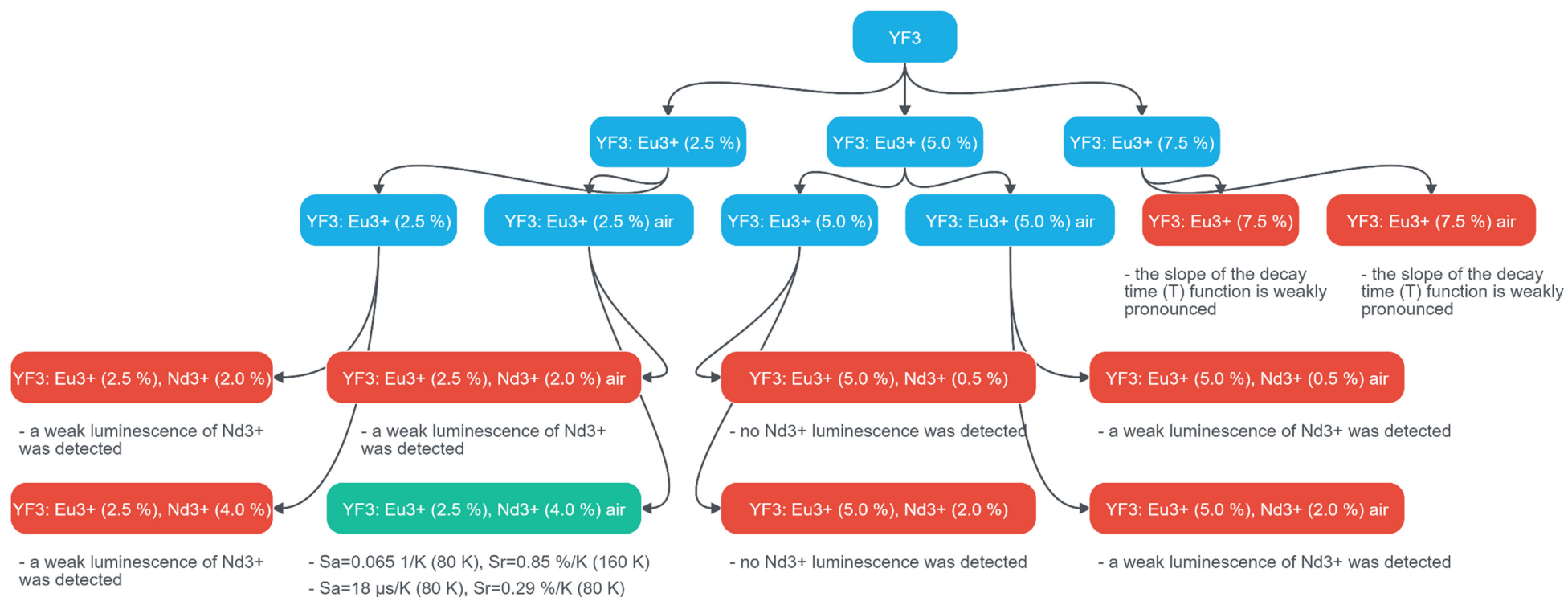


Table S1a. The sample classification (the only “green” sample Eu^{3+} (2.5%), Nd^{3+} (4.0%) :YF₃ was chosen for further investigation

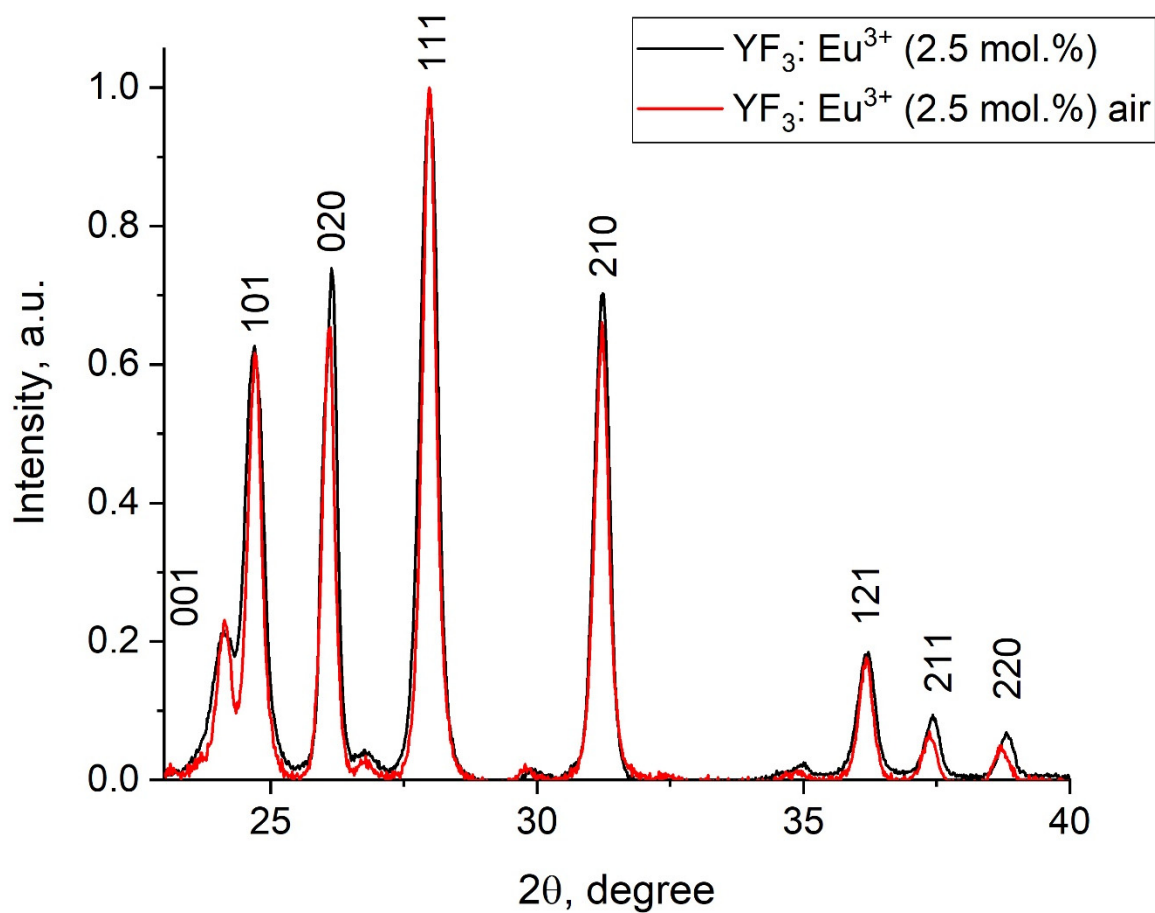


Figure S1. XRD patterns of $\text{YF}_3:\text{Eu}^{3+}$ (2.5 mol.%) nanoparticles before and after annealing in air (400 °C, 4 hours)

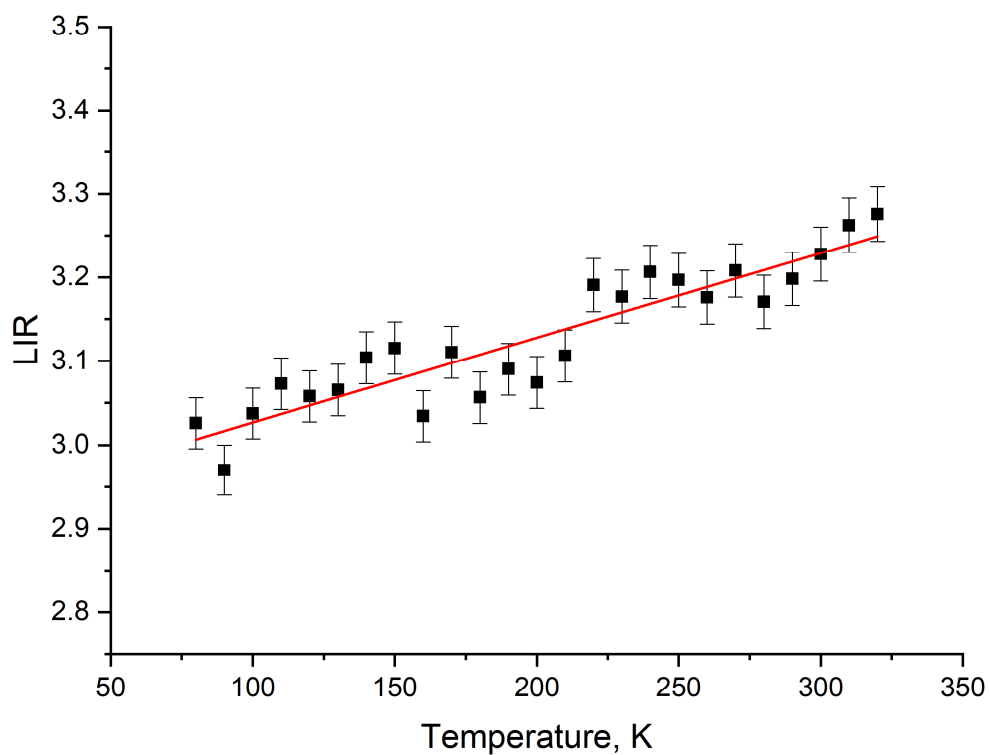
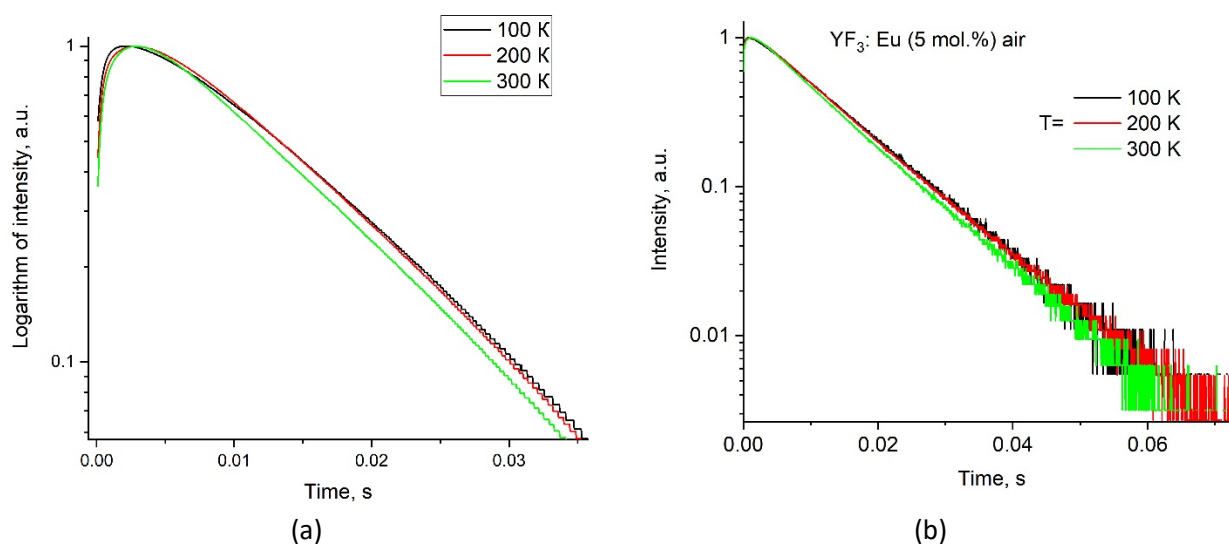


Figure S2. Luminescence intensity ratio (LIR) of two Eu^{3+} peaks corresponding to $^5\text{D}_0 - 7\text{F}_1$ and $^5\text{D}_0 - 7\text{F}_2$ transitions



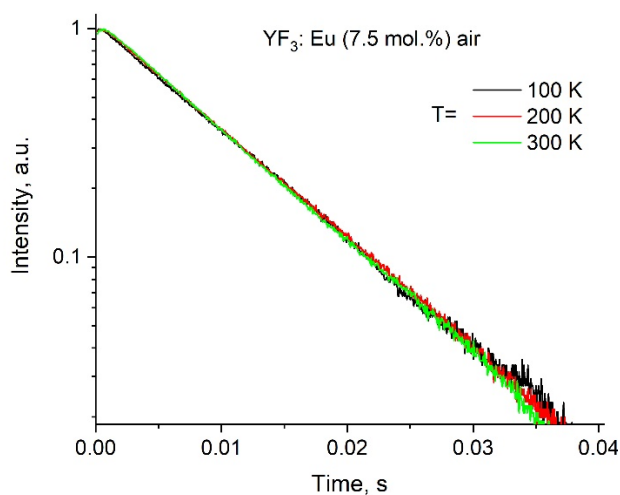
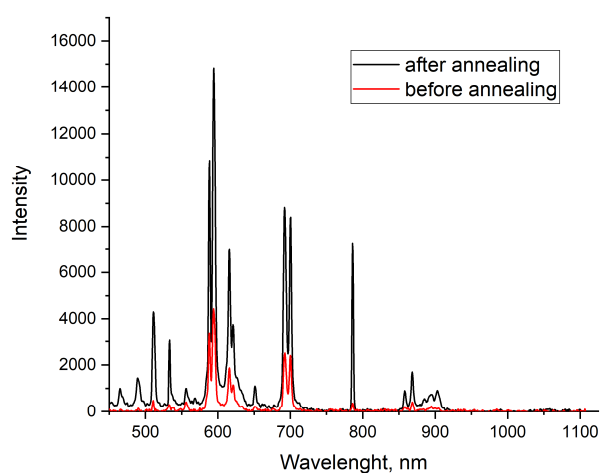
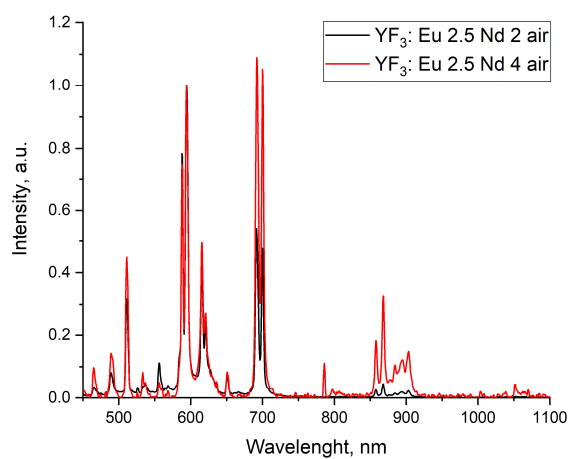


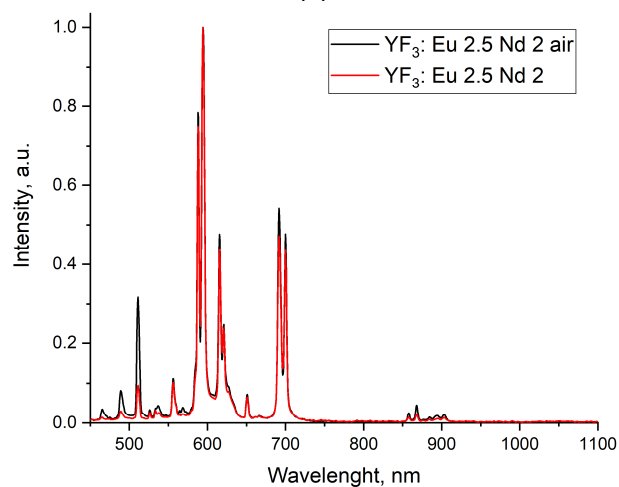
Figure S3. Luminescence decay curves at 589.5 nm ($^5D_0 - ^7F_1$ transition) for $YF_3:Eu^{3+}$ (a) 2.5; b) 5.0 and c) 7.5 mol.%) samples annealed in air in the temperature range 80-320 K



(a)



(b)



(c)

Figure S4. The spectra of $\text{YF}_3: \text{Eu}^{3+}, \text{Nd}^{3+}$ samples having different combinations of the doping ions (see in the Figure the values of concentrations)

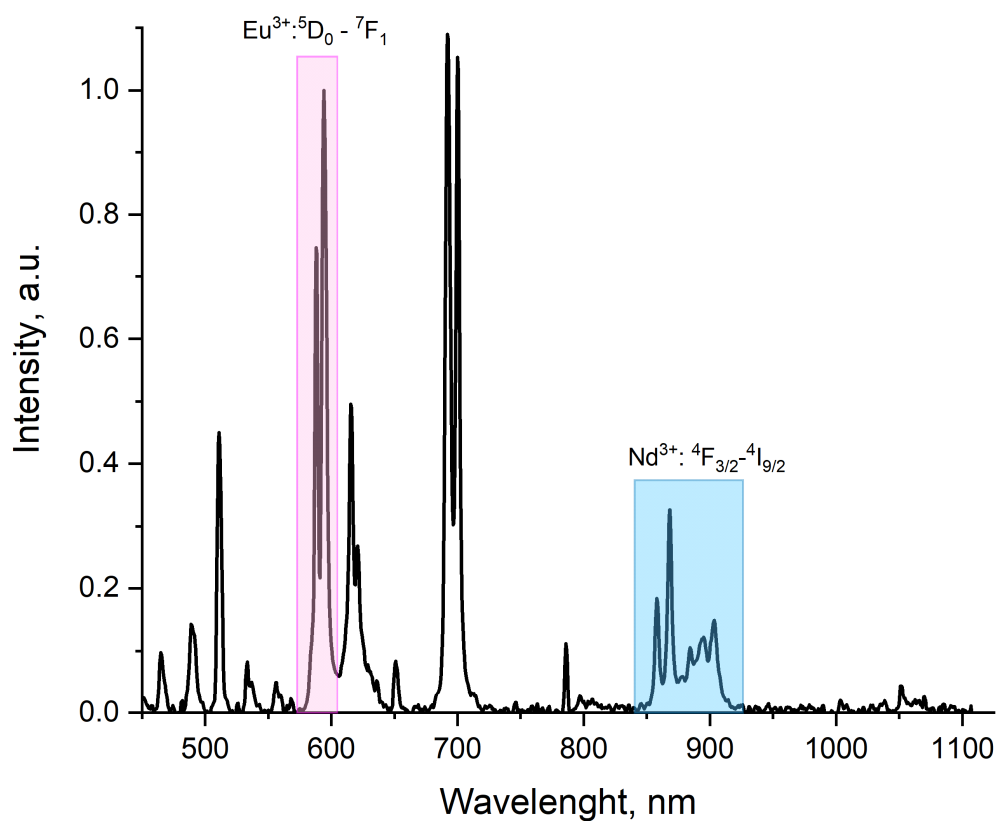


Figure S5. The schematic representation of LIR choice

Table S1. Luminescence decay time (τ_{decay}) at 589.5 nm ($^5D_0 - ^7F_1$ transition) for YF₃: Eu³⁺ (a) 2.5; b) 5.0 and c) 7.5 mol.% samples

T, K	YF ₃ : Eu ³⁺ (2.5 mol.%)		YF ₃ : Eu ³⁺ (2.5 mol.%)air		YF ₃ : Eu ³⁺ (5.0 mol.%)		YF ₃ : Eu ³⁺ (5.0mol.%)air		YF ₃ : Eu ³⁺ (7.5 mol.%)		YF ₃ : Eu ³⁺ (7.5 mol.%)air	
	Decay time, μs	Deviation, μs	Decay time, μs	Deviation, μs	Decay time, μs	Deviation, μs	Decay time, μs	Deviation, μs	Decay time, μs	Deviation, μs	Decay time, μs	Deviation, μs
80	12.29	0.024	13.48	0.04	10.38	0.016	11.8	0.017	7.63	0.024	9.08	0.02
90	12.2	0.021	13.75	0.046	10.26	0.014	11.77	0.019	7.65	0.022	9.012	0.021
100	12.15	0.022	13.66	0.047	10.09	0.013	11.72	0.016	7.57	0.023	9.35	0.025
110	11.94	0.02	13.57	0.042	10.01	0.013	11.65	0.014	7.38	0.018	9.18	0.021
120	11.61	0.013	13.41	0.042	9.87	0.013	11.63	0.017	7.24	0.019	9.18	0.021
130	11.54	0.012	13.41	0.044	9.77	0.012	11.55	0.015	7.17	0.02	9.1	0.017
140	11.48	0.011	13.44	0.046	9.69	0.014	11.47	0.015	7	0.021	9.18	0.018
150	11.46	0.011	13.37	0.046	9.59	0.012	11.45	0.014	7.13	0.019	9.19	0.017
160	11.57	0.014	12.97	0.035	9.5	0.012	11.37	0.013	6.94	0.018	9.14	0.016
170	11.48	0.013	13.45	0.052	9.34	0.011	11.32	0.013	6.89	0.019	9.19	0.016
180	11.41	0.013	12.89	0.037	9.24	0.01	11.26	0.011	6.94	0.018	9.18	0.013
190	11.33	0.012	12.79	0.036	9.13	0.011	11.19	0.013	6.85	0.017	9.15	0.013
200	11.23	0.013	12.26	0.023	9.04	0.01	11.01	0.0087	6.84	0.016	9.12	0.013
210	11.14	0.012	12.41	0.029	8.93	0.01	10.95	0.0077	6.8	0.016	9.12	0.013
220	11.08	0.013	12.26	0.026	8.81	0.01	10.9	0.0076	6.76	1.6E-5	9.09	0.013
230	11	0.012	12.08	0.022	8.73	0.011	10.78	0.0073	6.71	0.015	8.99	0.013
240	10.91	0.013	12.1	0.025	8.66	0.01	10.77	0.0068	6.69	0.014	9.03	0.013
250	10.8	0.012	12.09	0.027	8.54	0.01	10.63	0.0068	6.55	0.021	9.02	0.013
260	10.74	0.013	11.91	0.023	8.46	0.01	10.61	0.0069	6.55	0.017	9	0.0113
270	10.69	0.012	11.75	0.02	8.39	0.011	10.5	0.0071	6.45	0.015	8.92	0.012
280	10.7	0.013	11.52	0.015	8.3	0.01	10.46	0.0067	6.41	0.014	8.94	0.012
290	10.55	0.012	11.54	0.017	8.25	0.01	10.44	0.0087	6.39	0.016	8.91	0.012
300	10.44	0.013	11.5	0.017	8.19	0.01	10.41	0.0077	6.35	0.015	8.86	0.011
310	10.37	0.012	11.37	0.014	8.1	0.011	10.41	0.0076	6.36	0.014	8.87	0.011
320	10.33	0.013	11.28	0.013	8.02	0.01	10.31	0.0073	6.35	0.014	8.82	0.011