Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics.

Supporting Information

The influence of manganese concentration on the sensitivity of bandshape and lifetime luminescent thermometers in $Y_3Al_5O_{12}$:Mn^{3+}, Mn^{4+}, Nd^{3+} nanocrystals

K. Trejgis, L. Marciniak[1]*

[1]Institute of Low Temperature and Structure Research, Polish Academy of Sciences, Okólna 2, 50-422 Wroclaw, Poland

* corresponding author: l.marciniak@int.pan.wroc.pl

KEYWORDS YAG, Mn^{4+}, manganese, concentration effect, luminescent thermometers

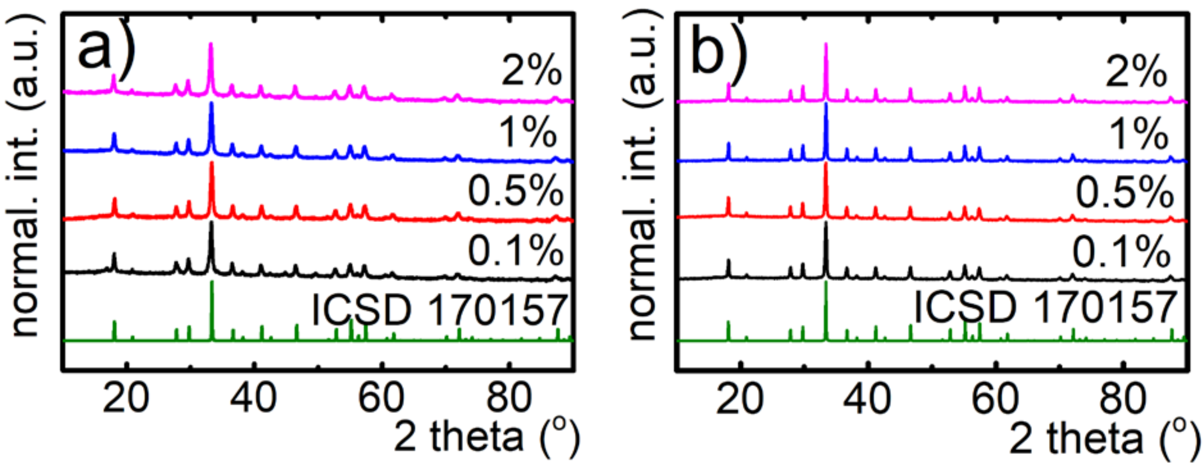

Figure S1. X-ray diffraction patterns of YAG: Mn^{3+}, Mn^{4+}, Nd^{3+} nanocrystals with different manganese concentration annealed at 850 °C -a; and at 1100 °C –b.

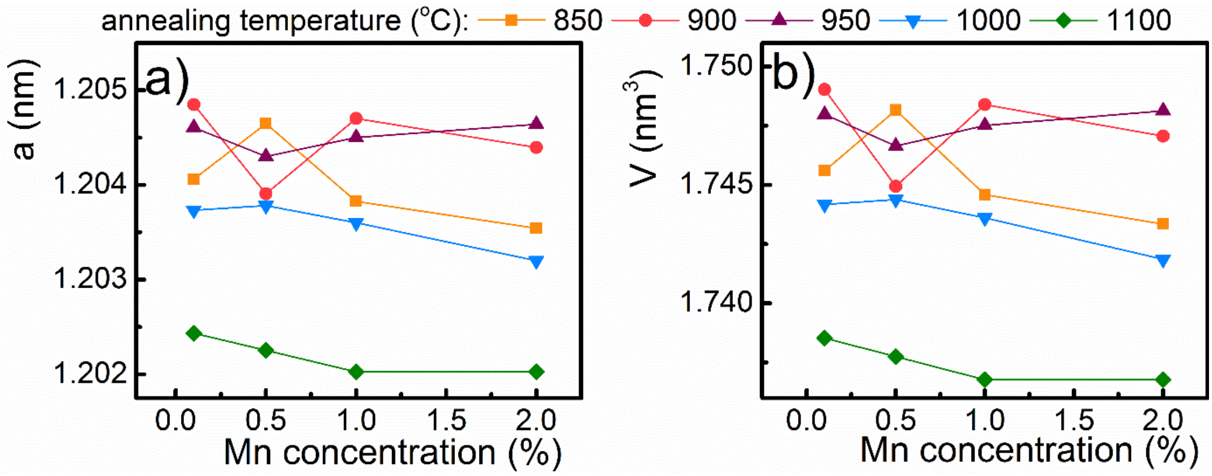

Figure S2 The influence of the manganese concentration on the unit cell parameter (a) –a and the volume of the unit cell –b for the YAG: Mn^{3+}, Mn^{4+}, Nd^{3+} nanocrystals annealed at different temperatures.

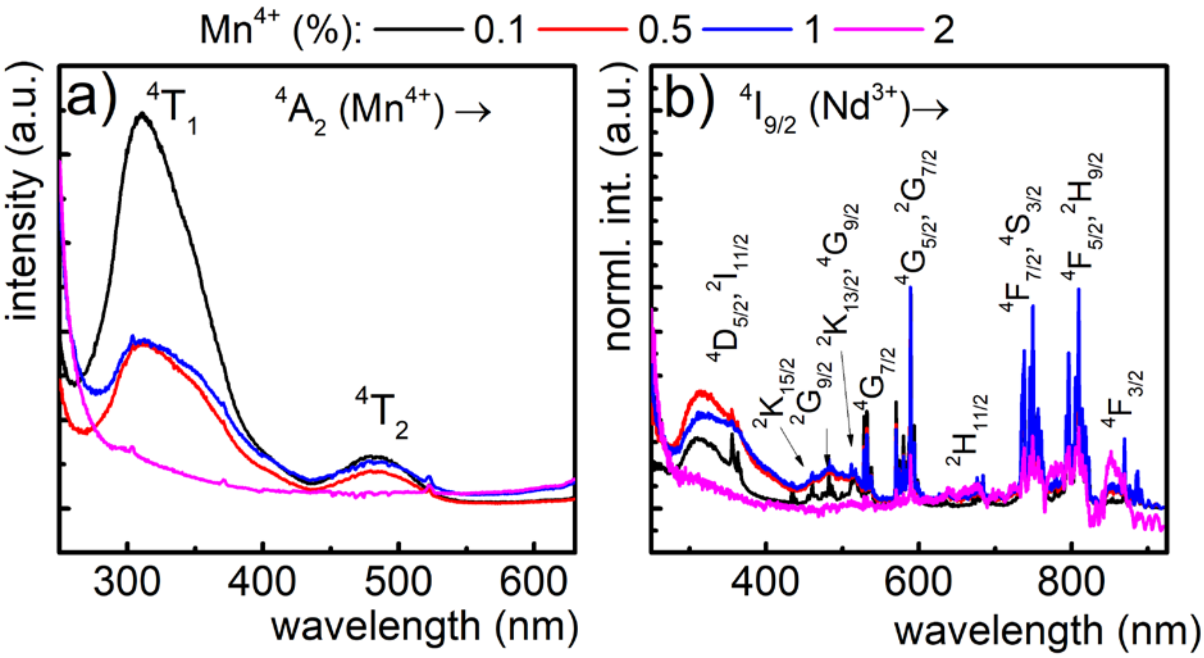

Figure S3 Excitation spectra of YAG: Mn^{3+}, Mn^{4+}, Nd^{3+} nanocrystals with different manganese concentration, annealed at 1100°C for λ_{em}=673 nm ($^2E \rightarrow {}^4A_2$ electronic transition of Mn^{4+} ions) –a; and λ_{em}=1064 nm ($^4F_{3/2} \rightarrow {}^4I_{11/2}$ electronic transition of Nd^{3+} ions) –b.

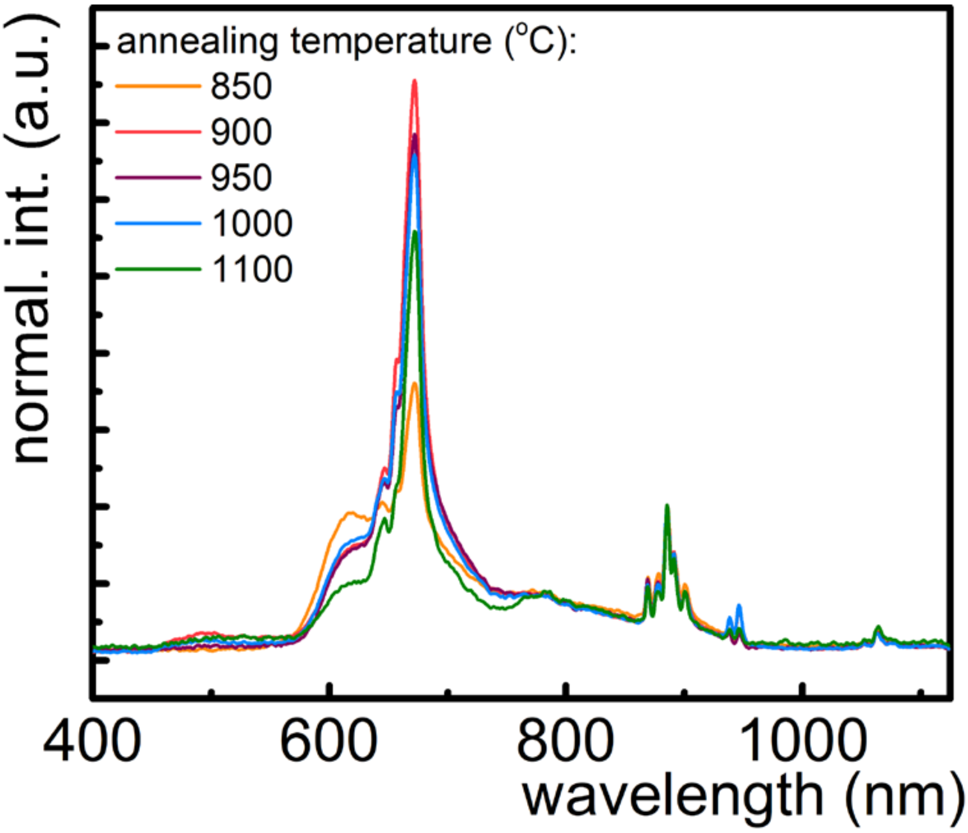

Figure S4. Normalized emission spectra (to the $^4F_{3/2}\rightarrow{}^4I_{11/2}$ electronic transition of Nd^{3+} ions, λ_{em}=1064 nm) of YAG: Mn^{3+}, Mn^{4+}, Nd^{3+} nanocrystals with 0.01% Mn^{4+} concentration obtained at 123 K upon 266 nm excitation line annealed at different temperatures.

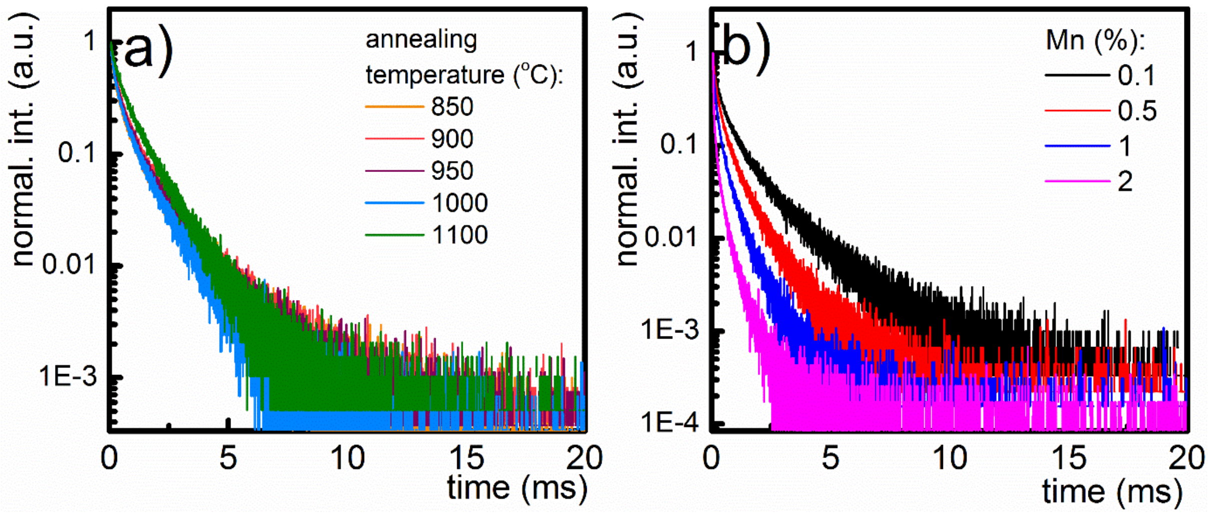

Figure S5 Luminescence decay profiles of $^2E\rightarrow{}^4A_2$ electronic transition of Mn^{4+} ions of the YAG: Mn^{3+}, Mn^{4+}, Nd^{3+} nanocrystals: the annealing temperatures effect for 0.1% of Mn^{4+} ions-a; and the manganese concentration effect for nanocrystals annealed at 850°C-b.

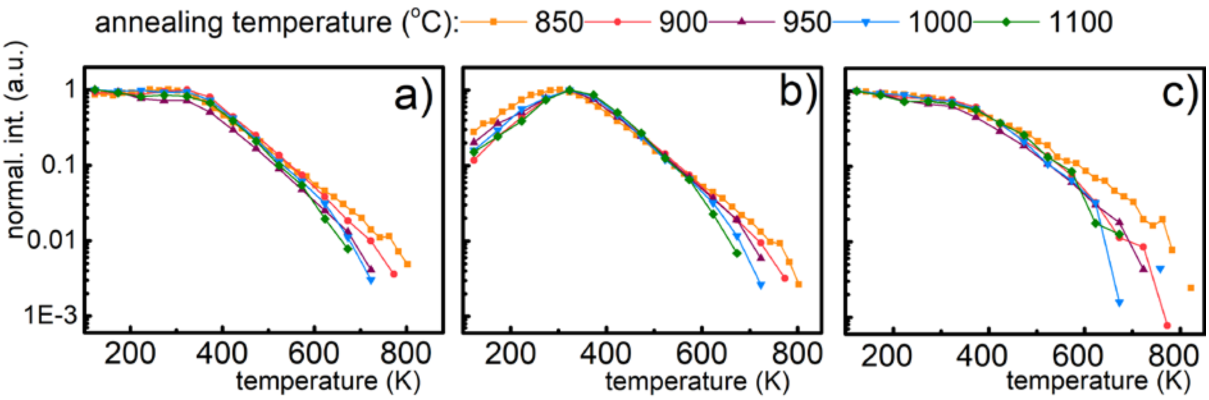

Figure S6 The influence of annealing temperature of thermal evolution of integral emission intensity of YAG: 0.01% (Mn^{3+}, Mn^{4+}) 1% Nd^{3+} nanocrystals measured for $^2E \rightarrow ^4A_2$ electronic transition of Mn^{4+} -a, Mn^{3+} ions-b; and $^4F_{3/2} \rightarrow ^4I_{9/2}$ electronic transition of Nd^{3+} ions-c.

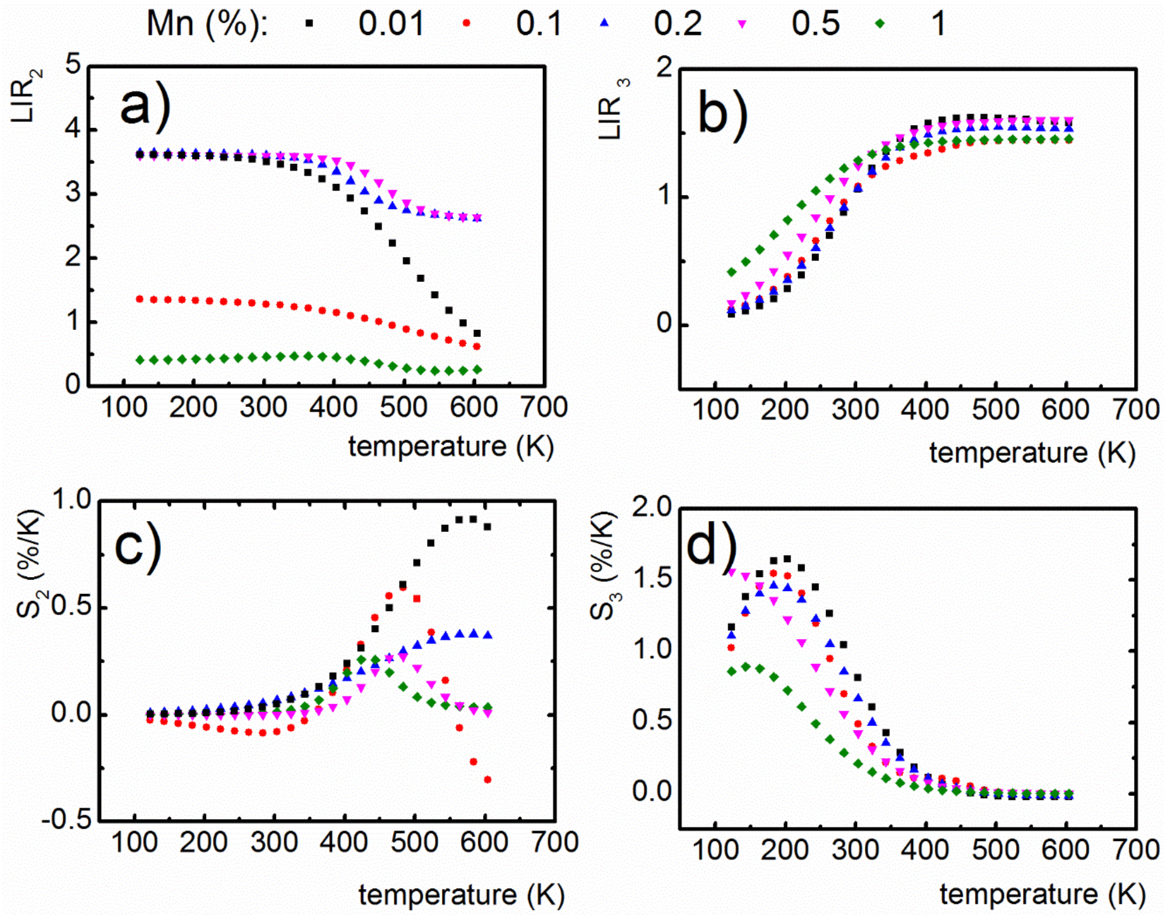

Figure S7. Thermal evolution of LIR_1-a and LIR_3-b and their relative sensitivities –c and d, respectively.

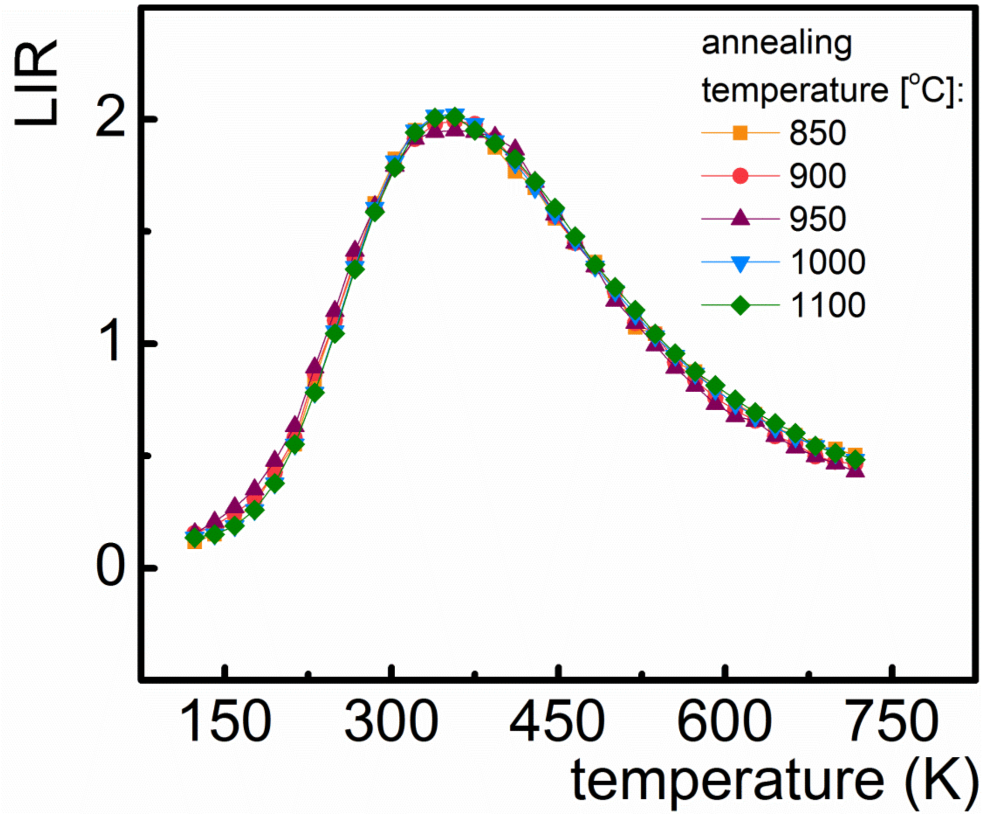

Figure S8 Thermal evolution of LIR of YAG: 0.01% (Mn^{3+}, Mn^{4+}) 1% Nd^{3+} nanocrystals annealed at different temperatures.

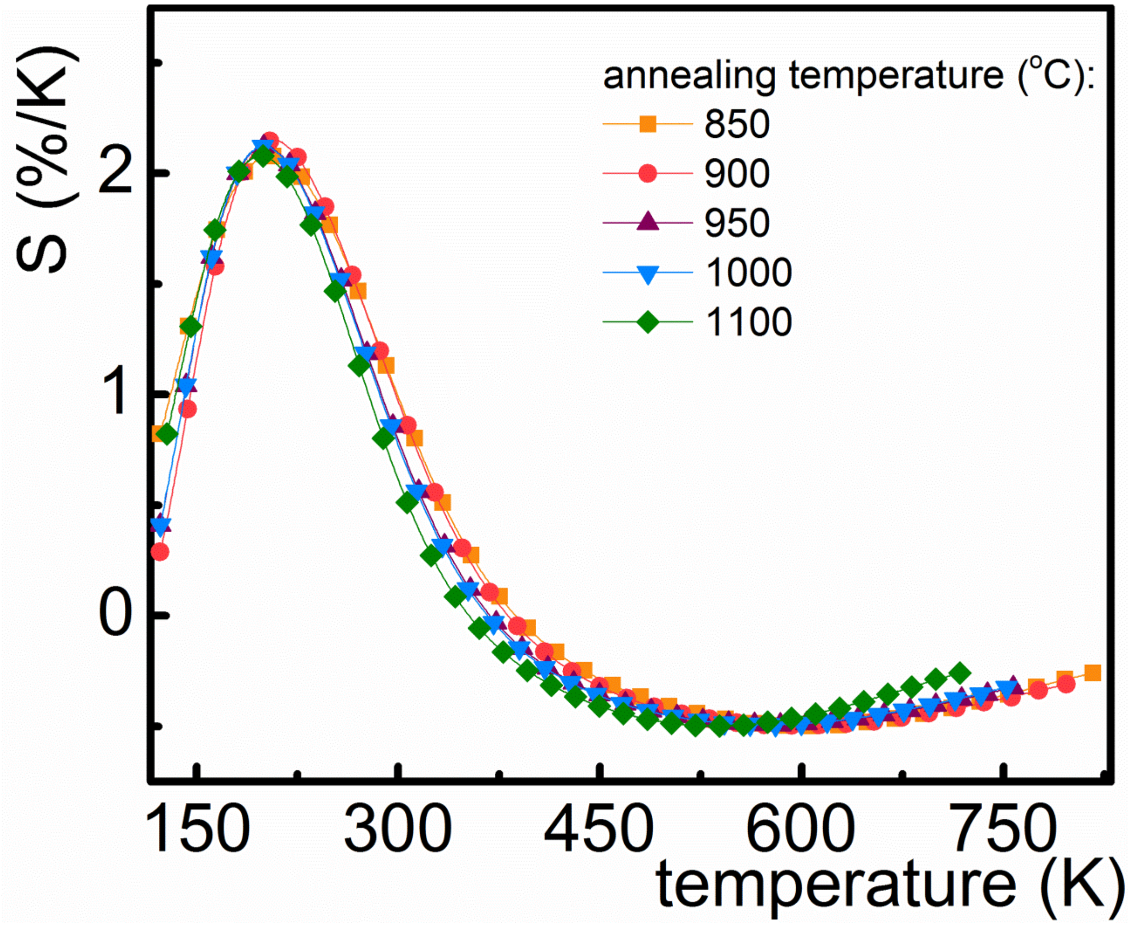

Figure S9 Thermal evolution of relative sensitivity (S) of YAG: 0.01% (Mn^{3+}, Mn^{4+}) 1% Nd^{3+} nanocrystals annealed at different temperatures.

Table S1. Comparison of the relative sensitivities of lifetime-based luminescent thermometers

Luminescent thermometer	**Sensitivity (%/K)**	**Reference**
CdTe QDs	1.7	[1]
CdSe QDs	0.08	[1]
Cd/Se QDs	~0.17 and 0.36	[2]
$Zn_xCd_{1-x}S$	~1.97	[3]
Tb-L_1	~1.2	[4]
Tb-L_2	~0.97	
YAG:Ce^{3+}	0.2	[5]

glass matrix,type Q88:Nd	$2.6\cdot10^{-4}$	6
ZBLALiP: 2% Er	~0.66	7
$SrZrO_3:Eu^{3+}$	2.22	8
Eu-DT	2.2	9
Eu(tta)3L complexes embedded into PTBS microbeads	1.1	10
MOF hybrid: Eu^{3+}	~0.27	11
MOF: Eu^{3+}/Tb^{3+}	0.57	12
YAG:0.01%Mn, 1%Nd3+	2.69	This work

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