Supporting Information

An up-conversion $Ba_3In(PO_4)_3$: Er^{3+}/Yb^{3+} phosphor enabling multi-mode temperature measurements and wide-gamut 'temperature mapping'

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Table S1. Atomic mass and quantity percentage of $Ba_3In(PO_4)_3$: $0.02Er^{3+}/0.05Yb^{3+}$

Element	Line type	wt%	wt% Sigma	Atomic percentage
O	K	23.89	0.21	63.60
P	K	11.42	0.11	15.70
In	L	12.02	0.15	4.46
Ba	L	51.19	0.26	15.87
Er	L	0.27	0.19	0.07
Yb	L	1.21	0.22	0.30

Table S2. Atomic coordinates of $Ba_3In(PO_4)_3$: $0.02Er^{3+}/0.05Yb^{3+}$

Atom	x	y	z
Ba1	0.06050	0.06050	0.06050
P1	0.37500	0.00000	0.25000
O1	0.29628	0.92880	0.34419
O2	0.29471	0.02760	0.37926
In1	0.08210	0.08210	0.08210
Er1	0.08194	0.08194	0.08194
Yb1	0.08222	0.08222	0.08222

Table S3. Dependence of emission intensity on pumping density

Yb^{3+} Concentration	523nm	545nm	658nm
5	1.5340	1.3836	1.1096
20	1.7952	1.4686	1.0835
40	1.7463	1.3309	1.0058
60	1.7218	1.2280	1.1114
80	1.8698	1.3452	1.0302
98	1.9948	1.4574	1.0962
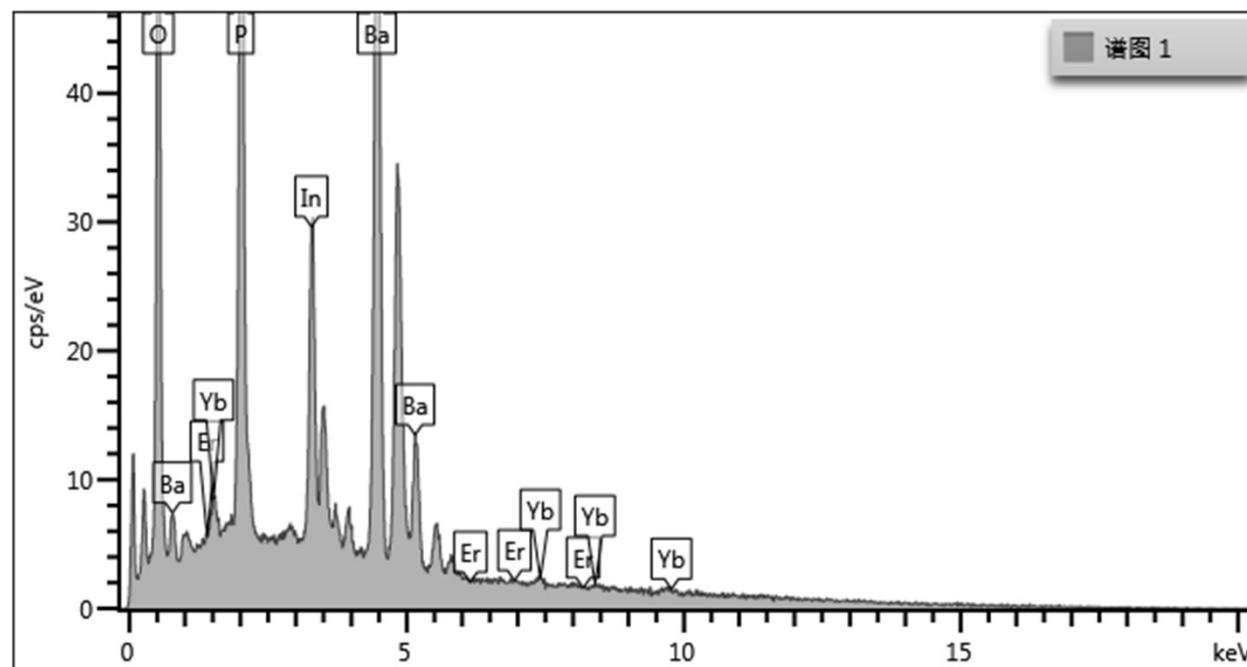
Fig. S1. EDS analysis of Ba$_3$In(PO$_4$)$_3$: 0.02Er^{3+}/0.05Yb^{3+} single phase powders.
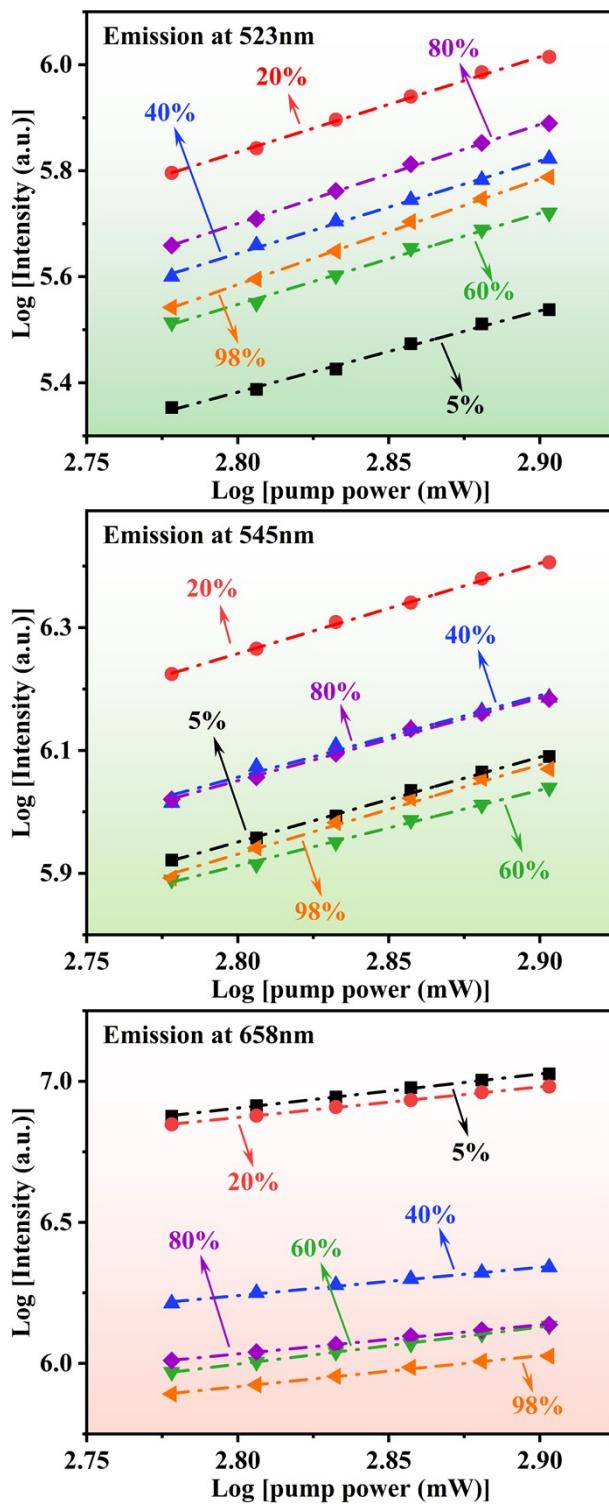
Fig. S2. Double logarithmic relationship of 523nm, 545nm and 658nm UC intensities versus power density of $Ba_3In(PO_4)_3$: Er^{3+}/Yb^{3+} with different doping concentrations.
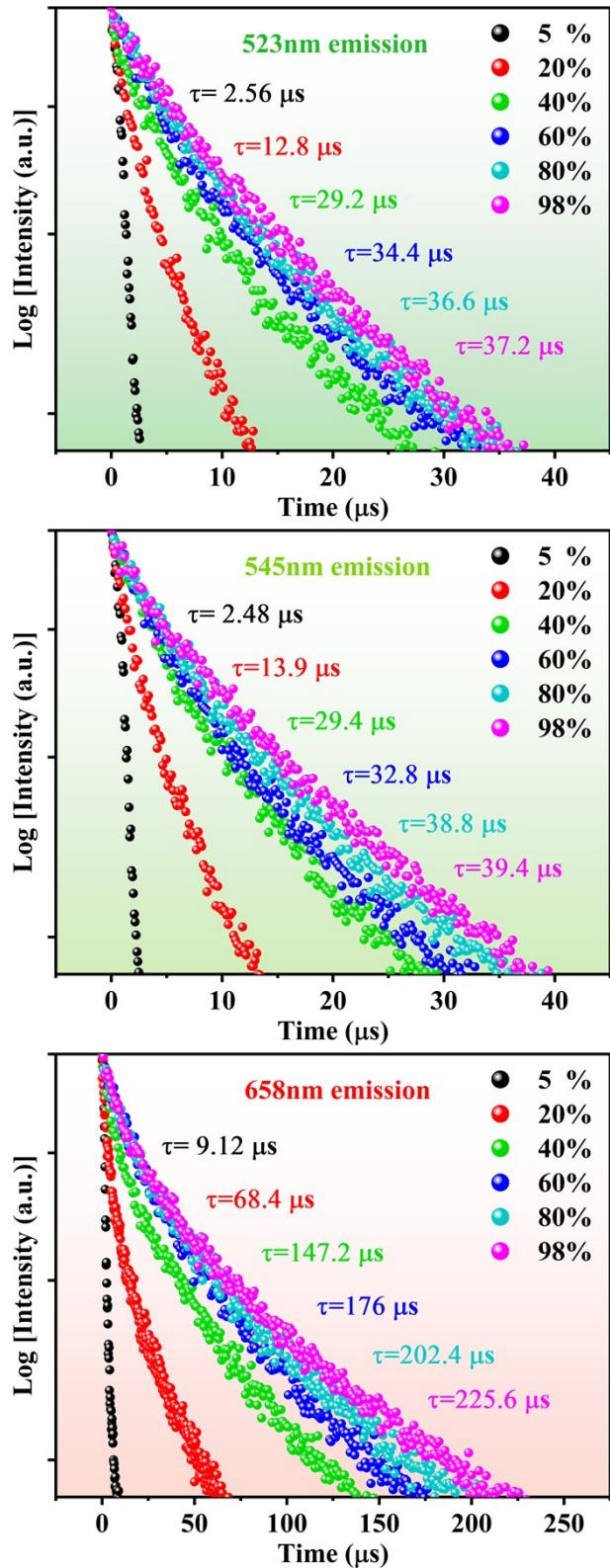
Fig. S3. Fluorescence decay curve of 523nm, 545nm and 658nm of $Ba_3In(PO_4)_3$: Er^{3+}/Yb^{3+} with different doping concentrations.
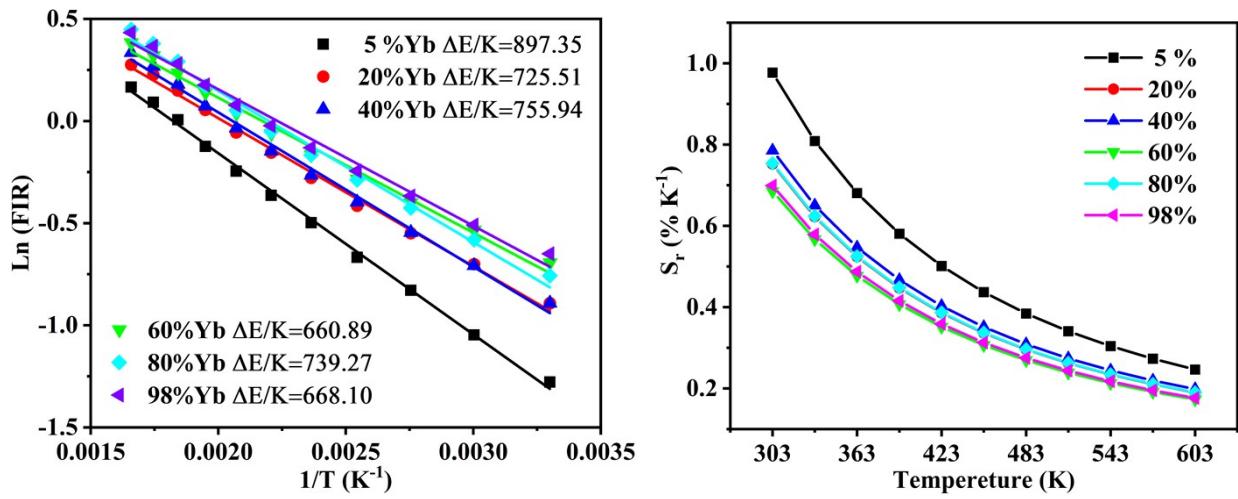
Fig. S4. Comparison of FIR and S_r values of samples with different Yb^{3+} doping concentrations.