

Supporting Information

Design of white-emitting optical temperature sensor based on energy transfer in Bi³⁺, Eu³⁺ and Tb³⁺ doped YBO₃ crystal

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Table S1 Selected Y–O distance in $\text{YBO}_3:\text{Bi}^{3+}$ and $\text{YBO}_3:0.04\text{Bi}^{3+}, 0.003\text{Eu}^{3+}, 0.008\text{Tb}^{3+}$ sample.

$\text{YBO}_3:\text{Bi}^{3+}$		$\text{YBO}_3:0.04\text{Bi}^{3+}, 0.003\text{Eu}^{3+}, 0.008\text{Tb}^{3+}$	
Bonds	Distance (Å)	Bonds	Distance (Å)
Y1-O1	2.28473	Y1-O1	2.30004
Y1-O1	2.28473	Y1-O1	2.30004
Y1-O2	2.39051	Y1-O2	2.40753
Y1-O2	2.39021	Y1-O2	2.40723
Y1-O2	2.39051	Y1-O2	2.40753
Y1-O2	2.39051	Y1-O2	2.40753
Y1-O2	2.39021	Y1-O2	2.40723
Y1-O2	2.39051	Y1-O2	2.40753

Table S2 CIE color coordinates (x, y) for the $\text{YBO}_3:0.04\text{Bi}^{3+}, x\text{Eu}^{3+}, y\text{Tb}^{3+}$ phosphor under excitations.

Numbe r (no.)	Bi^{3+} concentration	Eu^{3+} concentration	Tb^{3+} concentration	CIE (x,y) values
1	0.005	0	0	(0.148, 0.093)
2	0.01	0	0	(0.147, 0.095)
3	0.02	0	0	(0.147, 0.100)
4	0.04	0	0	(0.145, 0.109)
5	0.06	0	0	(0.145, 0.113)
6	0.07	0	0	(0.145, 0.112)
7	0.04	0.004	0	(0.293, 0.190)
8	0.04	0.007	0	(0.357, 0.224)
9	0.04	0.01	0	(0.393, 0.243)
10	0.04	0.02	0	(0.503, 0.300)
11	0.04	0.03	0	(0.550, 0.321)
12	0.04	0.04	0	(0.589, 0.340)
13	0.04	0	0.004	(0.211, 0.214)
14	0.04	0	0.007	(0.223, 0.274)
15	0.04	0	0.01	(0.236, 0.332)
16	0.04	0	0.02	(0.261, 0.455)
17	0.04	0	0.03	(0.276, 0.540)
18	0.04	0	0.04	(0.282, 0.566)
19	0.04	0.003	0.002	(0.348, 0.265)
20	0.04	0.003	0.004	(0.350, 0.278)
21	0.04	0.003	0.006	(0.356, 0.322)
22	0.04	0.003	0.008	(0.356, 0.346)
23	0.04	0.004	0.002	(0.374, 0.271)
24	0.04	0.004	0.004	(0.378, 0.286)
25	0.04	0.004	0.006	(0.376, 0.327)
26	0.04	0.004	0.008	(0.386, 0.361)

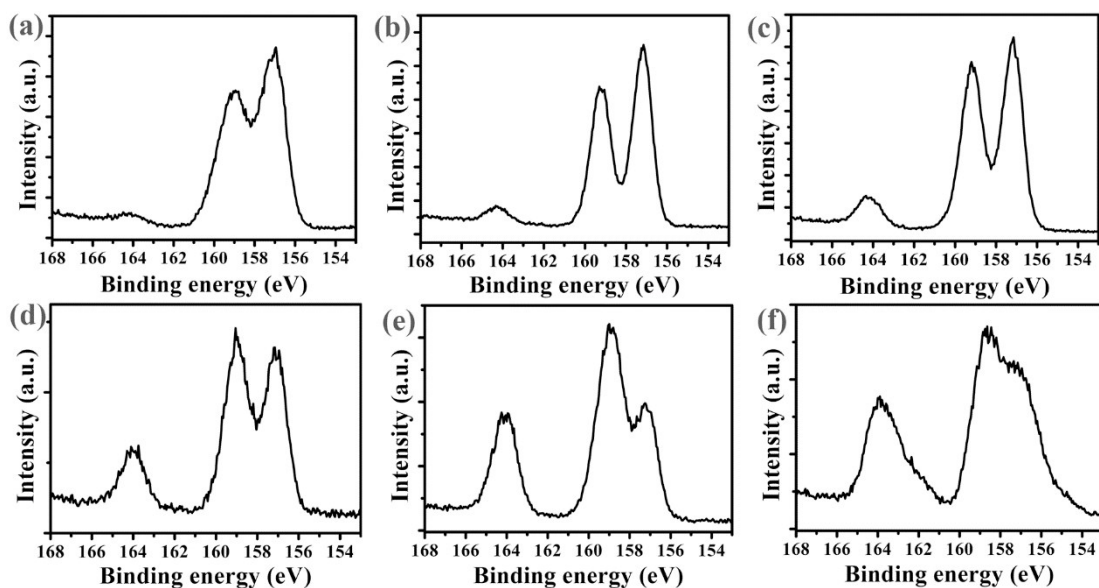


Fig. S1 XPS spectra of $\text{YBO}_3:\text{xBi}^{3+}$ samples; (a) $x=0.005$, (b) $x=0.01$, (c) $x=0.02$, (d) $x=0.04$, (e) $x=0.06$, (f) $x=0.07$.

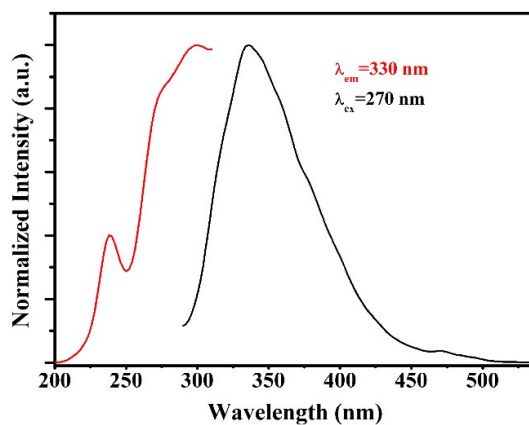


Fig. S2 Emission and excitation spectra of YBO_3 host, $\lambda_{\text{ex}} = 270 \text{ nm}$, $\lambda_{\text{em}} = 330 \text{ nm}$.

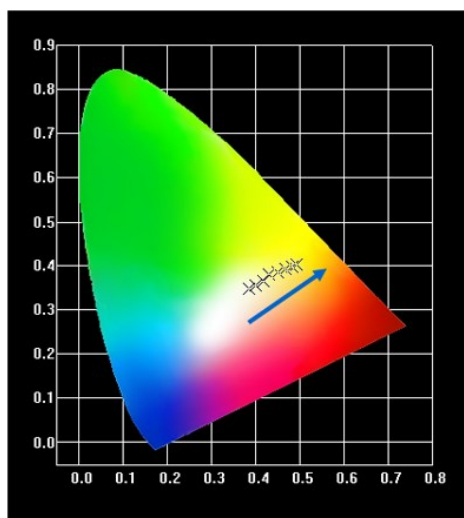


Fig. S3 The corresponding CIE chromaticity coordinates diagram of high-temperature-dependent emission spectra of $\text{YBO}_3:0.04\text{Bi}^{3+}$, 0.003Eu^{3+} , 0.008Tb^{3+} (298 to 473 K).