

## Supporting information

### **Multicolor tunable Bi<sup>3+</sup>, Sm<sup>3+</sup> co-doped Sr<sub>2</sub>GdGaO<sub>5</sub> phosphors and its application in optical thermometry**

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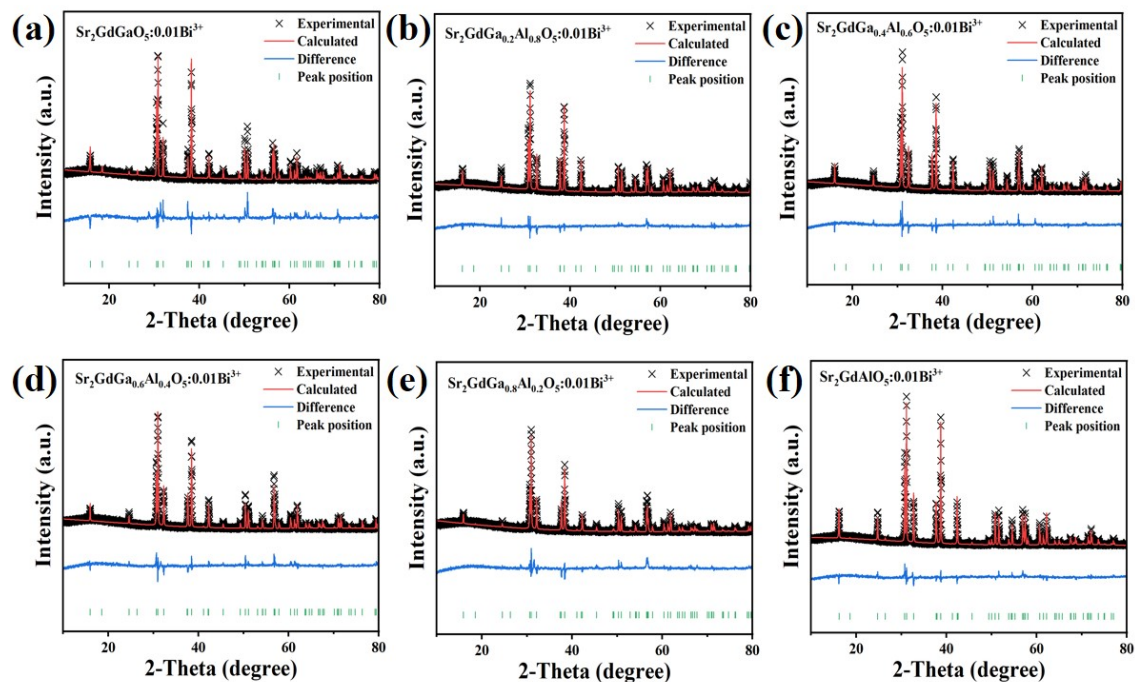


Fig. S1 (a-f) Rietveld refinement patterns of  $\text{Sr}_2\text{GdGa}_{1-z}\text{Al}_z\text{O}_5$  ( $z=0,0.2,0.4,0.6,0.8,1$ ) phosphors.

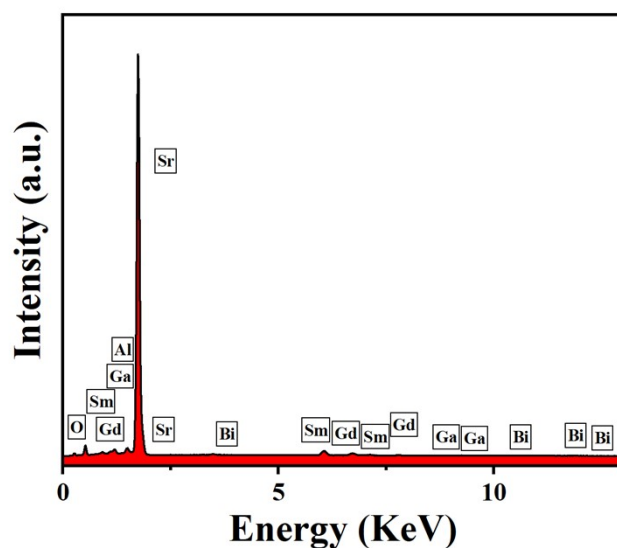


Fig. S2 EDS spectrum of SGGAO phosphor.

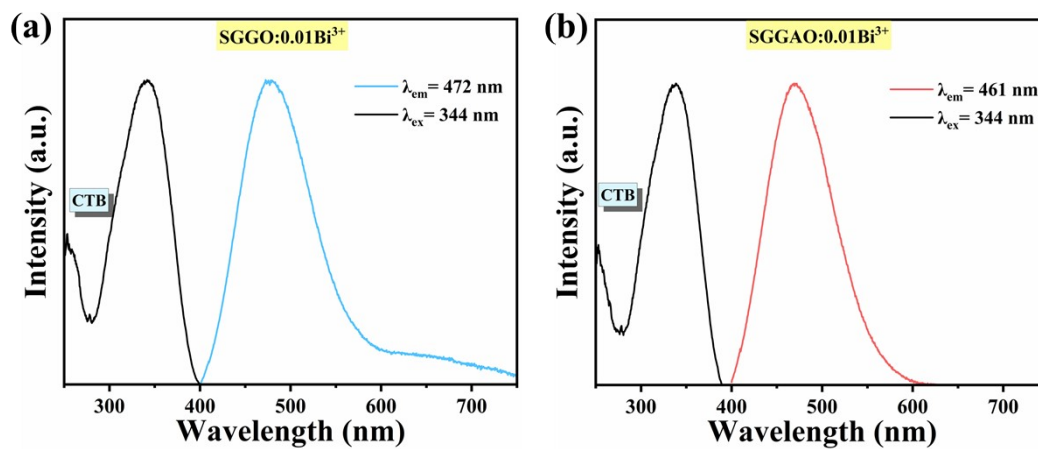


Fig. S3 The PL and PLE spectra of (a) SGGO:Bi<sup>3+</sup> and (b)SGGAO:Bi<sup>3+</sup> phosphors.

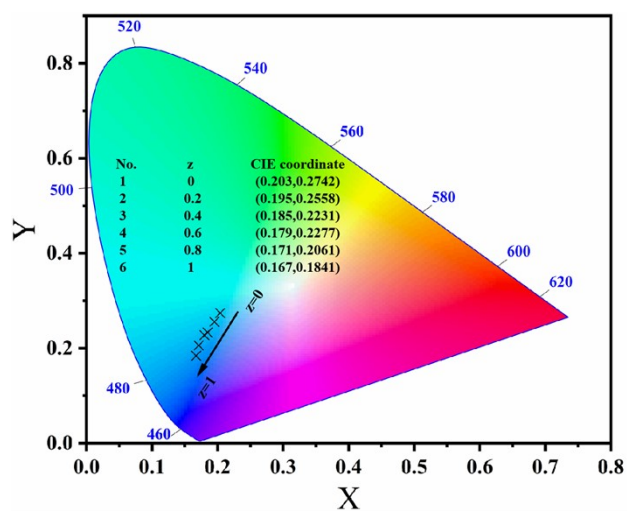


Fig. S4 The CIE chromaticity coordinate diagrams of SGGAO:0.01Bi<sup>3+</sup>(0≤z≤1) samples.

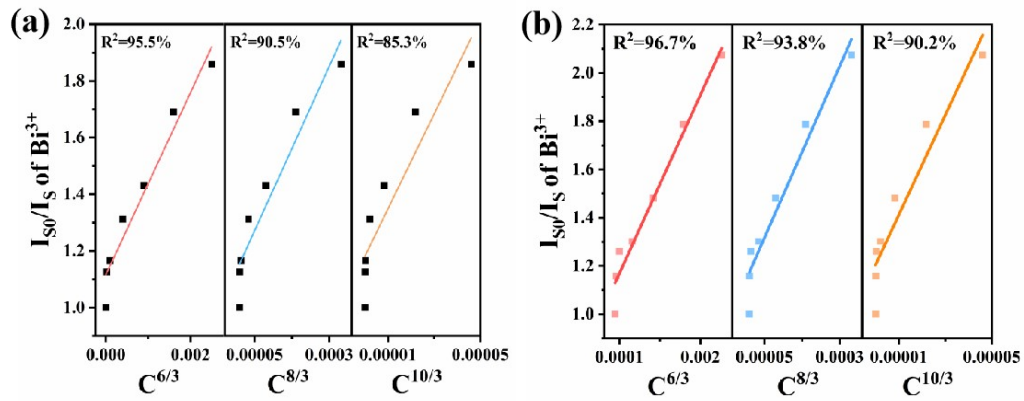


Fig. S5 Dependence  $I_{S0}/I_S$  of  $\text{Bi}^{3+}$  on  $C^{6/3}$ ,  $C^{8/3}$  and  $C^{10/3}$ : (a) SGGO:Bi<sup>3+</sup> and (b) SGGAO:Bi<sup>3+</sup>.

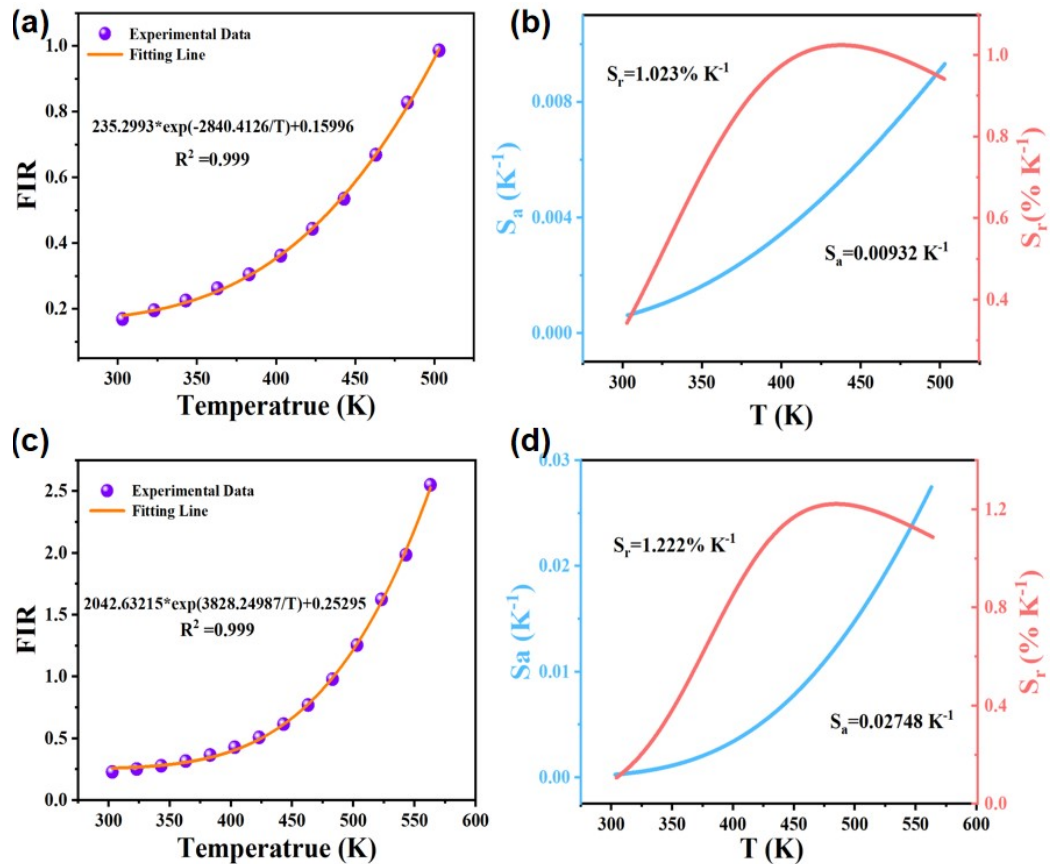
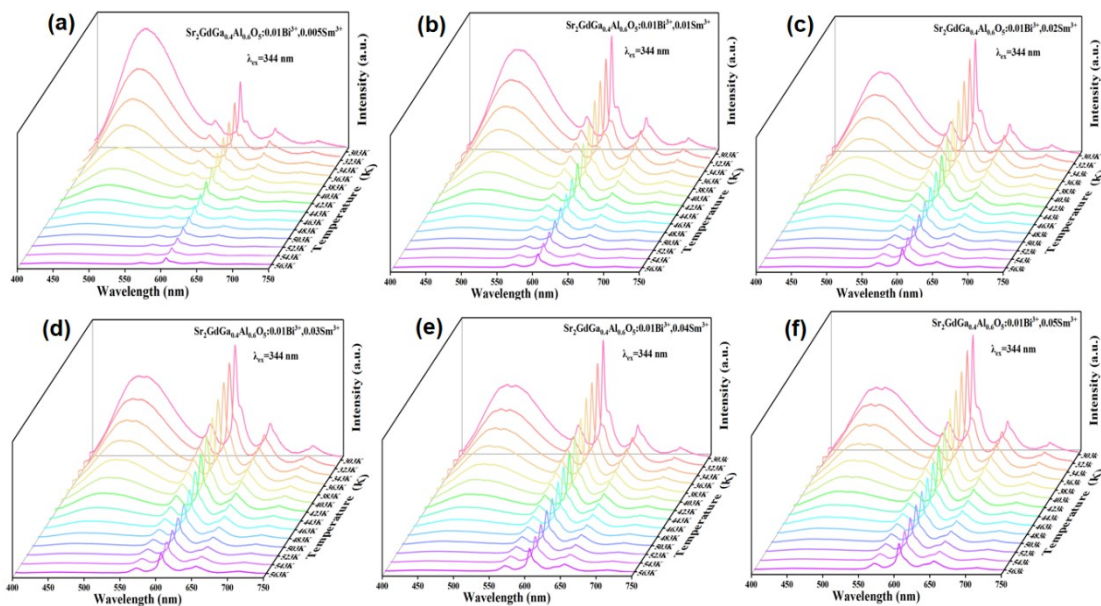
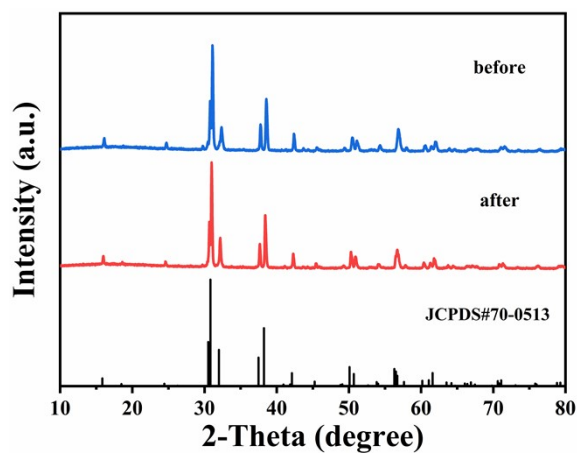


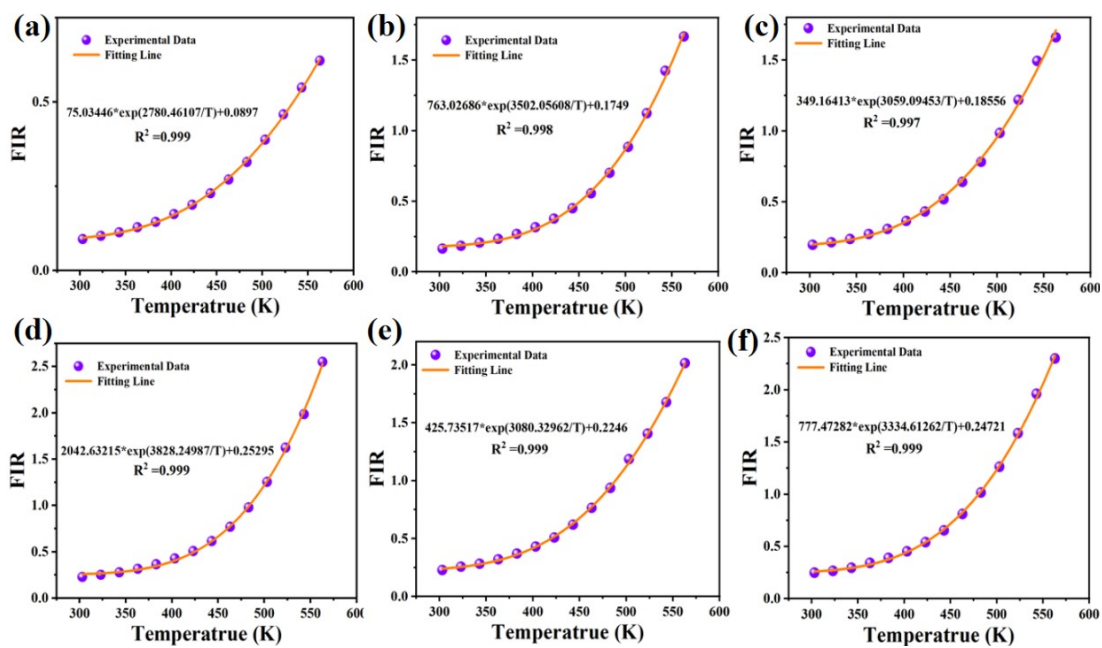
Fig. S6 (a,b) The FIR fitting curve of SGGO:0.01Bi<sup>3+</sup>,0.03Sm<sup>3+</sup> phosphor and its corresponding  $S_r$ ,  $S_a$  values. (c,d) The FIR fitting curve of SGGAO:0.01Bi<sup>3+</sup>,0.03Sm<sup>3+</sup> phosphor as well as its related  $S_r$ ,  $S_a$  values.



**Fig. S7** (a-f) The temperature-dependent PL spectra of SGGAO:0.01Bi<sup>3+</sup>,ySm<sup>3+</sup> (y=0.005, 0.01, 0.02, 0.03, 0.04, 0.05) phosphors.



**Fig. S8** The XRD patterns of phosphors before and after five cycles.



**Fig. S9** (a-f) The FIR fitting curve of SGGAO:0.01Bi<sup>3+</sup>,ySm<sup>3+</sup> (y=0.005, 0.01, 0.02, 0.03, 0.04, 0.05) phosphors.

**Table S1** The Rietveld refinement results of SGGAO phosphors.

SGG <sub>1-z</sub> A <sub>z</sub> O	a[Å]	b[Å]	c[Å]	v[Å <sup>3</sup> ]	R <sub>p</sub> [%]	R <sub>wp</sub> [%]	χ <sup>2</sup>
z=0	6.7747	6.7747	11.1830	513.2633	5.92	13.17	2.22
z=0.2	6.7605	6.7605	11.1346	508.9027	6.44	2.24	1.90
z=0.4	6.7552	6.7552	11.0840	505.7900	6.18	10.44	1.69
z=0.6	6.7451	6.7451	11.0321	501.9231	5.99	9.99	1.67
z=0.8	6.7406	6.7406	10.9877	499.2371	6.11	9.83	1.61
z=1.0	6.7398	6.7398	10.9331	496.6352	5.63	8.77	1.58

**Table S2** The comparison of maximum  $S_r$  among different materials with  $\text{Bi}^{3+}$ ,  $\text{RE}^{3+}$  co-doped.

Compounds	Temperature range(K)	$S_r(\text{max})(\% \text{ K}^{-1})$	Ref.
$\text{YNbO}_4: \text{Bi}^{3+}, \text{Sm}^{3+}$	303-463	1.57	[1]
$\text{LaNbO}_4: \text{Bi}^{3+}, \text{Sm}^{3+}$	303-483	1.36	[2]
$\text{BaGd}_2\text{O}_4: \text{Bi}^{3+}, \text{Sm}^{3+}$	293-473	1.11	[3]
$\text{Sr}_3\text{La}_2\text{Ge}_3\text{O}_{12}: \text{Bi}^{3+}, \text{Eu}^{3+}$	293-573	0.83	[4]
$\text{SrLu}_2\text{O}_4: \text{Bi}^{3+}, \text{Eu}^{3+}$	315-453	0.87	[5]
$\text{Sr}_2\text{YNbO}_6: \text{Bi}^{3+}, \text{Eu}^{3+}$	313-573	0.89	[6]
$\text{Sr}_2\text{GdGaO}_5: \text{Bi}^{3+}, \text{Sm}^{3+}$	303-503	1.02	This work
$\text{Sr}_2\text{GdGa}_{0.4}\text{Al}_{0.6}\text{O}_5: \text{Bi}^{3+}, \text{Sm}^{3+}$	303-563	1.22	This work

## Reference

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