

## Supplementary Information

# UVB upconversion of $\text{LiYO}_2:\text{Ho}^{3+},\text{Gd}^{3+}$ for application in luminescence thermometry

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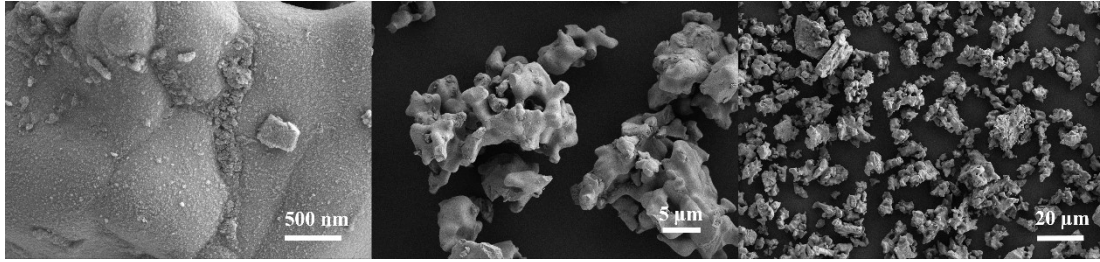


Fig. S1 The SEM images of  $\text{LiYO}_2:0.5\%\text{Ho}^{3+},13\%\text{Gd}^{3+}$  representative at different magnifications.

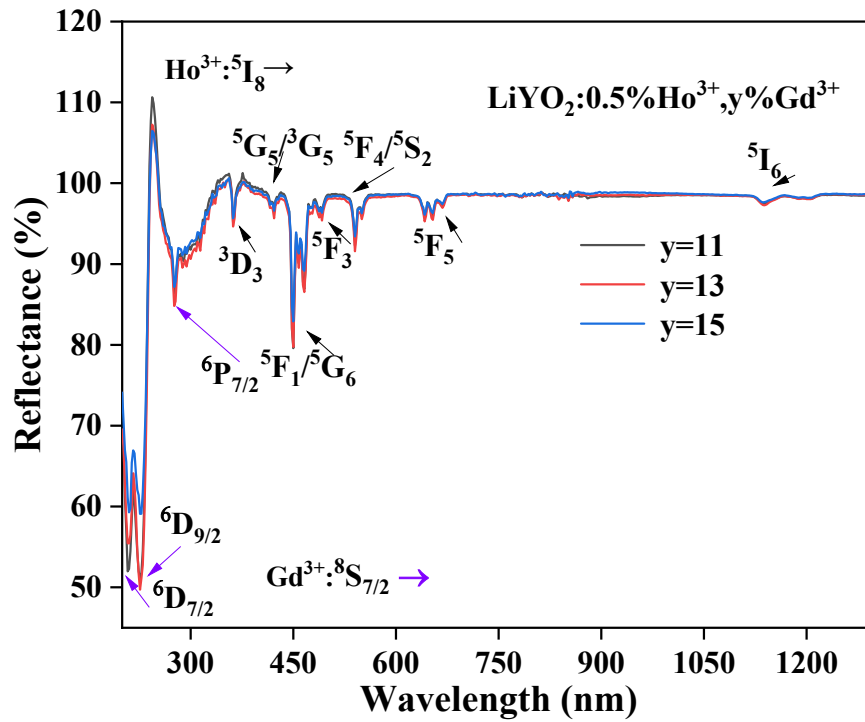
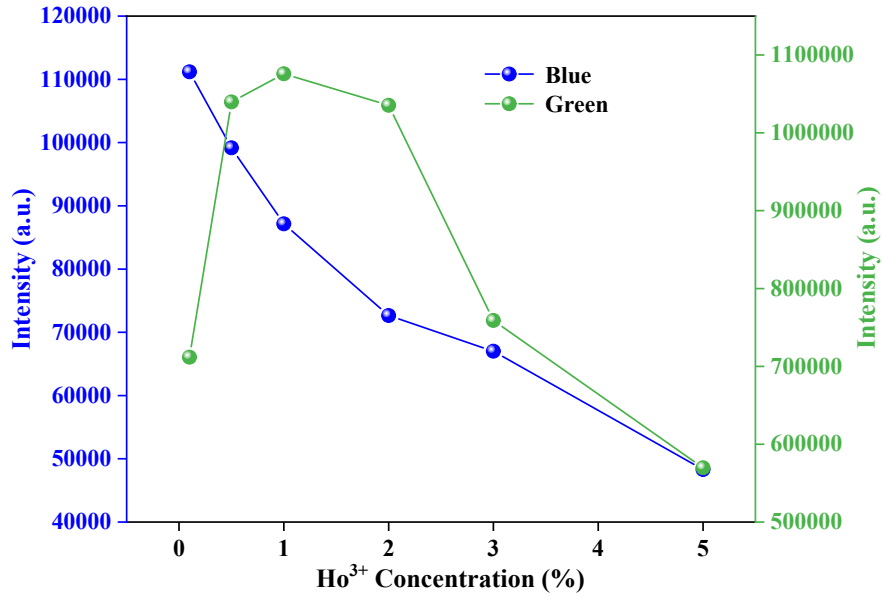
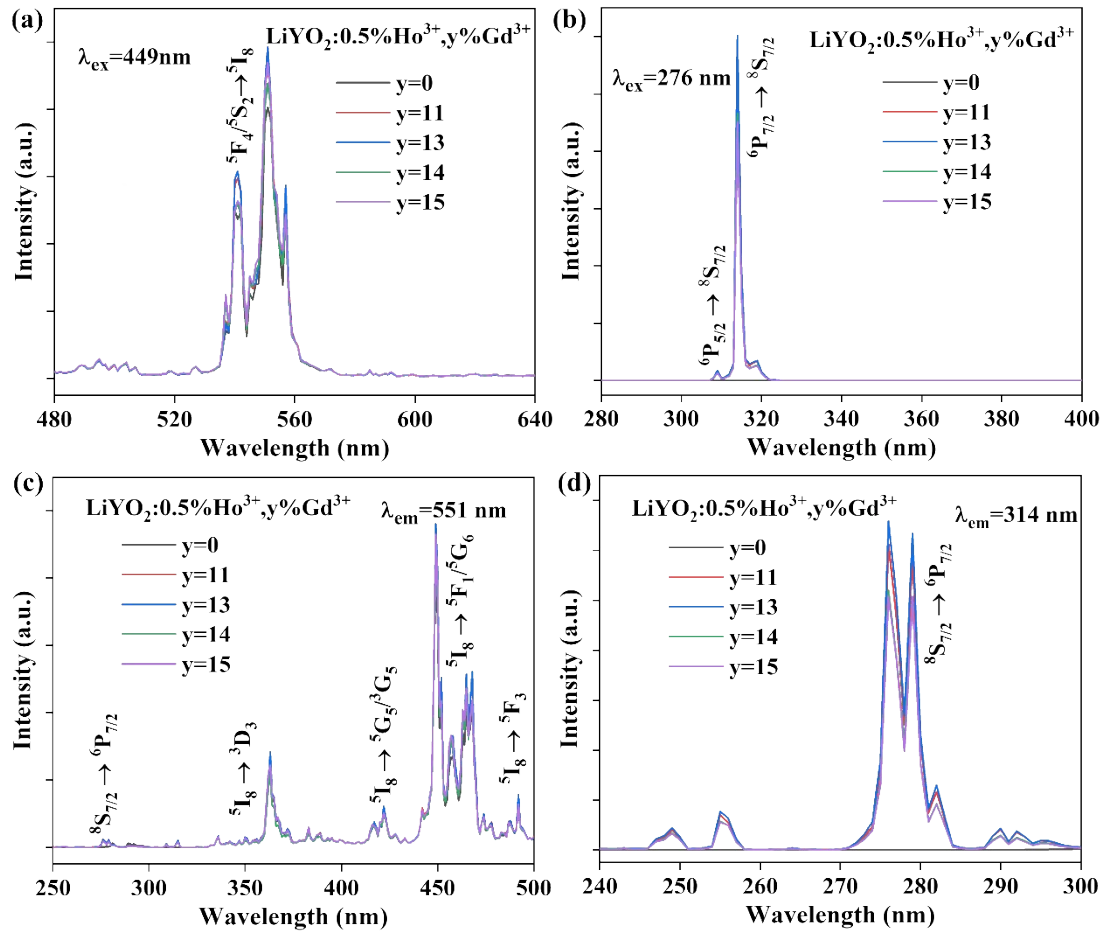


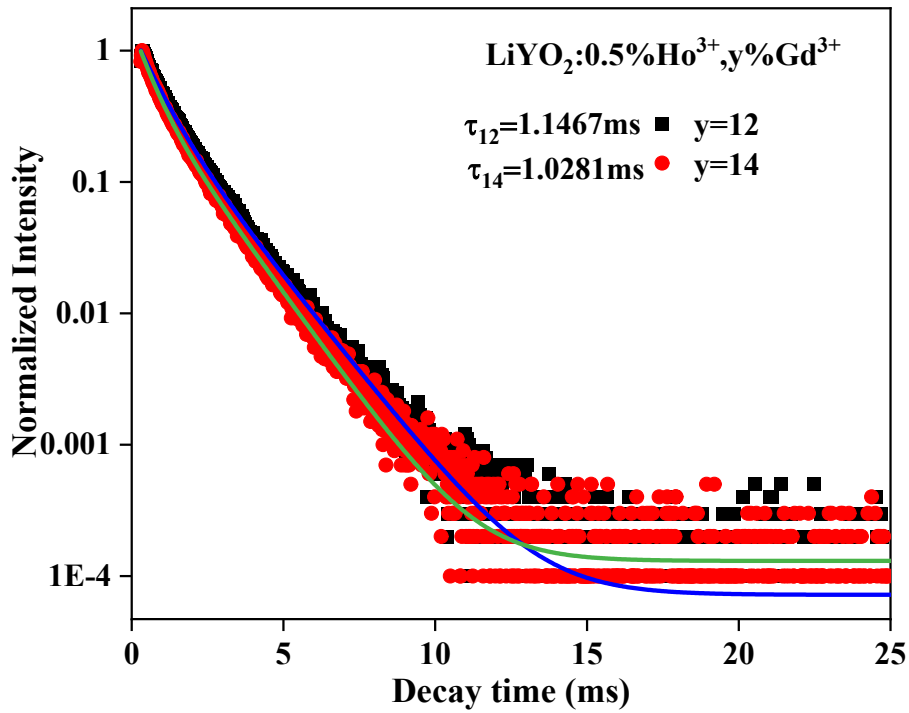
Fig. S2 Diffuse reflectance spectra of the  $\text{LiYO}_2:0.5\%\text{Ho}^{3+},y\%\text{Gd}^{3+}$  ( $y = 11, 13, 15$ ) phosphors.



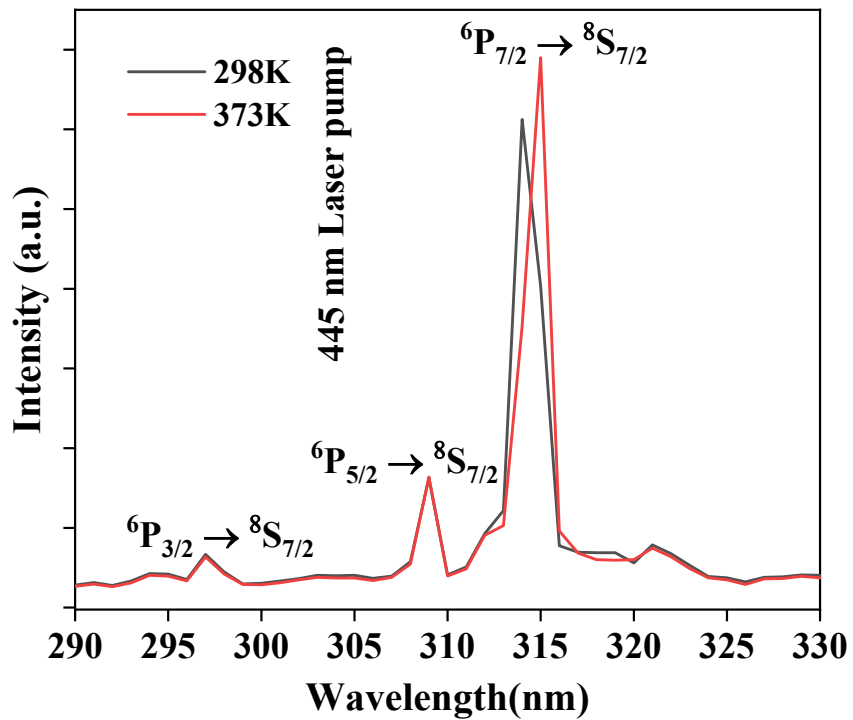
**Fig. S3** Under excitation of 449 nm, the integral intensities of blue emission band over 480-515 nm and that of green emissions over 530-575 nm versus Ho<sup>3+</sup> concentration for LiYO<sub>2</sub>:x%Ho<sup>3+</sup>,14%Gd<sup>3+</sup> (x = 0.1, 0.5, 1, 2, 3, 5).



**Fig. S4** (a-b) Photoluminescence spectra of the  $\text{LiYO}_2:0.5\%\text{Ho}^{3+},y\%\text{Gd}^{3+}$  ( $y = 0, 11, 13, 14, 15$ ) phosphors under excitation of (a) 449 nm and (b) 276 nm; (c-d) photoluminescence excitation spectra of the  $\text{LiYO}_2:0.5\%\text{Ho}^{3+},y\%\text{Gd}^{3+}$  ( $y = 11, 13, 14, 15$ ) phosphors monitoring (c) at 314 nm emission and (d) at 551 nm emission, respectively.



**Fig. S5** Under excitation of a 445 nm pulsed laser, decay curves of the LiYO<sub>2</sub>:0.5%Ho<sup>3+</sup>,y%Gd<sup>3+</sup> (y = 12, 14) phosphors.



**Fig. S6** UV-B upconversion luminescence spectra of LiYO<sub>2</sub>:2%Ho<sup>3+</sup>,4%Gd<sup>3+</sup> representative measured at 298 and 373 K under excitation of blue ~ 445 nm laser.

**Table S1** Results of EDS mapping of the  $\text{LiYO}_2:0.5\%\text{Ho}^{3+},13\%\text{Gd}^{3+}$  representative

Elements	Line type	Apparent concentration	K ratio	Wt%	Atomic percentage
O	K-line system	22.07	0.07427	24.47	66.49
Y	L-line system	53.28	0.53278	59.41	29.05
Gd	L-line system	13.82	0.13824	15.71	4.34
Ho	L-line system	0.36	0.00359	0.41	0.11
Total amount				100.00	100.00

**Table S2** Decay times of the  $\text{LiYO}_2:0.5\%\text{Ho}^{3+},y\%\text{Gd}^{3+}$  ( $y = 10, 11, 13, 15, 16$ ) phosphors

Phosphors		$\tau_1$	$\tau_2$	$\bar{\tau}$	$R^2$
$\text{Ho}^{3+}$ (%)	$\text{Gd}^{3+}$ (%)				
0.5	10	0.7316	1.6414	1.2213	0.9977
0.5	11	0.7593	1.6080	1.2156	0.9980
0.5	13	0.6970	1.5124	1.1467	0.9975
0.5	15	0.5199	1.3612	1.0281	0.9978
0.5	16	0.5149	1.2866	0.8809	0.9976