

Electronic supplementary information (ESI) for:

**Er<sup>3+</sup>/Tm<sup>3+</sup> co-doped Zr<sub>0.85</sub>Y<sub>0.15</sub>O<sub>1.925</sub>:Yb<sup>3+</sup> phosphors: Dual-mode ratiometric thermometry based on near infrared up-conversion/down-shifting photoluminescence**

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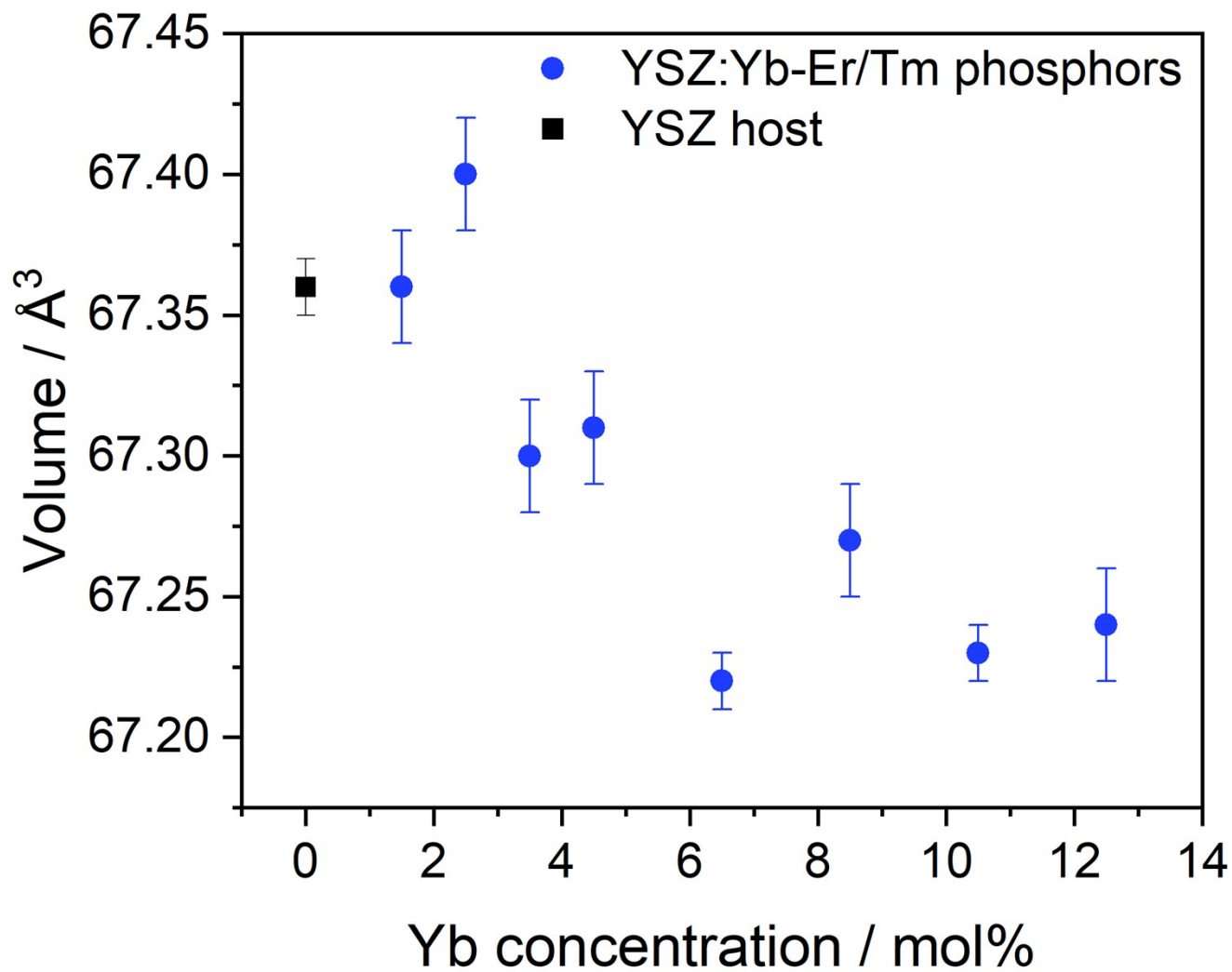
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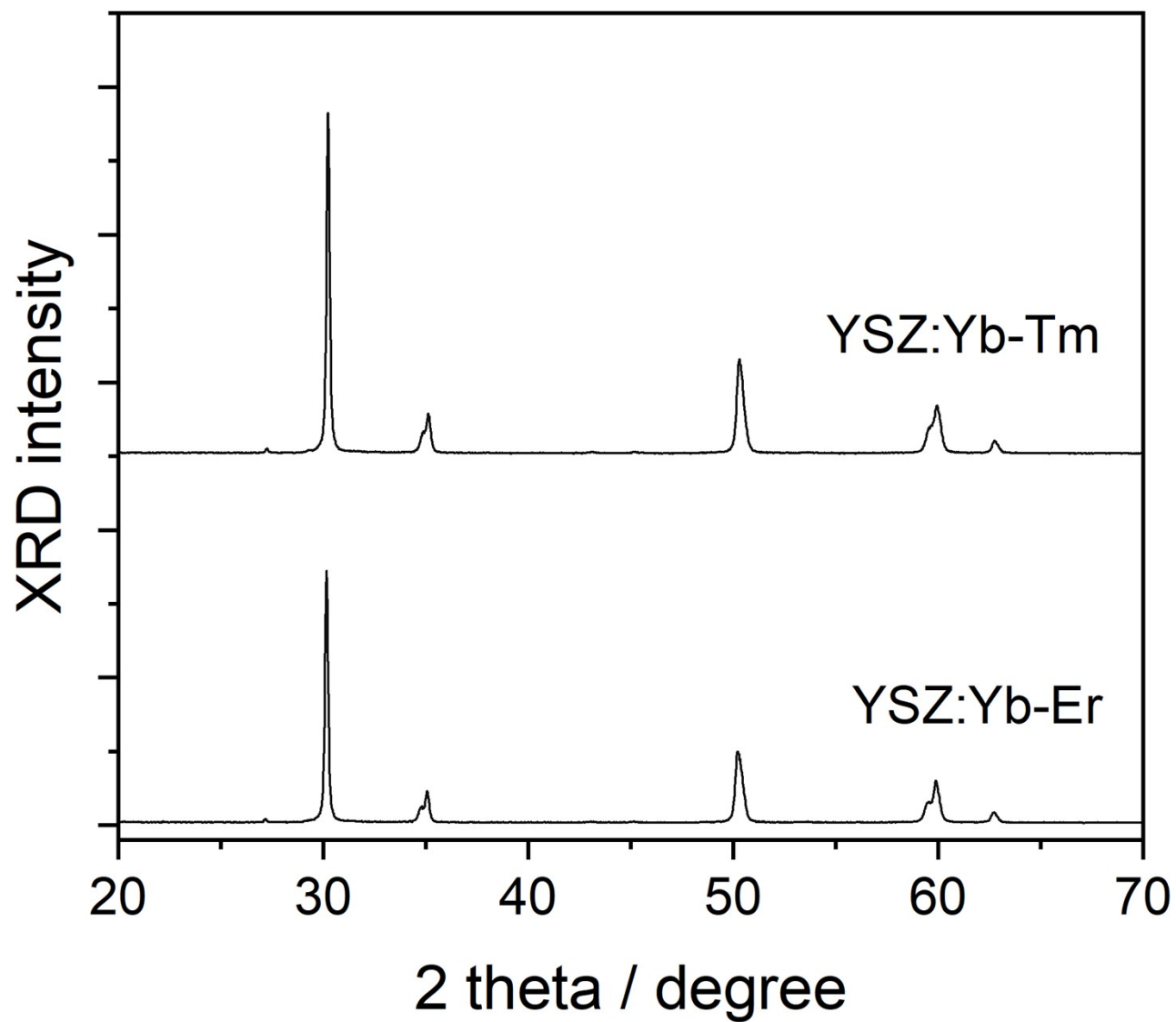
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**Table S1** *R*-factors of Rietveld analysis for the YSZ:Yb-Er/Tm phosphors with different Yb<sup>3+</sup> concentrations.

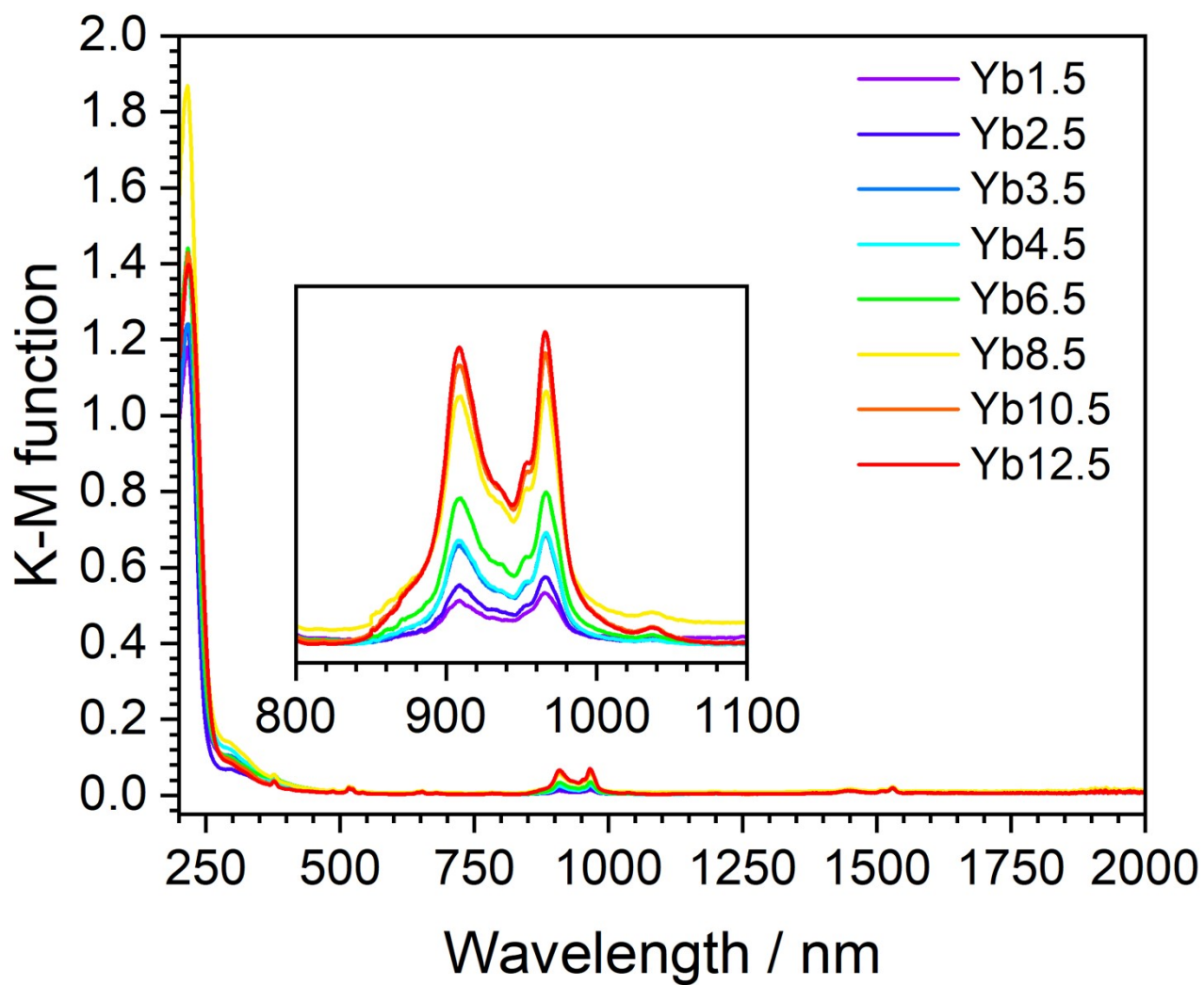
Yb	$R_{wp}$	$R_p$	$R_R$	$R_e$	$S$	$R_F$
host	6.76	4.659	9.501	5.008	1.3499	0.881
1.5	7.878	5.483	11.463	6.592	1.195	1.118
2.5	8.177	5.799	12.249	6.599	1.2392	1.036
3.5	8.118	5.744	12.491	6.881	1.1797	2.405
4.5	6.634	4.667	10.076	5.028	1.3195	0.795
6.5	6.697	4.698	10.003	5.023	1.3332	0.994
8.5	6.689	4.734	10.403	5.323	1.2567	0.931
10.5	6.899	4.873	10.478	4.946	1.3947	0.954
12.5	6.921	4.907	10.67	4.977	1.3906	0.983



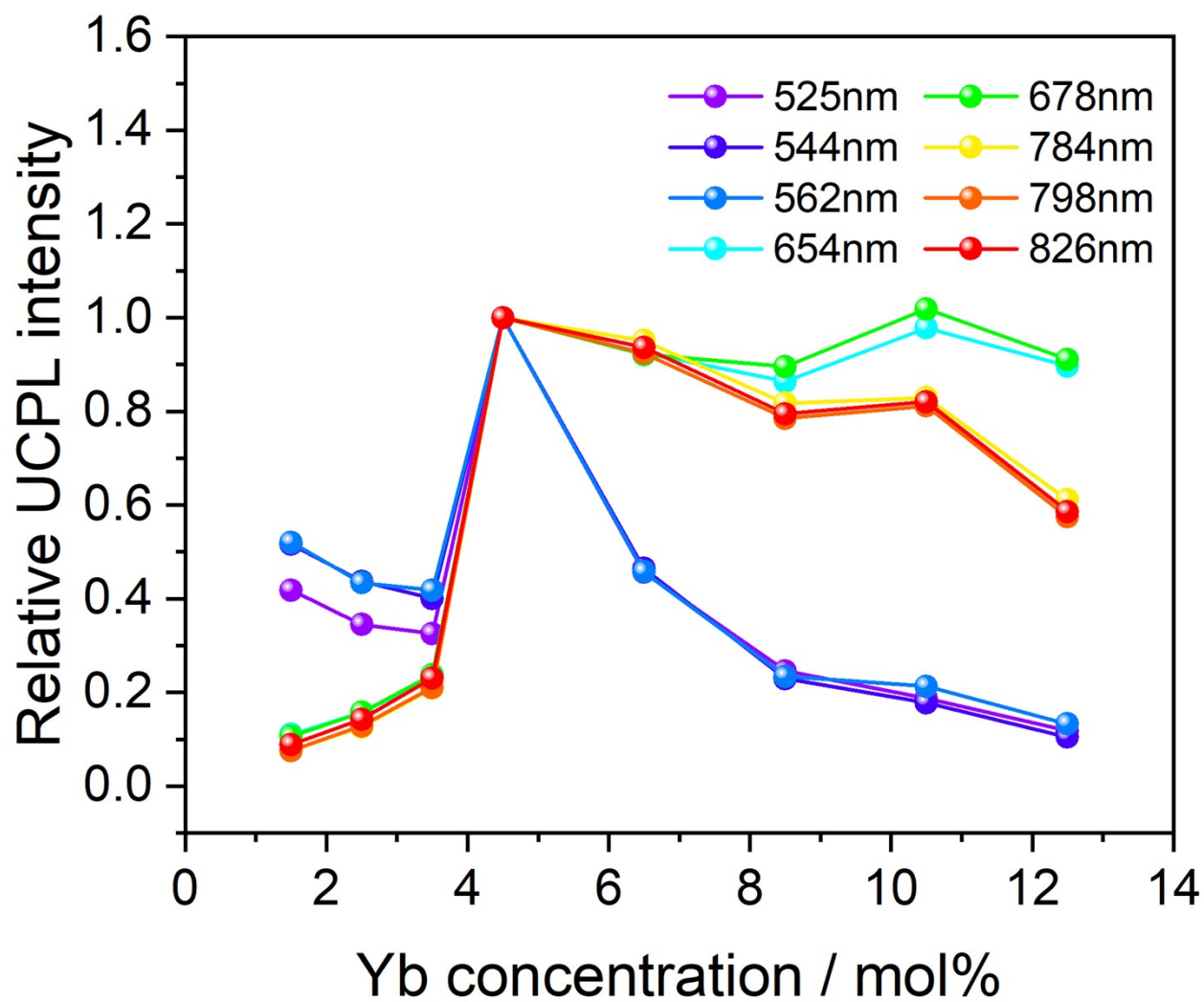
**Figure S1** Lattice volumes refined by Rietveld analysis of the YSZ:Yb-Er/Tm phosphors with different Yb<sup>3+</sup> concentrations.



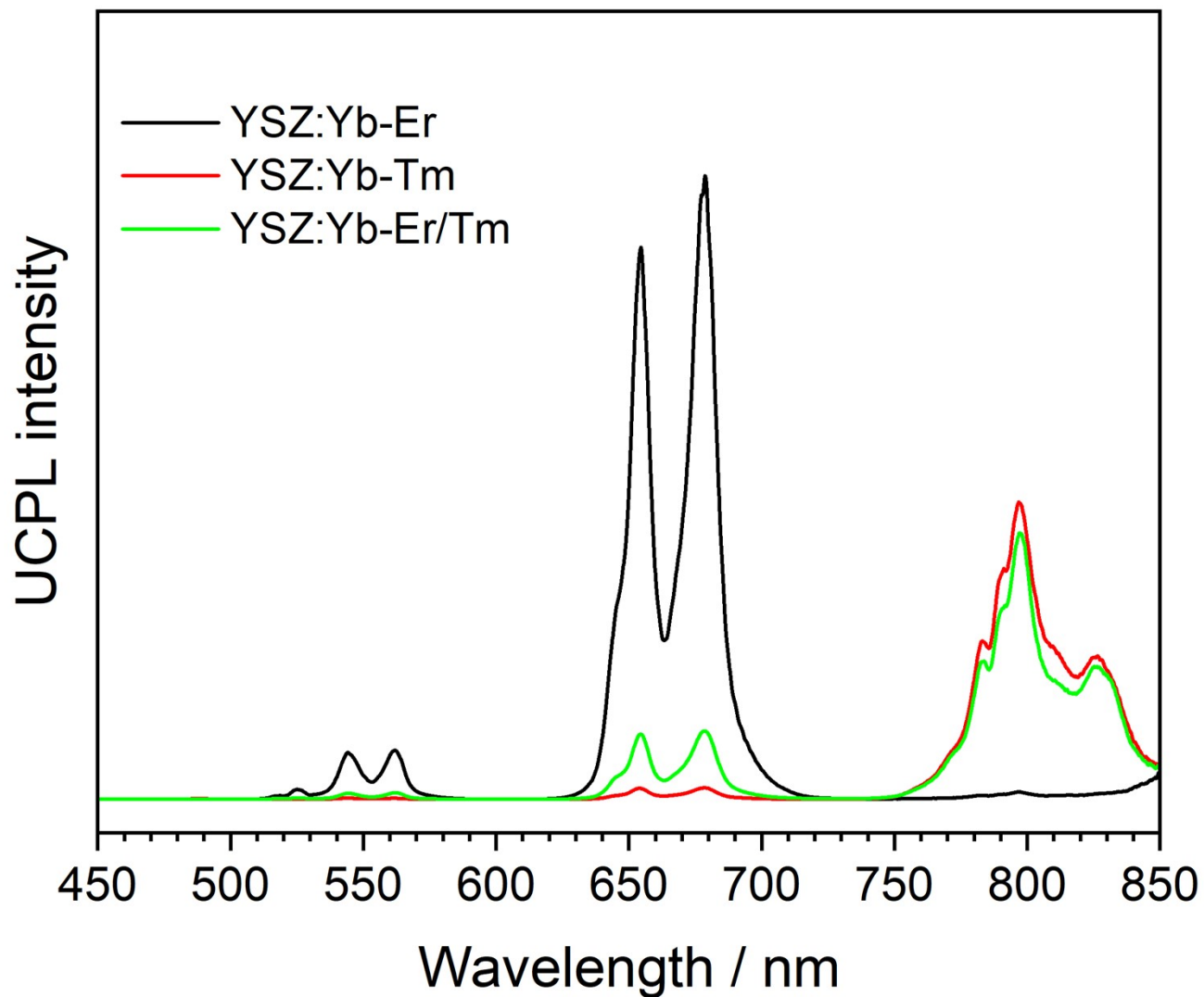
**Figure S2** XRD patterns of the YSZ:Yb-Er and the YSZ:Yb-Tm phosphors.



**Figure S3** Kubelka-Munk spectra of the YSZ:Yb-Er/Tm phosphors with different Yb<sup>3+</sup> concentrations.

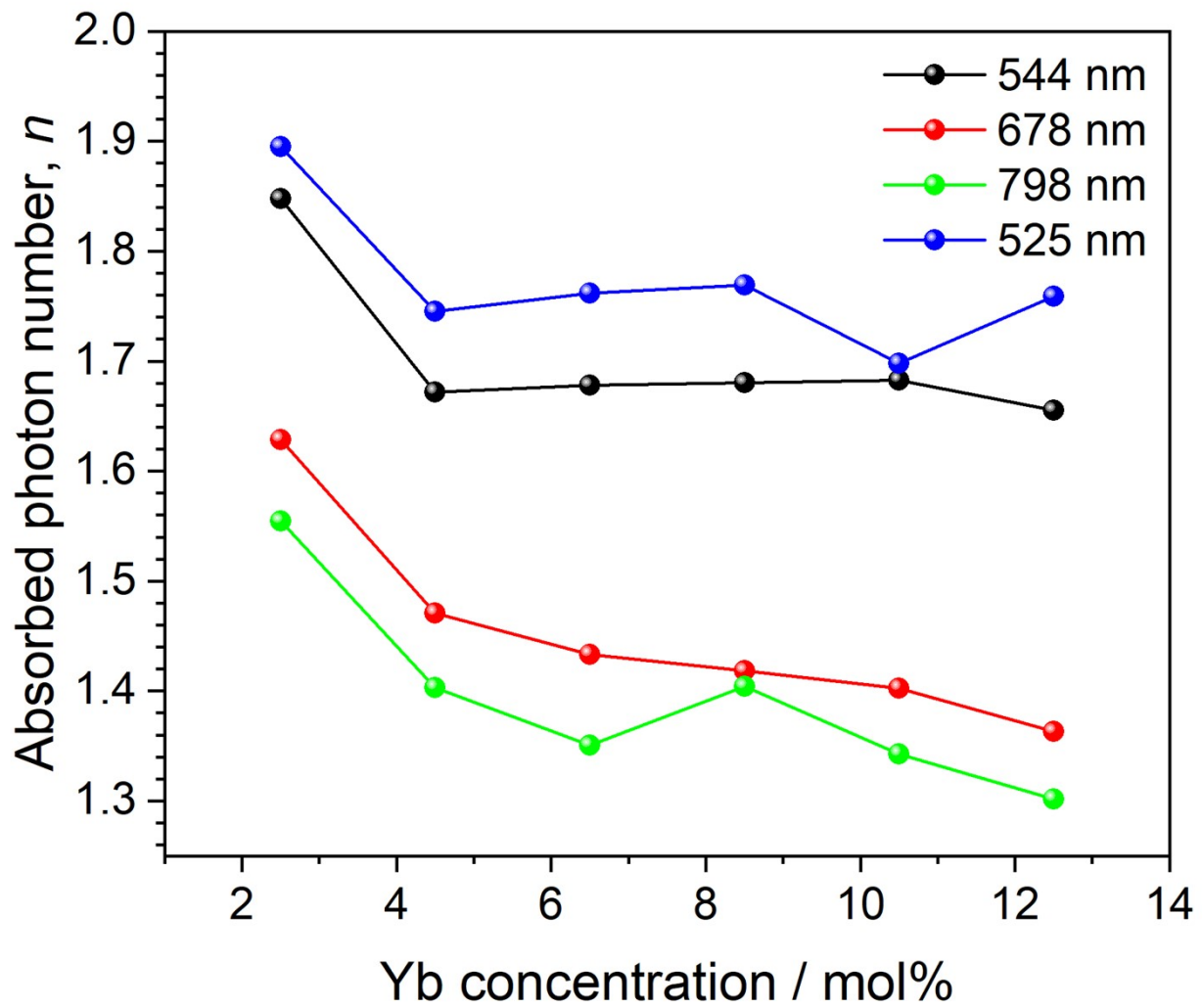


**Figure S4** Dependency of Relative PL intensities on the Yb<sup>3+</sup> concentrations of each transition for YSZ:Yb-Er/Tm phosphors.

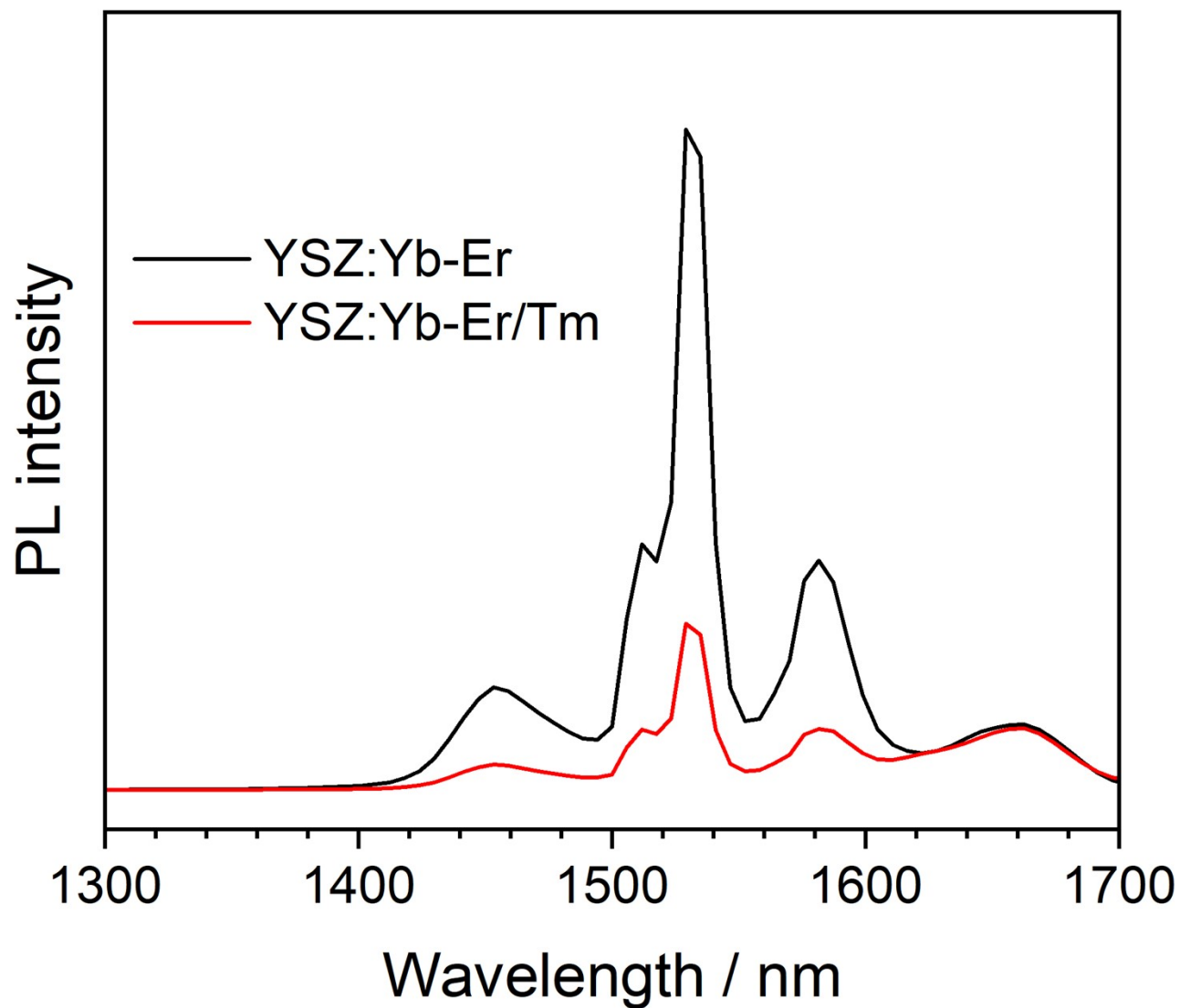


**Figure S5** UCPL spectra of the YSZ:Yb-Er, YSZ:Yb-Tm and YSZ:Yb-Er/Tm (Yb 4.5 mol%) phosphors.

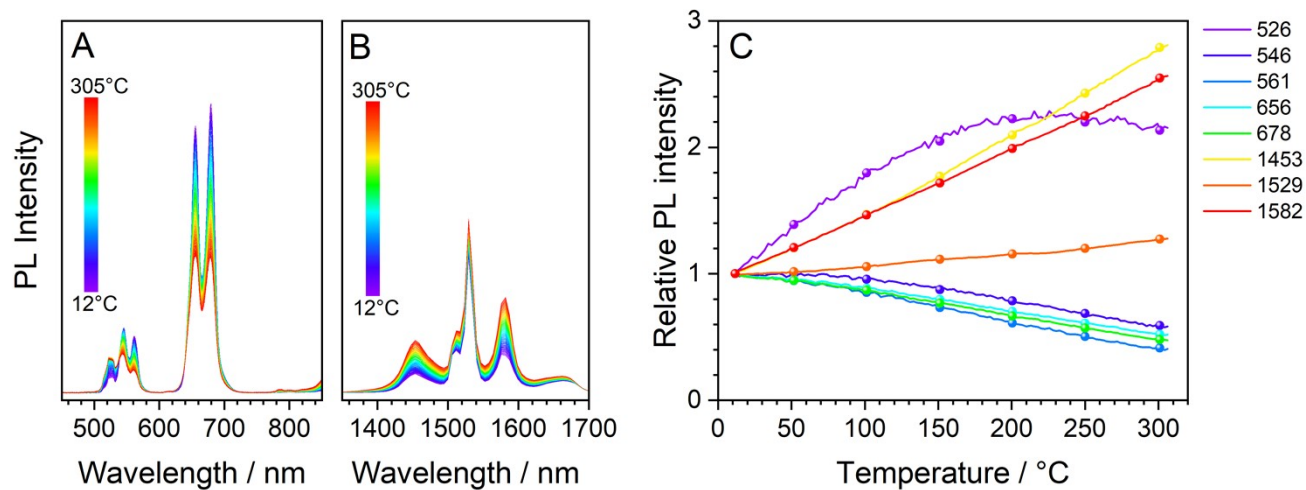




**Figure S6** Dependency of  $\text{Yb}^{3+}$  concentrations on the absorbed photon numbers of UCPL in the YSZ:Yb-Er/Tm.



**Figure S7** DSPL spectra of YSZ:Yb-Er and YSZ:Yb-Er/Tm (Yb 4.5 mol%) phosphors.



**Figure S8** Temperature dependency of PL properties of the YSZ:Yb-Erphosphor: (A,B) spectra and (C) relative PL peak intensity.

**Table S2** Summary of LIRs of YSZ:Yb-Er/Tm (Yb 4.5 mol%) phosphor.

LIR	B	C	$\Delta T$ / eV
1453/800 nm	0.081	29.934	0.17696
1529/800 nm	0.194	8.544	0.133209
1582/800 nm	0.183	49.849	0.168691
1663/800 nm	0.556	73.759	0.220507