Supporting Information

Efficient and zero thermal quenching Sm^{3+}-activated $Li_2LaTiTaO_7$ phosphor for white LEDs

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Figures and Figure Captions

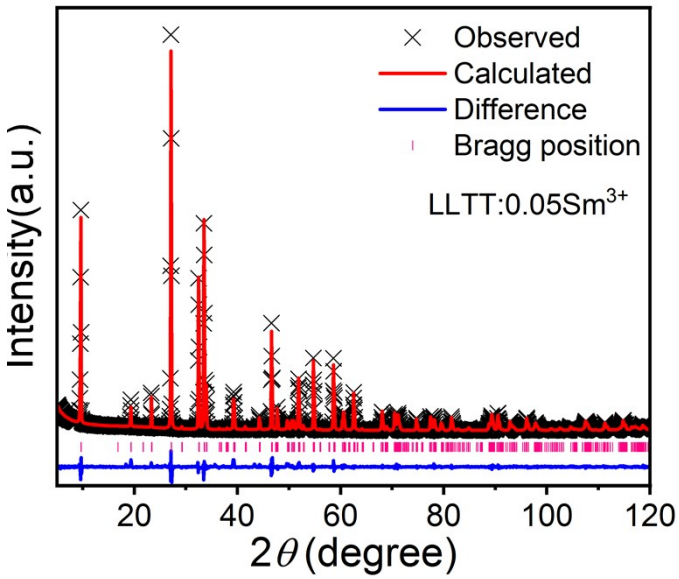

Fig. S1 Rietveld refinement of LLTT:0.05Sm^{3+} sample.

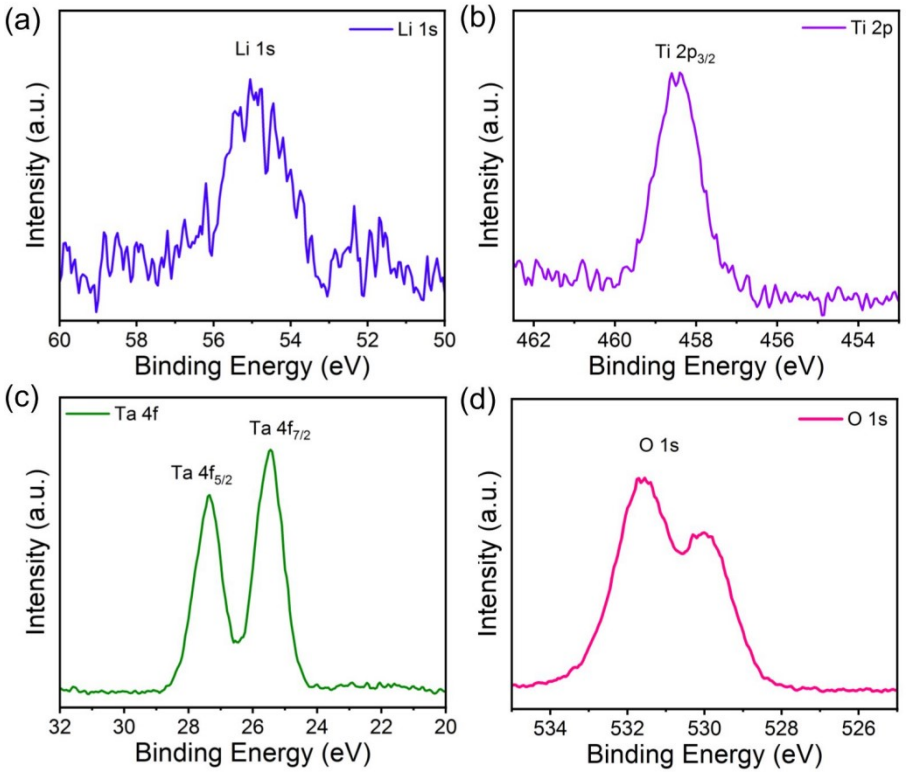

Fig. S2 (a)-(d) high-resolution XPS spectra of Li 1s, Ti 2p, Ta 4f, and O 1s, respectively.

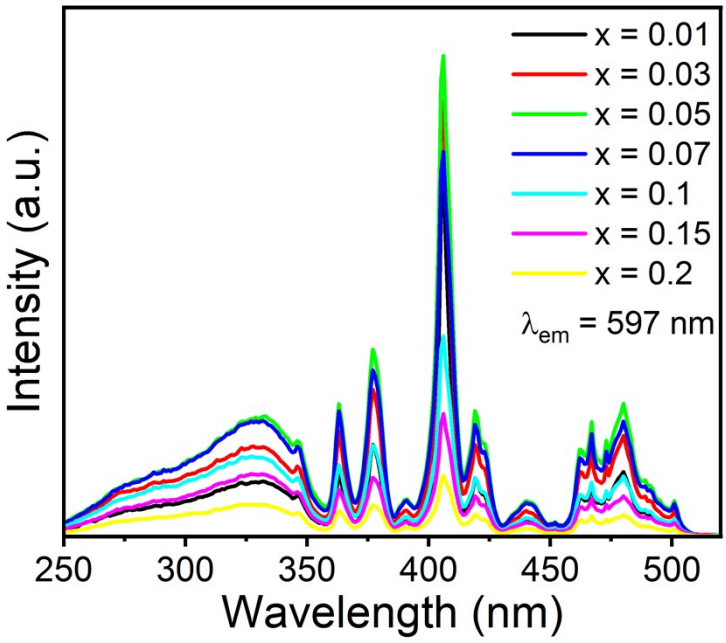

Fig. S3 (a) PLE spectra of LLTT:xSm^{3+} samples with varied x values monitored at 597 nm.

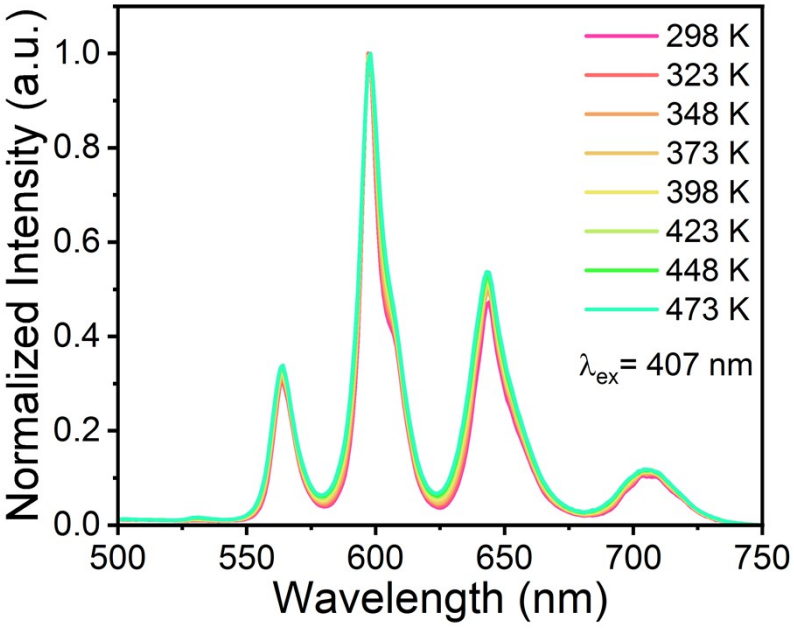

Fig. S4 Temperature-dependent Normalized PL spectra of the LLTT:0.05Sm^{3+} sample (298-473 K).

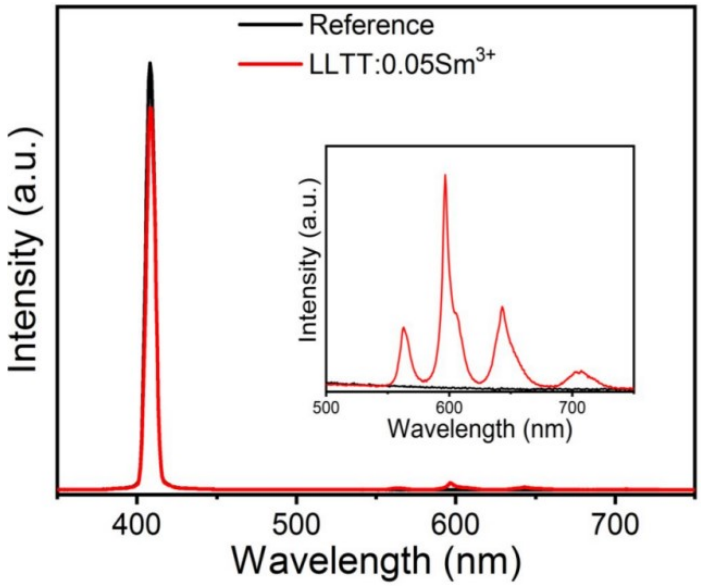

Fig. S5 The spectra of the LLTT:0.05Sm^{3+} sample and the reference sample (λex = 407 nm) in quantum efficiency measurements.

Tables and Table Captions

Table S1 Rietveld refinement and crystallographic data for the LLTT and LLTT:0.05Sm^{3+}.

Formula	LLTT	LLTT:0.05Sm^{3+}
Space group	*Cmcm* (No.63)	*Cmcm* (No.63)
Symmetry	Orthorhombic	Orthorhombic
Units, *Z*	4	4
a (Å)	18.3154(3)	18.3343(1)
b (Å)	5.5141(1)	5.5066(2)
c (Å)	5.5057(1)	5.5043(3)
V (A^3)	556.04(1)	555.72(1)
R_p (%)	4.8	5.23
R_{wp} (%)	6.54	7.13
χ^2	3.573	3.763

Table S2 Structural parameters of the LLTT determined by Rietveld refinement of the corresponding XRD pattern.

Atom	Wyck	*x/a*	*y/b*	*z/c*	Occ	U_{iso}
La1	4c	0.11656(8)	0.7548(8)	1/4	1.0	0.0200
Ta1	8g	0.11656(8)	0.7548(8)	1/4	0.5	0.0187
Ti1	8g	0.2824(22)	0	0	0.5	0.0187
Li1	8e	0	0.6970(34)	1/4	1.0	0.0220
O1	4c	0.2126(6)	0.7852(33)	1/4	1.0	0.0013
O2	8g	0.6149(8)	0	0	1.0	0.0129
O3	8e	0.0964(8)	0	0	1.0	0.0171
O4	8e	0.11656(8)	0.7548(8)	1/4	1.0	0.0338

Table S3 Structural parameters of the LLTT:0.05Sm^{3+} determined by Rietveld refinement of the corresponding XRD pattern.

Atom	Wyck	*x/a*	*y/b*	*z/c*	Occ	U_{iso}
La1	4c	0	0.2598(10)	1/4	0.95	0.0166
Ta1	8g	0.11691(9)	0.7542(8)	1/4	0.5	0.0143
Ti1	8g	0.11691(9)	0.7542(8)	1/4	0.5	0.0143
Li1	8e	0.2908(22)	0	0	1.0	0.0042
O1	4c	0	0.713(6)	1/4	1.0	0.0173
O2	8g	0.2141(6)	0.786(4)	1/4	1.0	0.0061
O3	8e	0.6190(8)	0	0	1.0	0.0101
O4	8e	0.1015(10)	0	0	1.0	0.0185
Sm1	4c	0	0.2598(10)	1/4	0.05	0.0166

Table S4 Average lifetime (τ) of Sm^{3+} 597 nm emission in LLTT: *x*Sm^{3+} phosphors (under 407 nm excitation)

Sm^{3+} (*x*)	A_1	τ_1 (ms)	A_2	τ_2 (ms)	τ_{av} (ms)
0.01	3956.21	1.79	981.84	0.9	1.69
0.03	3374.84	1.54	1436.92	0.61	1.41
0.05	2912.57	1.36	2056.93	0.54	1.18
0.07	2529.63	1.19	2415.97	0.45	0.99
0.1	1845.5	1.06	3219.24	0.42	0.8
0.15	1614.02	0.76	3273.32	0.31	0.56
0.2	2094.91	0.5	2662.12	0.2	0.4

Supplementary Notes

Supplementary Note 1:

The percentage difference in radius (D_r) should be explored to further ensure that the Sm^{3+} ion may be readily doped into the LLTT host, which could be calculated using the following formula:[1]

$$D_r = \frac{R_1(\mathrm{CN}) - R_2(\mathrm{CN})}{R_1(\mathrm{CN})} \quad \text{(S1)}$$

where the radius of the activated Sm^{3+} ions (R_2 (CN)) and the potential superseded La^{3+} ions (R_1 (CN)) are 1.24 and 1.36 Å, respectively, when the coordination number (CN) is 12.

Supplementary References

1. M. Peng, Z. Pei, G. Hong and Q. Su, *J. Mater. Chem.,* 2003, **13**, 1202-1205.