Fig. S1 In-suit XRD patterns of the SSET.
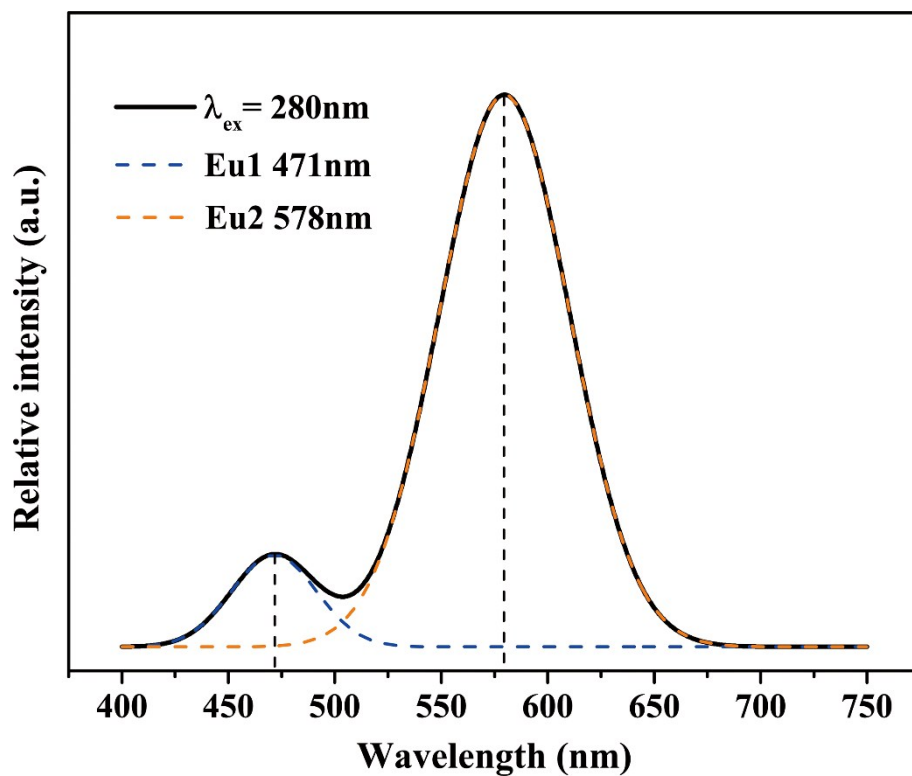
Fig. S2 PL spectrum of SSET under 280nm excitation.
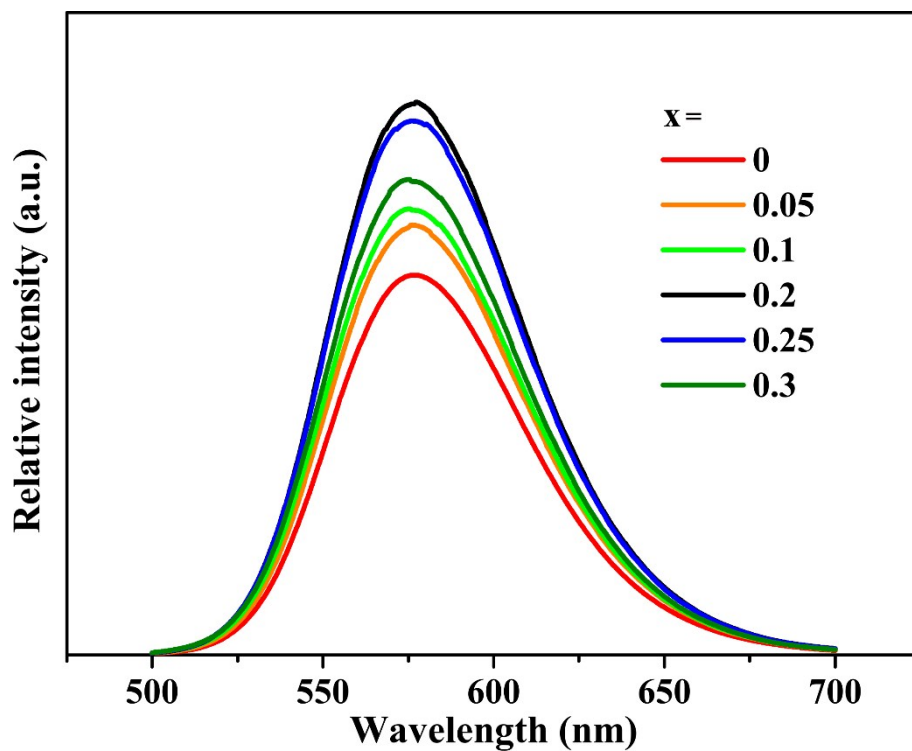

Fig. S3 PL spectra of $Sr_{2.95-x}SiO_5$: $0.5Eu^{2+}$, xTm^{3+} under 468nm excitation.
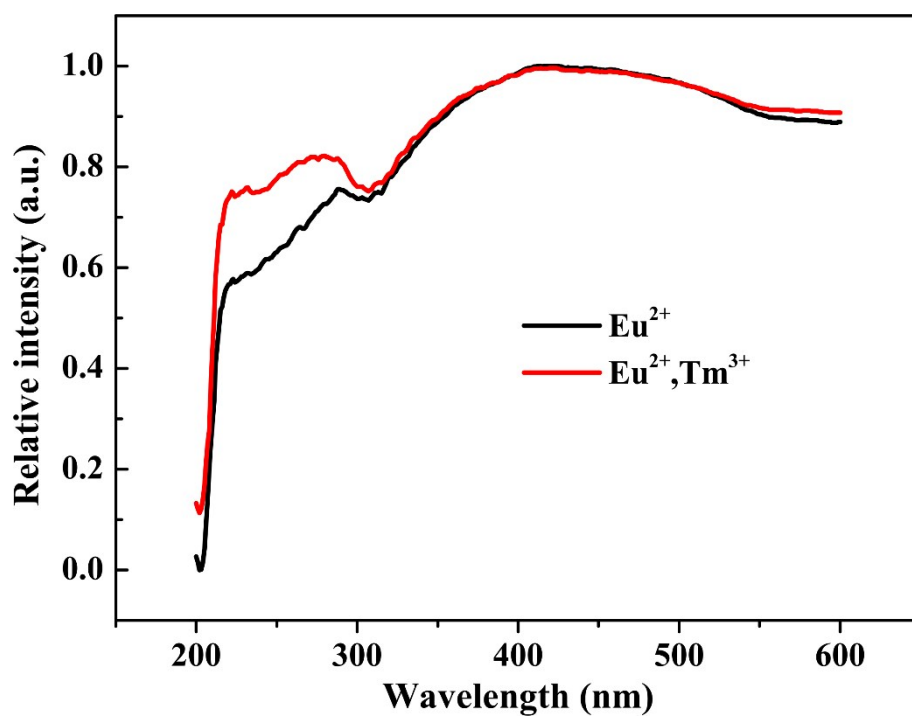
Fig. S4 Absorption spectra of SSE (black line) and SSET (red line).
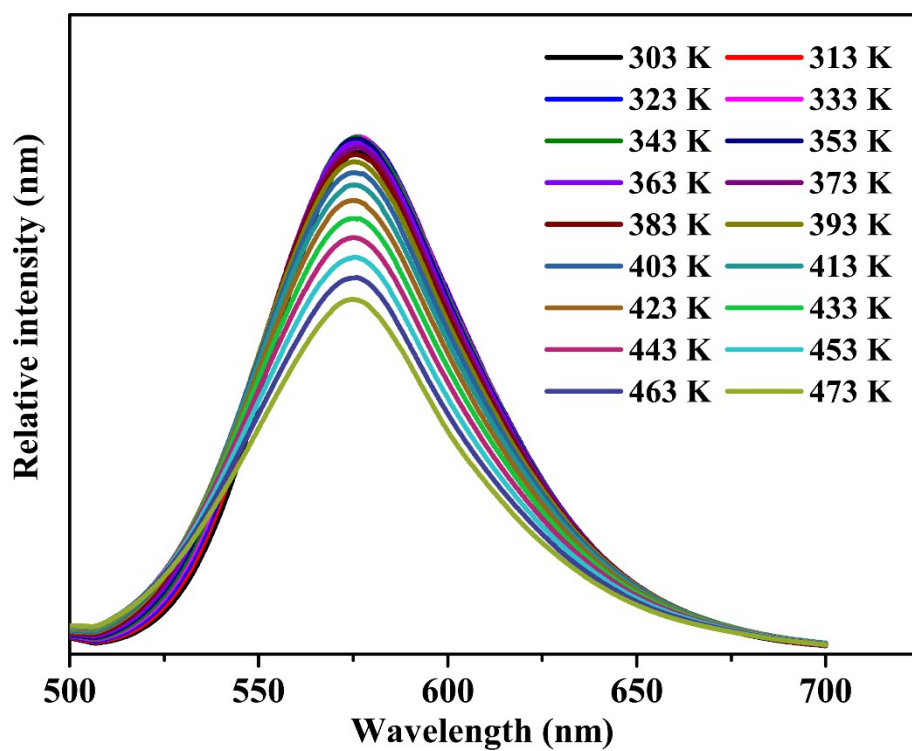

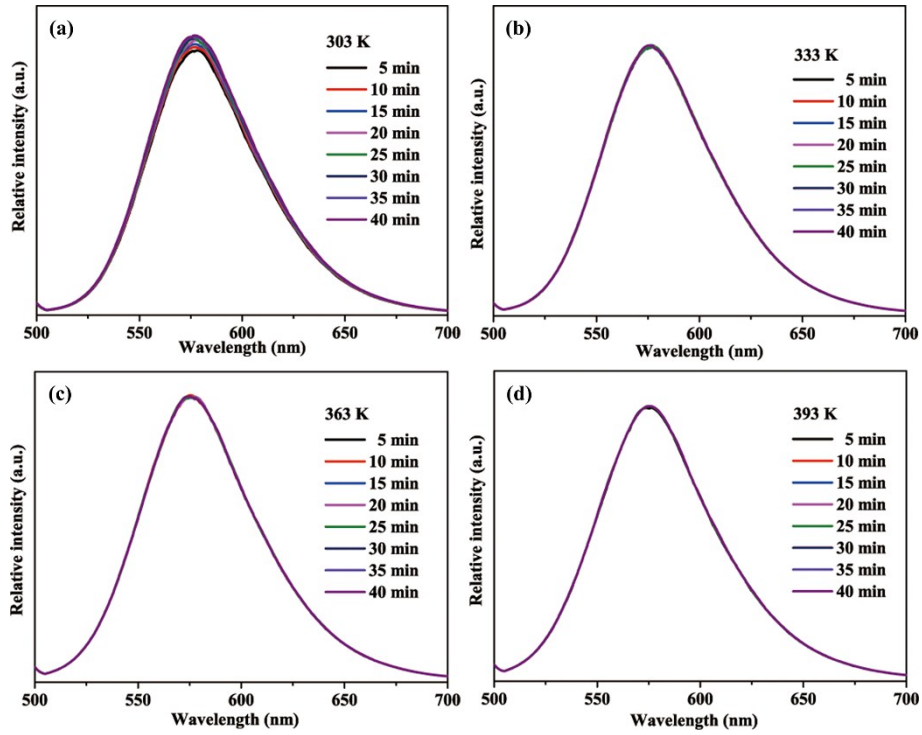Fig. S5 Temperature-dependent PL spectra of SSET under 468 nm excitation.

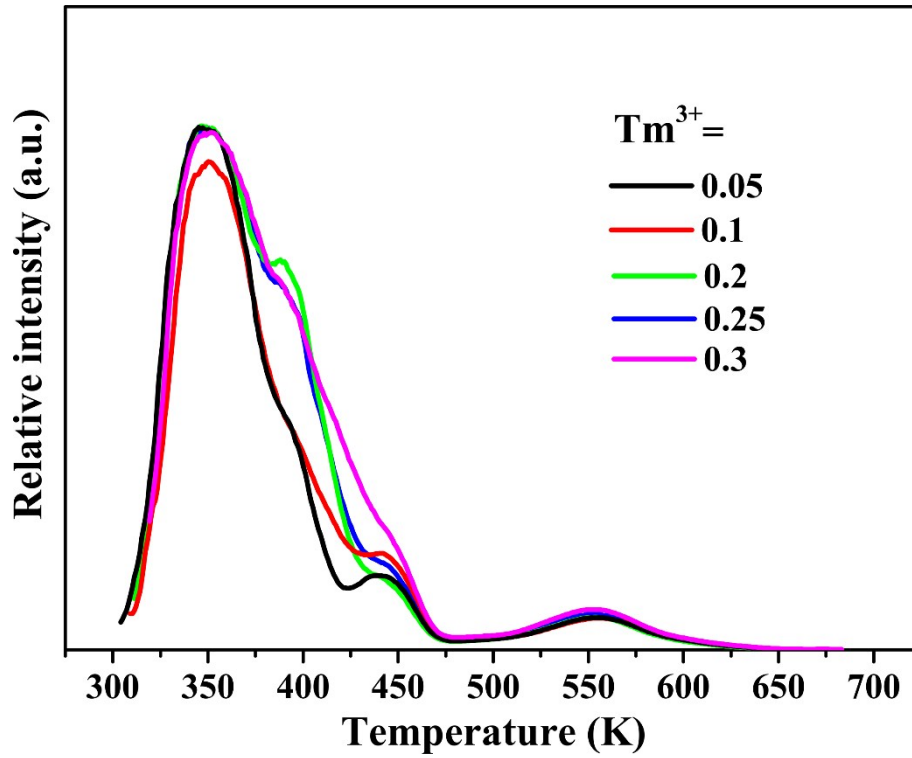Fig. S6 PL spectra of SSET at different duration time and ambient temperature.
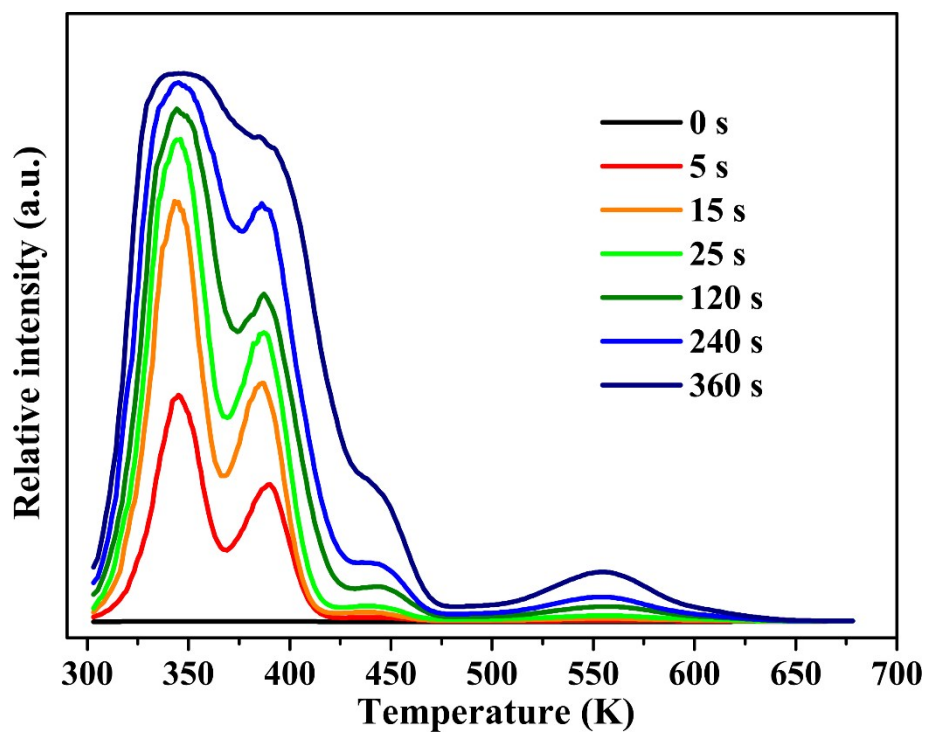

Fig. S7 TL curves of SSET.
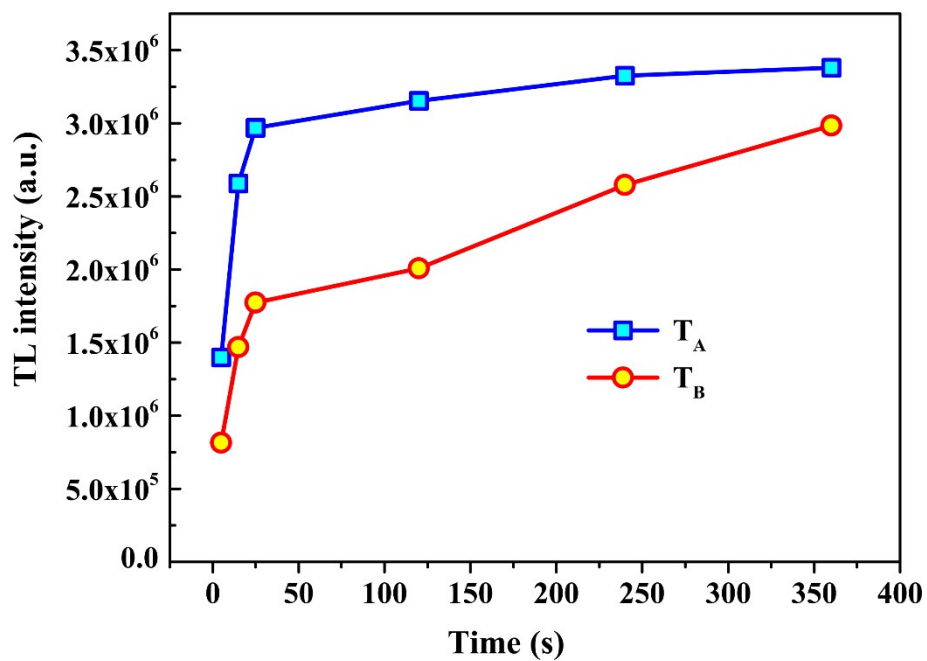
Fig. S8 Duration-dependent TL curves of SSET.

Fig. S9 TL intensity of T_A and T_B dependent on duration time.
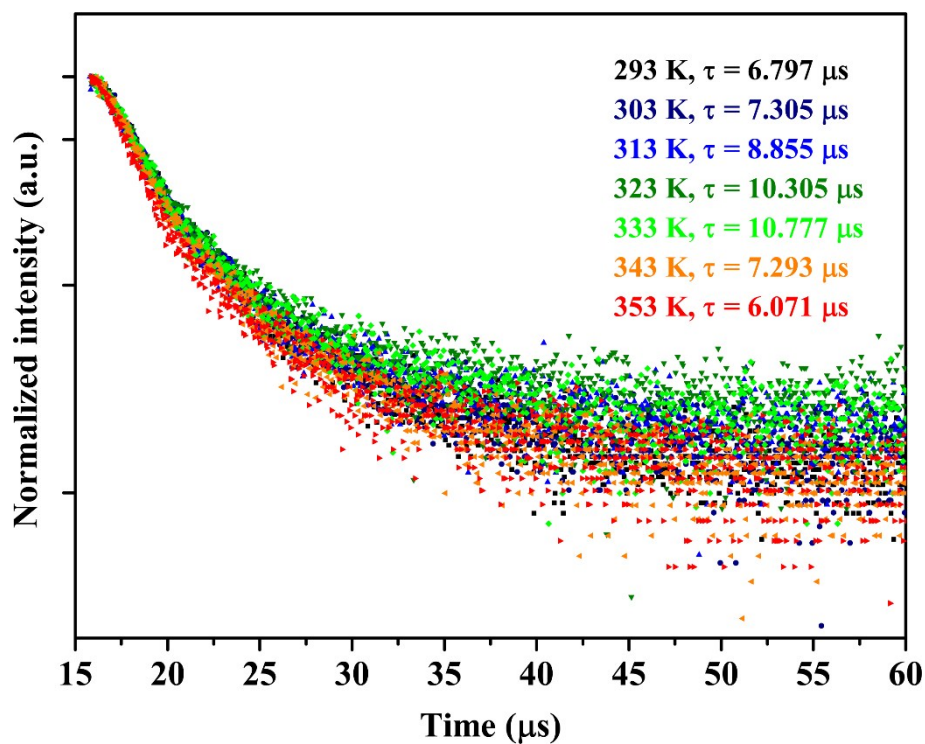
Fig. S10 Temperature-dependent decay curves of SSET.

The fluorescence decay curves are fitted by a double-exponential function:

$$I = A_1 exp\left(-t/\tau_1\right) + A_2 exp\left(-t/\tau_2\right)$$

Where I is the fluorescence intensity, A is a constant, t is the time, τ_1 and τ_2 are the decay times. The effective lifetime τ of 578 nm emission can be calculated by following equation:

$$\tau = \left(A_1\tau_1^2 + A_2\tau_2^2\right) / \left(A_1\tau_1 + A_2\tau_2\right)$$

Table. S1 Refinement parameters of Sr_3SiO_5: Eu^{2+}, Tm^{3+}

Refinement parameters of SSET	
Symmetry	Tetragonal
Space group	$P4/ncc$
***a*/Å**	6.9548(2)
***c*/Å**	10.7677(6)
volume/Å	520.83(1)
Z	4
R_b**(%)**	16.32
R_{wp}**(%)**	12.57
χ^2	1.29

Table. S2 Structure parameters of Sr_3SiO_5.

Atomic parameters					
Atom.	**Ox.**	**Wyckoff position**	***x/a***	***y/b***	***z/c***
Sr1	+2	8*f*	0.1810(0)	0.1810(0)	0.25
Sr2	+2	4*c*	0	0.5	0
Si	+4	4*b*	0	0	0
O1	-2	16*g*	0.1690(0)	-0.0920(0)	0.0880(0)
O2	-2	4*c*	0	0.5	0.25