Electronic Supplementary Material (ESI) for Inorganic Chemistry Frontiers.

Supporting Information

	Stoichiometric composition	Notation
Group I	$LiSr_{2.964}SiO_4Cl_3:0.036Eu^{2+}$	LSSOC:Eu
	$LiSr_{2.964}SiO_4Cl_3:0.036Eu^{2+},0.018Dy^{3+}$	LSSOC:Eu,Dy
	$LiSr_{2.964}SiO_4Cl_3:0.036Eu^{2+},0.018Ho^{3+}$	LSSOC:Eu,Ho
	$LiSr_{2.964}SiO_4Cl_3:0.036Eu^{2+}, 0.018Er^{3+}$	LSSOC:Eu,Er
Group II	$LiSr_3SiO_4Cl_3$	LSSOC
	$LiSr_{2.97}SiO_4Cl_3:0.03Pr^{3+}$	LSSOC:Pr
	$LiSr_{2.97}SiO_4Cl_3:0.03Ce^{3+}$	LSSOC:Ce
Group III	$LiSr_{2.964}SiO_4Cl_3:0.036Eu^{2+},0.009Dy^{3+},0.009Ho^{3+}$	LSSOC:Eu,Dy,Ho
	$LiSr_{2.964}SiO_4Cl_3:0.036Eu^{2+},0.009Dy^{3+},0.009Er^{3+}$	LSSOC:Eu,Dy,Er
	$LiSr_{2.964}SiO_4Cl_3:0.036Eu^{2+},0.009Dy^{3+},0.009Mn^{2+}$	LSSOC:Eu,Dy,Mn
	$LiSr_{2.964}SiO_4Cl_3:0.036Eu^{2+},0.009Dy^{3+},0.009Nd^{3+}$	LSSOC:Eu,Dy,Nd
	$LiSr_{2.964}SiO_4Cl_3:0.036Eu^{2+},0.009Dy^{3+},0.009Pr^{3+}$	LSSOC:Eu,Dy,Pr
	$LiSr_{2.964}SiO_4Cl_3:0.036Eu^{2+},0.009Ho^{3+},0.009Er^{3+}$	LSSOC:Eu,Ho,Er
	$LiSr_{2.964}SiO_4Cl_3:0.036Eu^{2+},0.009Ho^{3+},0.009Mn^{2+}$	LSSOC:Eu,Ho,Mn
	$LiSr_{2.964}SiO_4Cl_3:0.036Eu^{2+},0.009Ho^{3+},0.009Nd^{3+}$	LSSOC:Eu,Ho,Nd
	$LiSr_{2.964}SiO_4Cl_3:0.036Eu^{2+},0.009Ho^{3+},0.009Pr^{3+}$	LSSOC:Eu,Ho,Pr
	$LiSr_{2.964}SiO_4Cl_3:0.036Eu^{2+},0.009Er^{3+},0.009Mn^{2+}$	LSSOC:Eu,Er,Mn
	$LiSr_{2.964}SiO_4Cl_3:0.036Eu^{2+},0.009Er^{3+},0.009Nd^{3+}$	LSSOC:Eu,Er,Nd
	$LiSr_{2.964}SiO_4Cl_3:0.036Eu^{2+},0.009Er^{3+},0.009Pr^{3+}$	LSSOC:Eu,Er,Pr
	$LiSr_{2.964}SiO_4Cl_3:0.036Eu^{2+},0.009Mn^{2+},0.009Nd^{3+}$	LSSOC:Eu,Mn,Nd
	$LiSr_{2.964}SiO_4Cl_3:0.036Eu^{2+},0.009Mn^{2+},0.009Pr^{3+}$	LSSOC:Eu,Mn,Pr
	$LiSr_{2.964}SiO_4Cl_3:0.036Eu^{2+},0.009Nd^{3+},0.009Pr^{3+}$	LSSOC:Eu,Nd,Pr

Table S1. Stoichiometric compositions and notations of the samples. Group I is the Eu^{2+}-activated samples. Group II and III are used to construct and verify the host-referred binding energy and vacuum-referred binding energy (HRBE and VRBE) schemes.

Formula	**$LiSr_3SiO_4Cl_3$**
Crystal system	**orthorhombic**
Space group	***Pmna(53)***
Lattice parameters	
a (Å)	***a=9.4695 Å***
b (Å)	***b=6.9952 Å***
c (Å)	***c=13.6800 Å***
R-Factors	
R_{wp}	**11.93%**
R_p	**9.22%**

Table S2 XRD refined parameters of the LSSOC host

Atom	Ox.	Wyck.	x/a	y/b	z/c
Li1	**1**	**2d**	**0**	**1/2**	**0**
Li2	**1**	**2c**	**0**	**1/2**	**1/2**
O1	**-2**	**4h**	**0**	**0.5774**	**0.1605**
O2	**-2**	**8i**	**0.6395**	**0.0885**	**0.6485**
O3	**-2**	**4h**	**0**	**0.2276**	**0.0082**
Sr1	**2**	**4h**	**0**	**0.2220**	**0.1894**
Sr2	**2**	**4e**	**0.2406**	**0**	**1/2**
Sr3	**2**	**4g**	**1/4**	**0.6701**	**1/4**
Si1	**4**	**4h**	**0**	**0.7918**	**0.1115**
Cl1	**-1**	**4h**	**0**	**0.1985**	**0.6071**
Cl2	**-1**	**8i**	**0.1834**	**0.3348**	**0.3736**

Table S3 relevant cell parameters of the LSSOC host

Type	Atom	Bond Length (Å)	Average Bond Length (Å)
Eu1	O3	2.479	2.870
	O1	2.517	
	O2	2.603	
	O2	2.603	
	Cl2	3.160	
	Cl2	3.160	
	Cl2	3.218	
	Cl2	3.218	
Eu2	O2	2.408	2.804
	O2	2.408	
	Cl2	2.961	
	Cl2	2.961	
	Cl1	3.044	
	Cl1	3.044	
	O2	2.424	
Eu3	O2	2.424	2.833
	O1	2.743	
	O1	2.743	
	Cl2	2.959	
	Cl2	2.959	
	Cl1	3.205	
	Cl1	3.205	

Table S4 bond length of the adjacent pairs in Eu1, Eu2, and Eu3.

n	Ln	ΔE(n+1,7,2+)	E_{fd}(n+1,2+,free)	ΔE(n,6,3+)	E_{fd}(n,3+,free)	E_{exch}(n,3+,F)
0	La	5.61	-0.94	-	-	
1	Ce	4.13	-0.35	5.24	6.12	
2	Pr	2.87	1.56	3.39	7.63	
3	Nd	2.43	1.93	1.9	8.92	
4	Pm	2.34	1.96	1.46	9.24	
5	Sm	1.25	3	1.27	9.34	
6	Eu	0	4.22	0	10.5	
7	Gd	4.56	-0.2	-1.34	11.8	
8	Tb	3.31	1.19	3.57	7.78	1.0
9	Dy	2.27	2.17	2.15	9.25	0.74
10	Ho	2.4	2.25	1.05	10.1	0.51
11	Er	2.58	2.12	1.12	9.86	0.35
12	Tm	1.72	2.95	1.28	9.75	0.28
13	Yb	0.433	4.22	0.236	10.89	0.22
14	Lu	-		-1.02	12.26	0.15

Table S5 Parameter values (in eV) that define the 4f and 5d binding energy curves for the divalent and trivalent lanthanides in compounds.

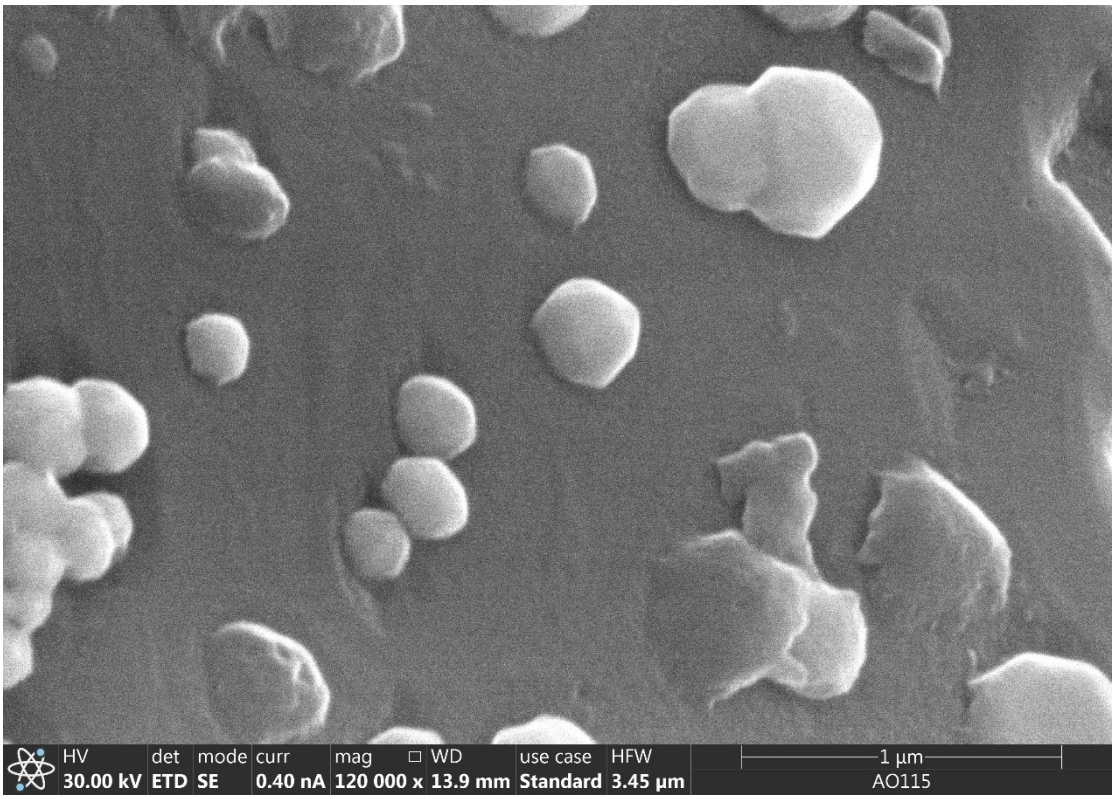

Fig. S1. SEM image of the LSSOC:Eu,Ho phosphors.

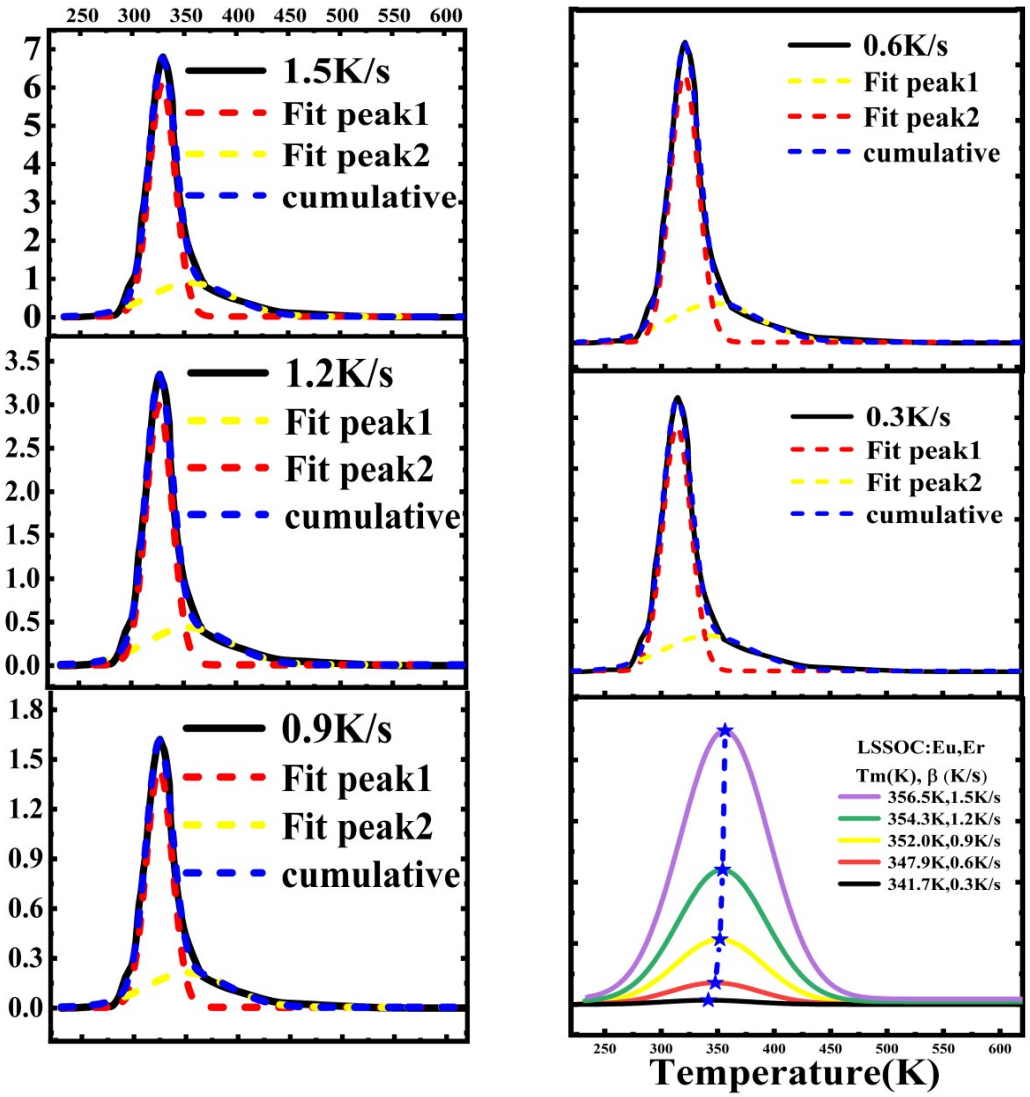

Fig. S2. The fitting TL curve of band A and band B in LSSOC:Eu,Er. And the fitting TL curve only the bands B decided by Er under some heating rate of 1.5, 1.2, 0.9, 0.6, 0.3K/s, respectively.

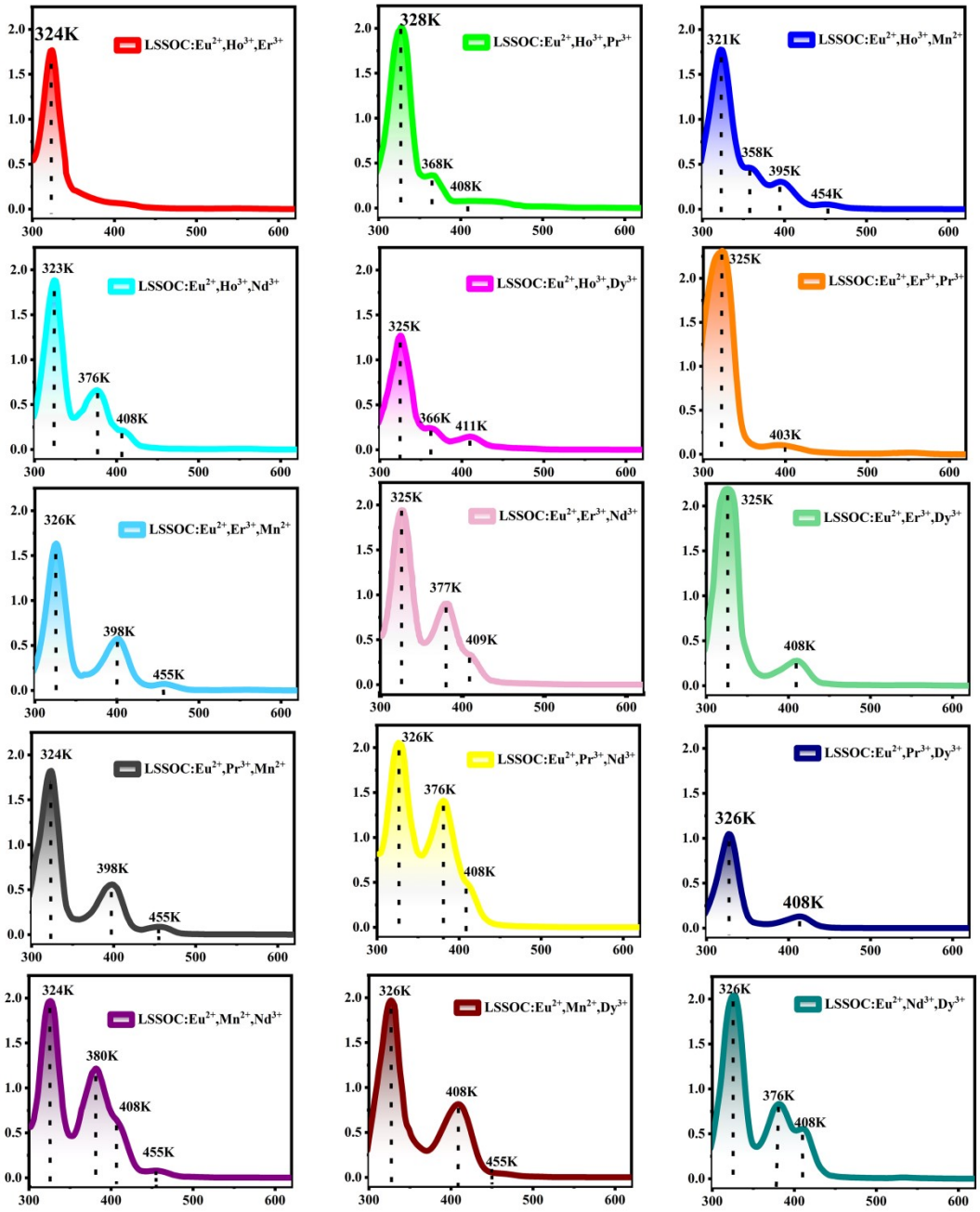

Fig. S3. The TL curves ($\times 10^6$) which were been codoped by two species of the six ions (Dy^{3+}, Ho^{3+}, Er^{3+}, Mn^{2+}, Nd^{3+}, Pr^{3+}) with LSSOC:Eu at the heating rate of 0.9 K/s.

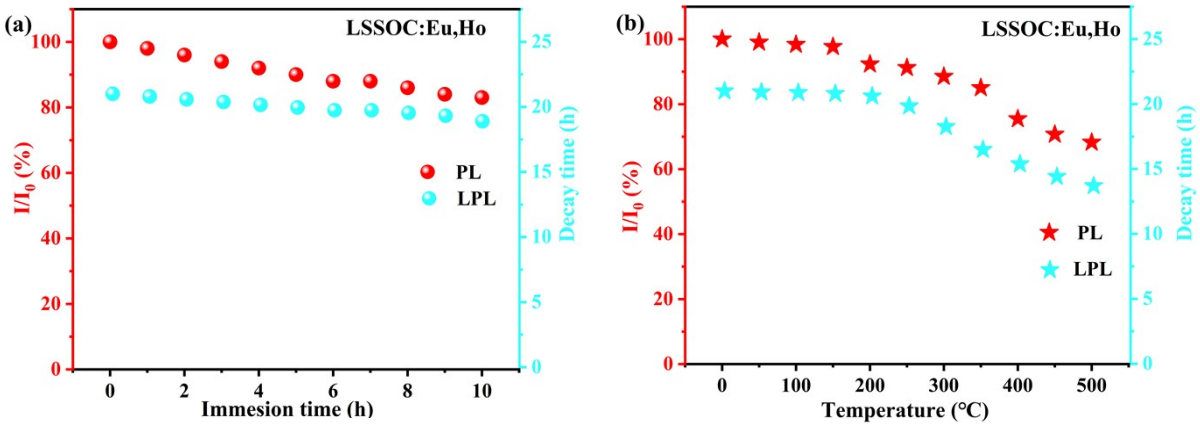

Fig. S4. (a) Water resistance tests of the LSSOC:Eu,Ho after being placed in tap water for different time. (b) Temperature resistance tests of the LSSOC:Eu,Ho after being sintered in tube furnace for 1 h at different temperature.

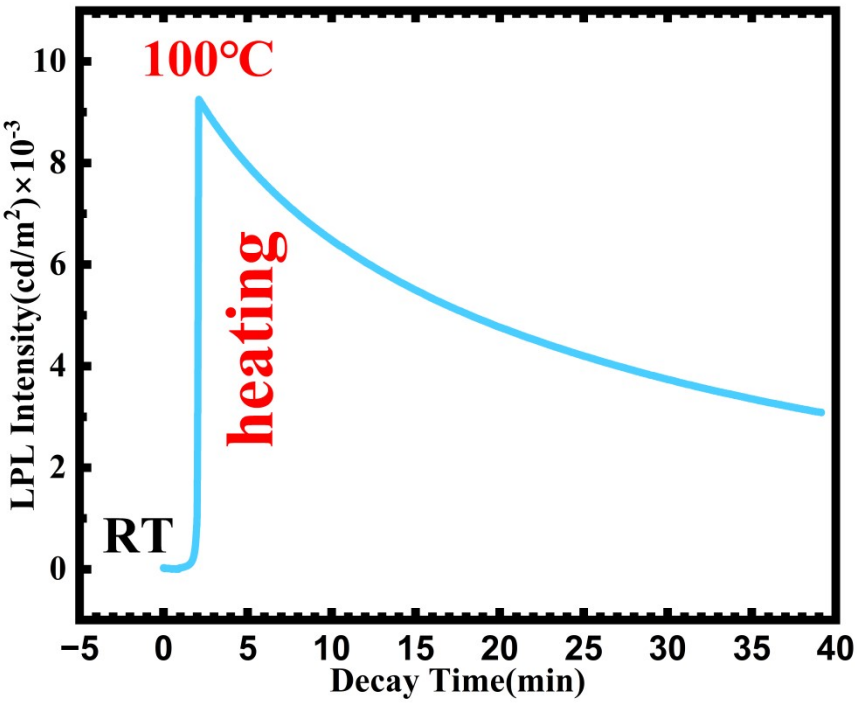

Fig. S5. Intensity of readout signal from the LSSOC:Eu,Ho under high-temperature thermal stimulation (100 ºC, from the second minute). Before the readout, the sample was exposed by UV light for 10 min and kept in the dark for 10 days at RT.