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Electronic Supporting Information

The Luminescence Enhancement and Energy Transfer of Ce^{3+} and Sm^{3+} in $CaSrSiO_4$ Phosphor

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Table S1. Refined unit cell parameters and atomic coordinates of $Ca_{0.97}Sr_{0.97}Ce_{0.01}Sm_{0.02}Na_{0.03}SiO_4$.

Atom	site	X	Y	Z
Sr1	4a	0.2812(43)	0.4260(92)	0.7506(26)
Sr2	4a	0.4502(44)	0.0919(63)	0.7881(26)
Sr3	4a	0.1122(48)	0.0606(71)	0.7844(25)
Ca1	4a	0.0024(99)	0.1996(12)	0.2811(59)
Ca2	4a	0.3343(10)	0.1922(14)	0.2707(59)
Ca3	4a	0.1677(93)	0.3125(16)	0.2446(54)
Si1	4a	0.2642(15)	0.0805(25)	0.7712(61)
Si2	4a	0.4169(92)	0.4497(20)	0.7716(57)
Si3	4a	0.0974(18)	0.4360(24)	0.8184(49)
O1	4a	0.111	0.065	0.318
O2	4a	0.445	0.067	0.322
O3	4a	0.249	0.194	0.531
O4	4a	0.065	0.328	0.987
O5	4a	0.227	0.156	0.981
O6	4a	0.083	0.309	0.542
O7	4a	0.281	0.436	0.3
O8	4a	0.333	0.061	0.82
O9	4a	0.166	0.431	0.813
O10	4a	0.403	0.328	0.978
O11	4a	0.002	0.056	0.753
O12	4a	0.403	0.341	0.5
Formula: $CaSrSiO_4$;				
Symmetry: Orthorhombic;				
Space Group: *Pna2₁*(33);				
Cell parameters: a = 20.8653 (14) Å; b = 9.47962 (62) Å; c = 5.59615(37) Å; V = 1106.89 (13) $Å^3$				

Table S2. Comparison of the CIE Chromaticity Coordinates (*x*, *y*) for $Ca_{0.99-y}Sr_{0.99-y}Ce_{0.01}Sm_yNa_{0.01+y}SiO_4$ (y = 0 to 0.025) and $Ca_{0.99}Sr_{0.99}Sm_{0.01}Na_{0.01}SiO_4$ phosphors.

Sample	Sample Composition (*y*)	CIE coordinates (*x*, *y*)
1	0	(0.155, 0.066)
2	0.005	(0.200, 0.092)
3	0.01	(0.238, 0.132)
4	0.015	(0.281, 0.163)
5	0.02	(0.302, 0.183)
6	0.025	(0.390, 0.245)
7	$Ca_{0.99}Sr_{0.99}Sm_{0.01}Na_{0.01}SiO_4$	(0.599, 0.389)

Table S3. Lifetimes, fitting parameters, ET rates, and ET efficiencies for $Ca_{0.99-y}Sr_{0.99-y}Ce_{0.01}Sm_yNa_{0.01+y}SiO_4$.

Sm^{3+}	τ_1 (ns)	τ_2 (ns)	A_1	A_2	R^2_{adj}	τ^* (ns)	$^a k_{ET}$ (μs)$^{-1}$	η (%)
0	38.9± 0	38.9± 0	0.1185	0.1185	0.9994	38.9	0.0	0.0
0.005	3± 0.6	40.4 ± 0.5	0.2965	0.6886	0.9959	37.8	0.75	2.83
0.01	50.9± 0.3	26.3 ± 0.5	0.6657	0.2080	0.9970	36.14	1.96	7.10
0.015	22± 0.08	44.8± 0.2	0.9776	0.5912	0.9958	34.04	3.67	12.49
0.02	17 ± 0.04	38.7 ± 0.2	0.1416	0.1685	0.9957	29.44	8.26	24.32
0.025	13± 0.02	37.2±0.1	0.9863	0.5632	0.9918	23.08	17.62	40.67

Table S4. The fitting parameters and the c_A/c_0 ratios obtained from the Inokuti-Hirayama model.

$c_A(Sm^{3+})$	R^2_{adj}	c_A/c_0
0	0.9994	-
0.005	0.9959	0.28
0. 01	0.9970	0.22
0.015	0.9958	0.45
0.02	0.9957	0.53
0.025	0.9918	1.14

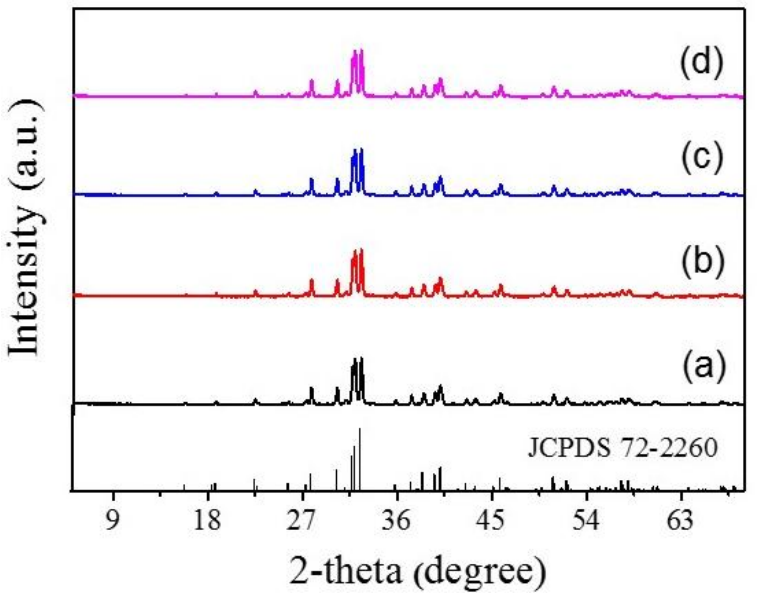

Fig. S1 XRD profiles of as-synthesized phosphors of $Ca_{0.99}Sr_{0.99}Ce_{0.01}Na_{0.01}SiO_4$ (a), $Ca_{0.99}Sr_{0.99}Sm_{0.01}Na_{0.01}SiO_4$ (b), $Ca_{0.98}Sr_{0.98}Ce_{0.01}Sm_{0.01}Na_{0.02}SiO_4$ (c) and $Ca_{0.97}Sr_{0.97}Ce_{0.01}Sm_{0.02}Na_{0.03}SiO_4$ (d).

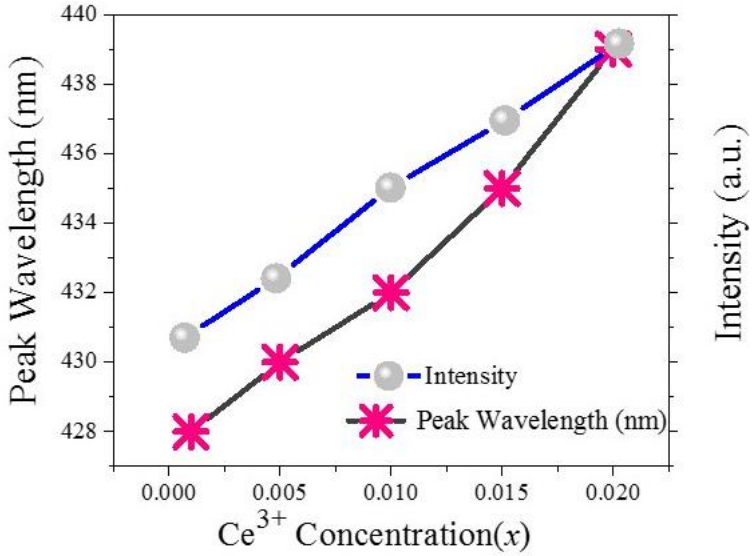

Fig. S2 Variation of emission intensity and peak wavelength as a function of Ce^{3+} concentration in $Ca_{1-x}Sr_{1-x}Ce_xNa_xSiO_4$.

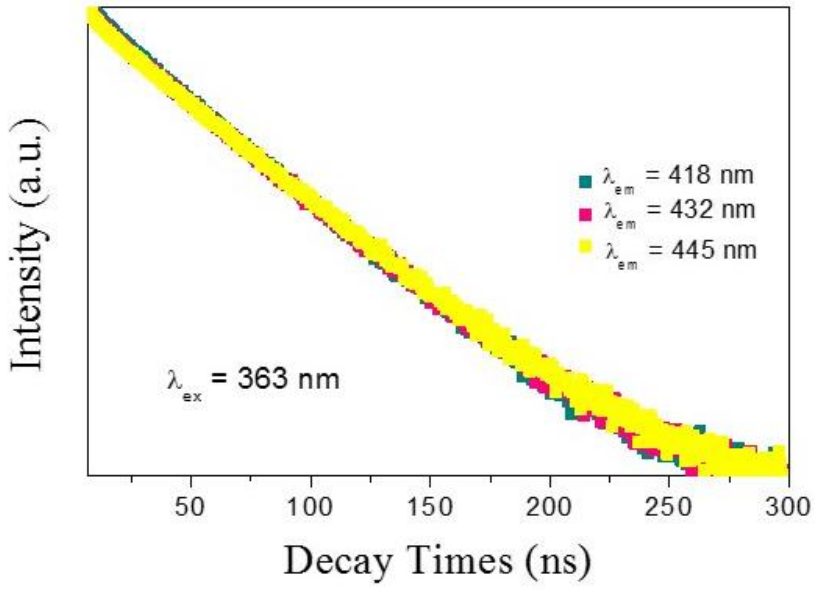

Fig. S3 Decay curves of $Ca_{0.99}Sr_{0.99}Ce_{0.01}Na_{0.01}SiO_4$ phosphor monitored at some selected wavelengths in the corresponding emission spectrum.

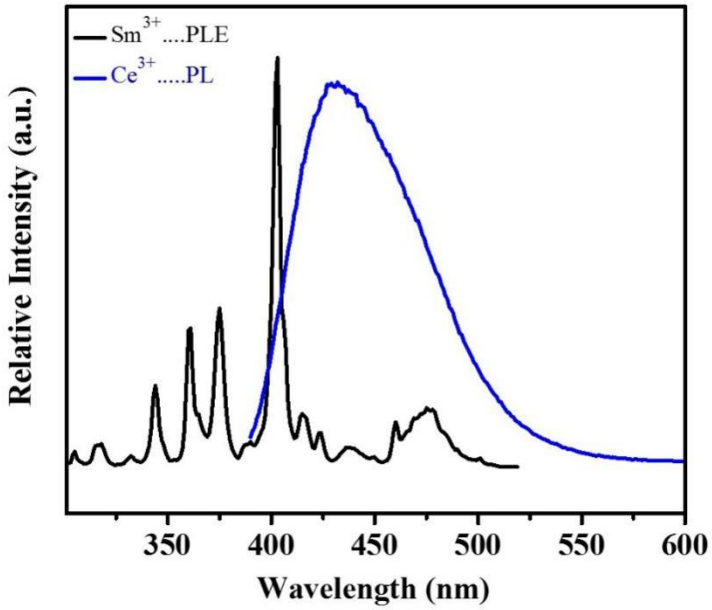

Fig. S4 Spectral overlap~~ping~~ between the Ce^{3+} emission band of $Ca_{0.99}Sr_{0.99}Ce_{0.01}Na_{0.01}SiO_4$ and the excitation spectrum of $Ca_{0.99}Sr_{0.99}Sm_{0.01}Na_{0.01}SiO_4$.

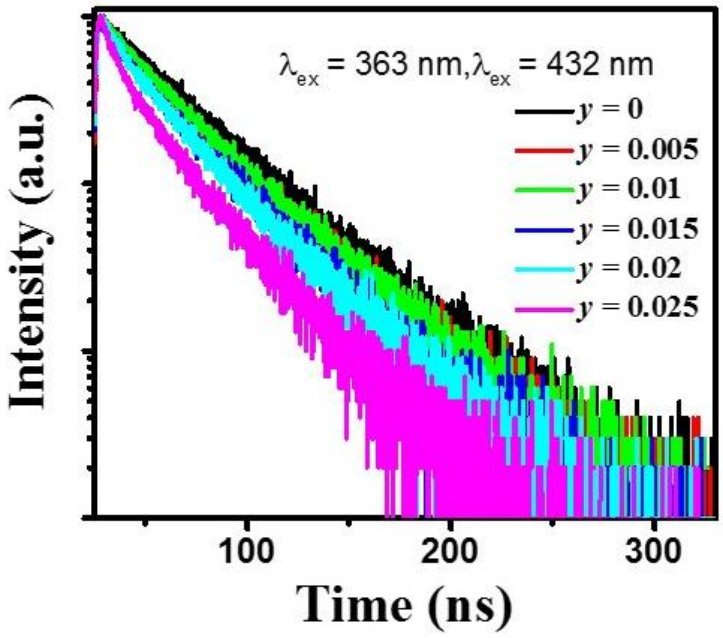

Fig. S5 Decay curves of $Ca_{0.99-y}Sr_{0.99-y}Ce_{0.01}Sm_yNa_{0.01+y}SiO_4$ (y = 0 to 0.025) phosphors.

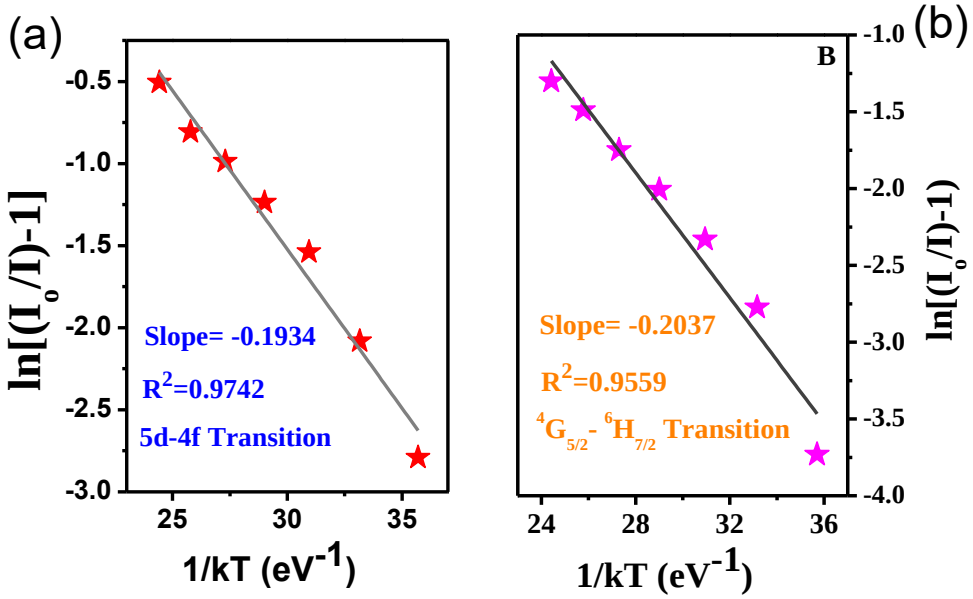

Fig. S6 The fitting lines of ln[(I_o/I)-1] versus 1/kT for the blue (a) and yellow-orange (b) emissions of $Ca_{0.97}Sr_{0.97}Ce_{0.01}Sm_{0.02}Na_{0.03}SiO_4$ phosphor.