Highly Efficient $Sr_3Y_2(Si_3O_9)_2$:Ce^{3+}, Tb^{3+}/Mn^{2+}/Eu^{2+} Phosphors for White LEDs: Structure Refinement, Color Tuning and Energy Transfer

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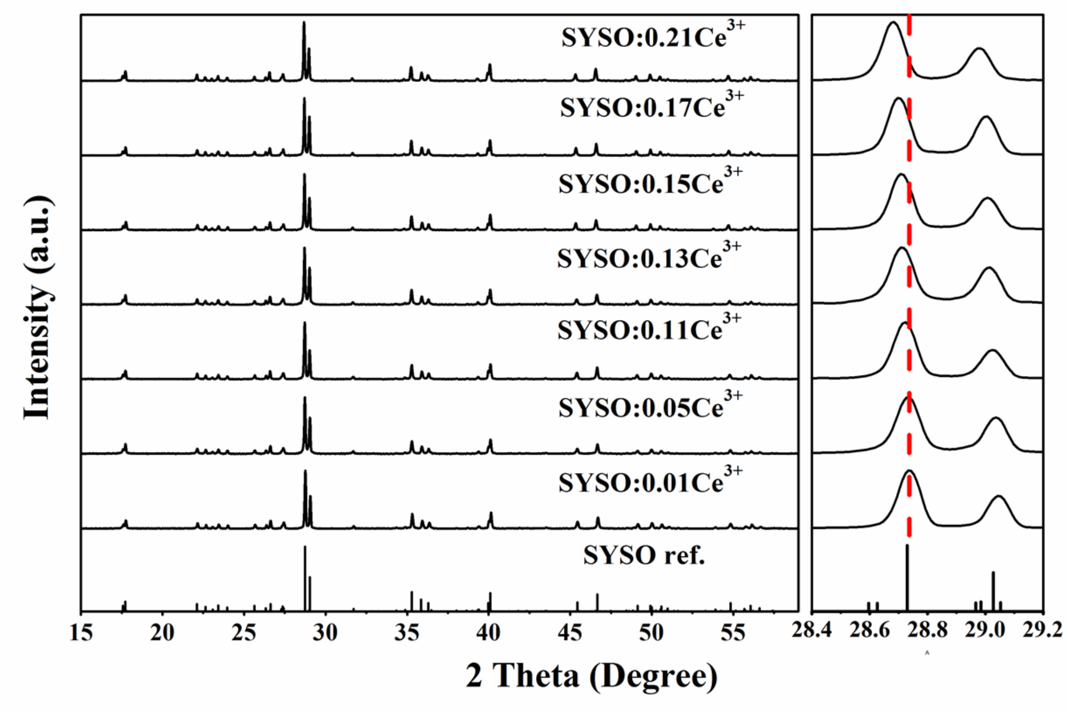

Figure S1. XRD patterns of the SYSO host and different Ce^{3+} -doped SYSO samples.

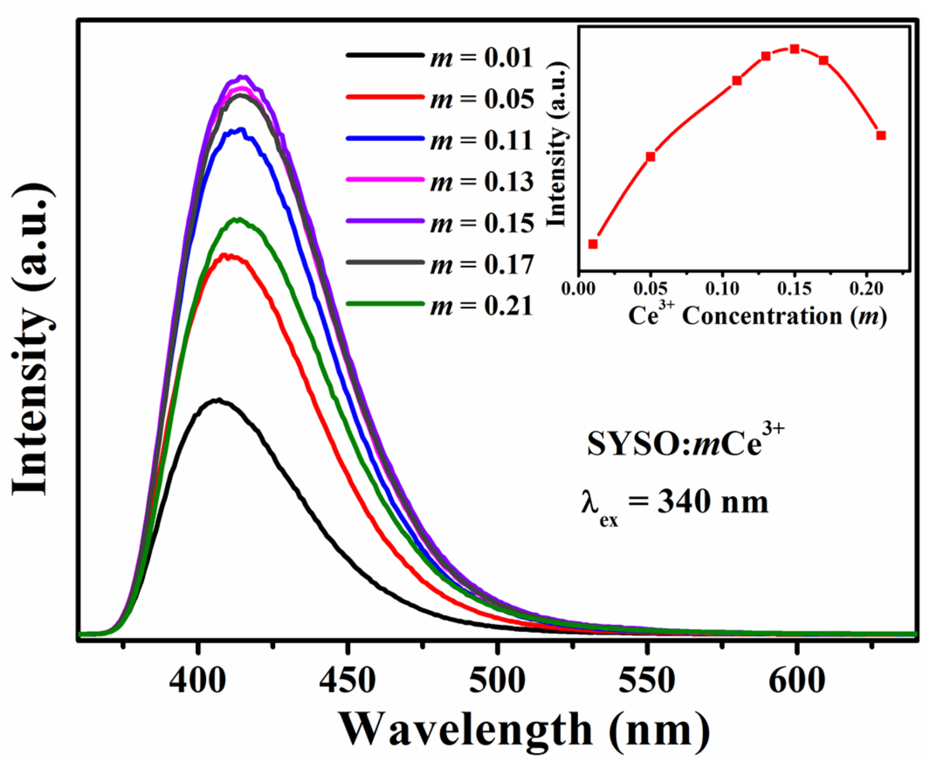

Figure S2. The PL spectra of SYSO:$m$$Ce^{3+}$ phosphors (m = 0.01, 0.05, 0.11, 0.13, 0.15, 0.17 and 0.21). The inset illustrates the PL intensity of SYSO:$m$$Ce^{3+}$ phosphors as a function of the Ce^{3+} doping concentration (m).

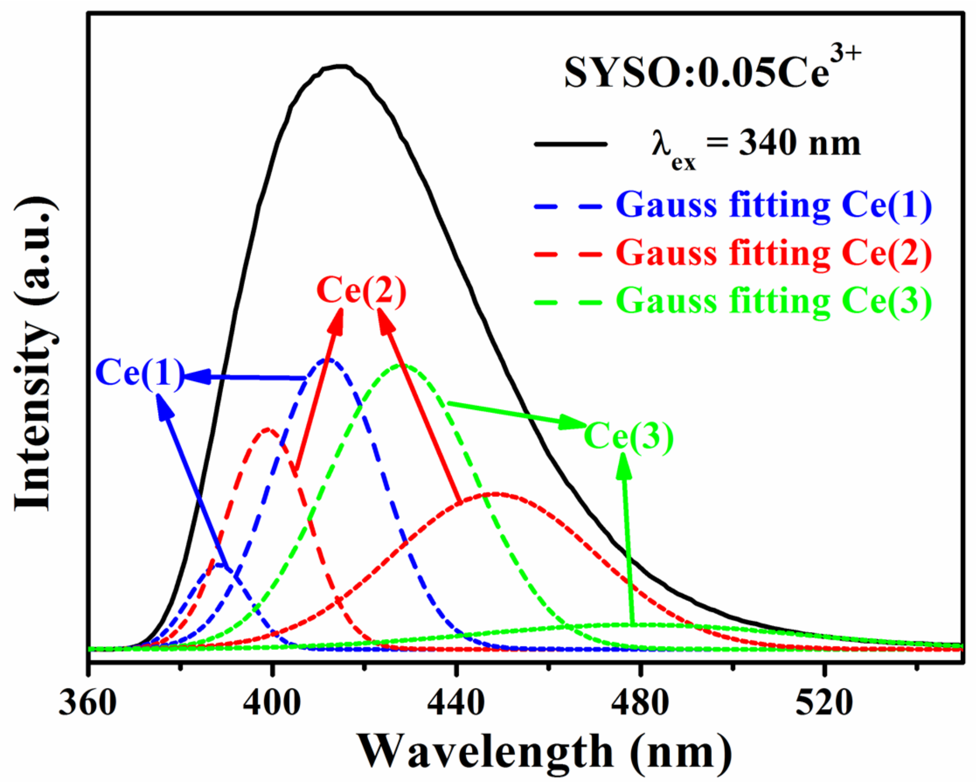

Figure S3. The PL spectrum (black solid line) of SYSO:0.05Ce^{3+}, together with the six Gaussian peaks fitting (blue/red/green dashed lines) of the PL spectrum.

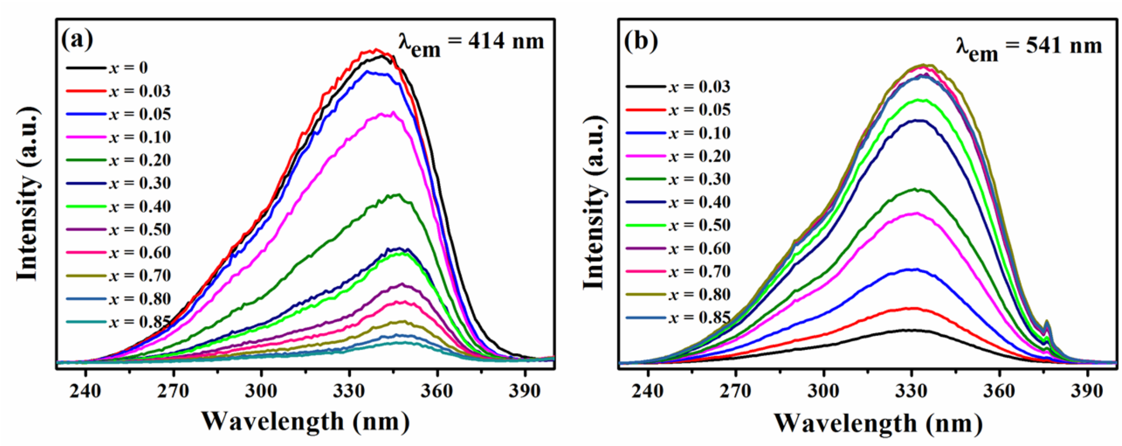

Figure S4. The PLE spectra of SYSO:0.15Ce^{3+}, $x$$Tb^{3+}$ phosphors (x = 0, 0.03, 0.05, 0.10, 0.20, 0.30, 0.40, 0.50, 0.60, 0.70, 0.80 and 0.85) monitored at different UV. (a) λ_{em} = 414 nm; (b) λ_{em} = 541 nm.

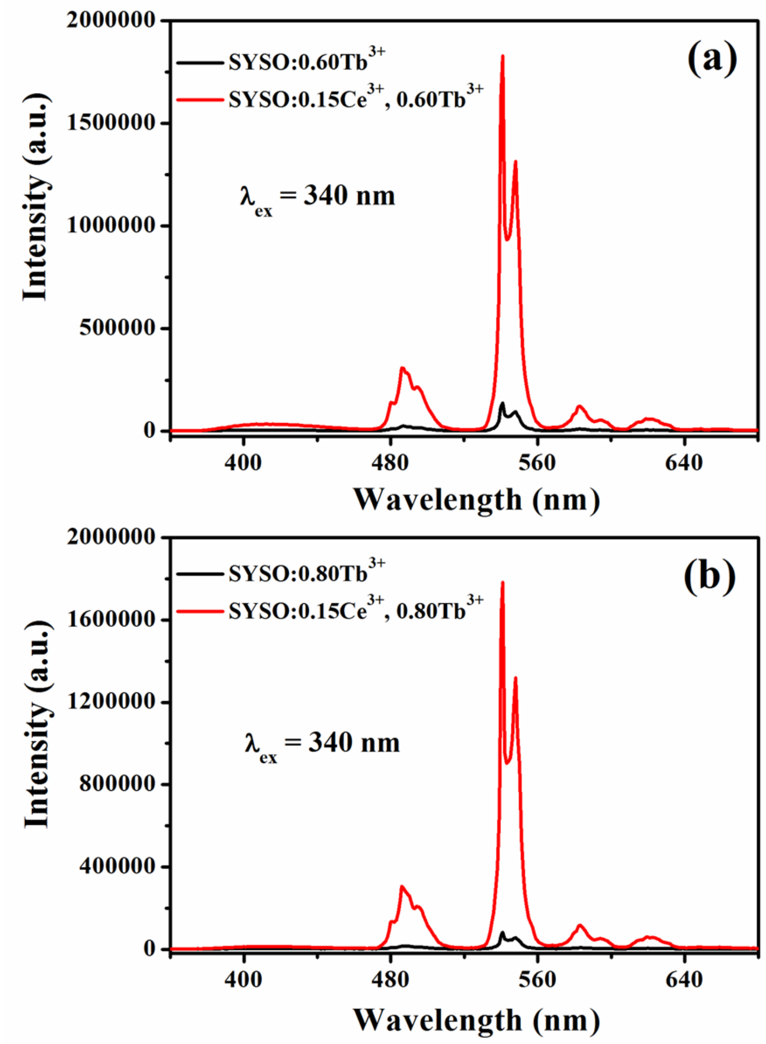

Figure S5. (a) The PL spectra of SYSO:0.60Tb^{3+} (black line), SYSO:0.30Ce^{3+}, 0.60Tb^{3+} (red line); (b) The PL spectra of SYSO:0.80Tb^{3+} (black line), SYSO:0.30Ce^{3+}, 0.80Tb^{3+} (red line).

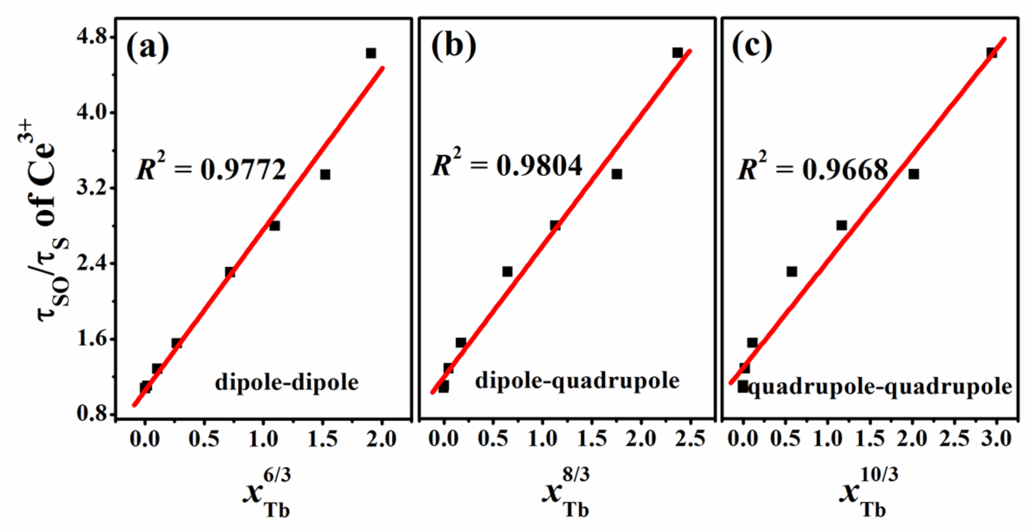

Figure S6. Dependence of τ_{SO} / τ_S of Ce^{3+} on (a) $x_{Tb}^{6/3}$, (b) $x_{Tb}^{8/3}$ and (c) $x_{Tb}^{10/3}$.

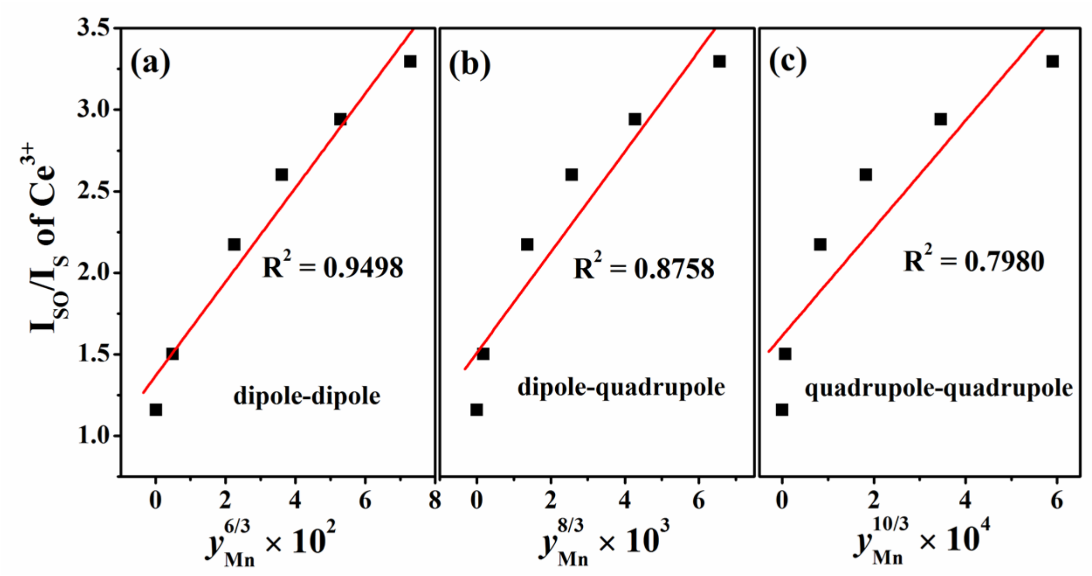

Figure S7. Dependence of I_{SO} / I_S of Ce^{3+} on (a) $y_{Mn}^{6/3}$, (b) $y_{Mn}^{8/3}$ and (c) $y_{Mn}^{10/3}$.

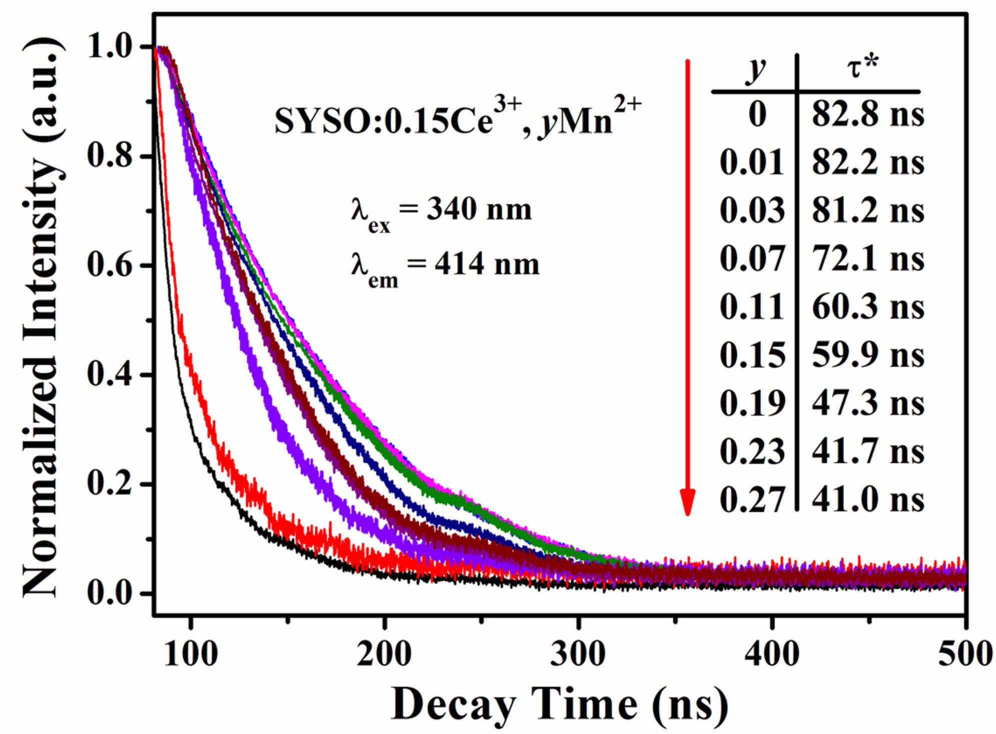

Figure S8. Decay curves of Ce^{3+} emission monitored at 414 nm for SYSO:0.15Ce^{3+}, $y$$Mn^{2+}$ (y = 0, 0.01, 0.03, 0.07, 0.11, 0.15, 0.19, 0.23 and 0.27) under excitation at 340 nm.

Table S1. The integral intensity and ratio of the Gaussian peaks fitting of SYSO:*m*Ce^{3+} at 400 nm, 420 nm, and 450 nm, respectively.

m	400 nm	420 nm	450 nm	ratio
0.01	13959782	26231280	18212926	1:1.88:1.30
0.05	22512548	45777373	32400194	1:2.03:1.44
0.11	29161561	63568220	45641352	1:2.18:1.57
0.13	31221538	69650610	51032696	1:2.23:1.63
0.15	32424034	72454306	51905218	1:2.24:1.60
0.17	30781358	69697328	50335947	1:2.26:1.64
0.21	25020274	54013588	38080012	1:2.16:1.52

Table S2. The photoluminescence lifetimes for the SYSO:0.15Ce^{3+}, $y$$Tb^{3+}$/$z$$Mn^{2+}$ (y = 0 – 0.85; z = 0 – 0.27) samples (λ_{em} = 340 nm).

SYSO:0.15Ce^{3+}, $y$$Tb^{3+}$/$z$$Mn^{2+}$	A_1	A_2	A_3	τ_1	τ_2	τ_3
y = 0, z = 0	0.000584	0.000584	0.000584	8.28E-08	8.28E-08	8.28E-08
y = 0.03, z = 0	0.000492	0.000492	0.000492	8.01E-08	8.01E-08	8.01E-08
y = 0.05, z = 0	0.000427	0.000427	0.000427	7.69E-08	7.69E-08	7.69E-08
y = 0.10, z = 0	0.000332	0.000332	0.000332	7.49E-08	7.49E-08	7.49E-08
y = 0.20, z = 0	0.000176	0.000176	0.000176	6.45E-08	6.45E-08	6.45E-08
y = 0.30, z = 0	5.61E-05	5.61E-05	5.61E-05	5.33E-08	5.33E-08	5.33E-08
y = 0.40, z = 0	-3.7E-11	6.07E-12	2.47E-06	1.54E-08	1.4E-08	4.1E-08
y = 0.50, z = 0	3.96E-06	3.96E-06	3.96E-06	3.82E-08	3.82E-08	3.82E-08
y = 0.60, z = 0	2.38E-06	2.38E-06	2.38E-06	3.59E-08	3.59E-08	3.59E-08
y = 0.70, z = 0	3.23E-07	3.23E-07	3.23E-07	2.96E-08	2.96E-08	2.96E-08
y = 0.80, z = 0	3.49E-08	3.49E-08	3.49E-08	2.48E-08	2.48E-08	2.48E-08
y = 0.85, z = 0	1.44E-10	1.44E-10	1.44E-10	1.79E-08	1.79E-08	1.79E-08
y = 0, z = 0.01	0.00055	0.00055	0.00055	8.22E-08	8.22E-08	8.22E-08
y = 0, z = 0.03	0.000553	0.000553	0.000553	8.12E-08	8.12E-08	8.12E-08
y = 0, z = 0.07	0.000284	0.000284	0.000284	7.2E-08	7.2E-08	7.2E-08
y = 0, z = 0.11	6.99E-05	6.99E-05	6.99E-05	6.03E-08	6.03E-08	6.03E-08
y = 0, z = 0.15	9.82E-05	9.82E-05	9.82E-05	5.99E-08	5.99E-08	5.99E-08
y = 0, z = 0.19	1.64E-05	1.64E-05	1.63E-05	4.73E-08	4.73E-08	4.73E-08
y = 0, z = 0.23	-9.2E-13	2.22E-13	1.35E-06	1.36E-08	1.27E-08	4.17E-08
y = 0, z = 0.27	-3.7E-11	6.07E-12	2.47E-06	1.54E-08	1.4E-08	4.1E-08