

Electronic Supplementary Information

Improved luminescent properties of a novel red dodec-fluoride phosphor

Ba₃Sc₂F₁₂:Mn⁴⁺ with extraordinary thermal stability for WLEDs application

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Table S1. Lattice parameters of the red phosphor $\text{Ba}_3\text{Sc}_2\text{F}_{12}:\text{Mn}^{4+}$ with various concentrations of K_2MnF_6 (unit: pm, degree) (note: x is concentrations of K_2MnF_6)

Sample	x	a (Å)	b (Å)	c (Å)	α	β	γ
1	x=0.01	10.1961	5.5536	5.5536	90°	90°	90°
2	x=0.02	9.6576	5.4431	5.4431	90°	90°	90°
3	x=0.04	9.6548	5.4371	5.4371	90°	90°	90°
4	x=0.06	9.6299	5.4438	5.4438	90°	90°	90°
5	x=0.08	9.5821	5.3806	5.3806	90°	90°	90°
6	x=0.1	9.5811	5.1775	5.1775	90°	90°	90°

Table S2. Lattice parameters of the red phosphor $\text{Ba}_3\text{Sc}_2\text{F}_{12}:\text{Mn}^{4+}$ with part of Ba^{2+} substituted ions with Ca^{2+} ions. (unit: pm, degree)

Sample	$\text{Ca}^{2+}/\text{Ba}^{2+}$	a (Å)	b (Å)	c (Å)	α	β	γ
1	no Ca^{2+} doped	9.6654	5.5600	5.6000	90°	90°	90°
2	$\text{Ca}^{2+}/\text{Ba}^{2+} = 1/9$	9.4725	5.5525	5.5525	90°	90°	90°
3	$\text{Ca}^{2+}/\text{Ba}^{2+} = 2/8$	9.4622	5.5497	5.5497	90°	90°	90°
4	$\text{Ca}^{2+}/\text{Ba}^{2+} = 3/7$	9.4283	5.4792	5.4792	90°	90°	90°

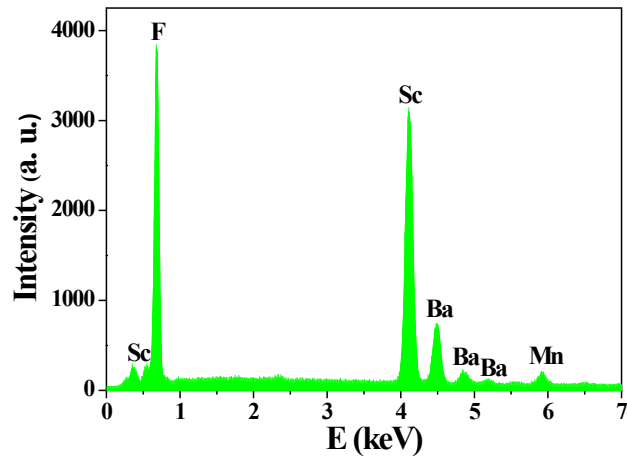


Figure S1 Energy dispersive spectrum (EDS) of red phosphor $\text{Ba}_3\text{Sc}_2\text{F}_{12}:\text{Mn}^{4+}$.

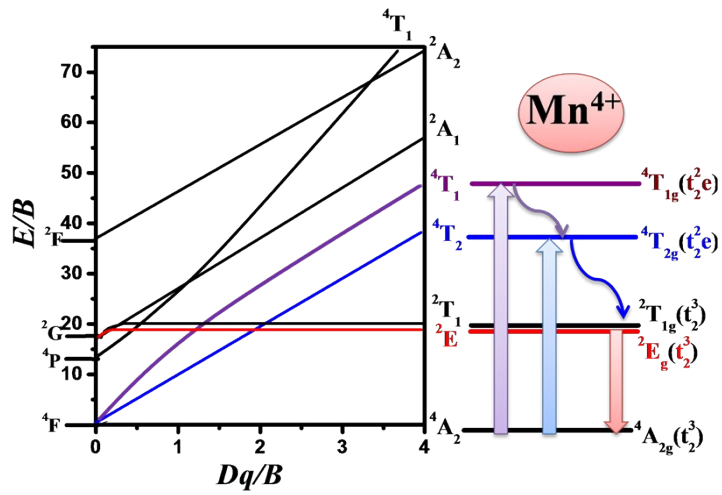


Figure S2 Schematic energy level diagram for $5d^3$ electron configuration of Mn^{4+} in the center of octahedron structure.

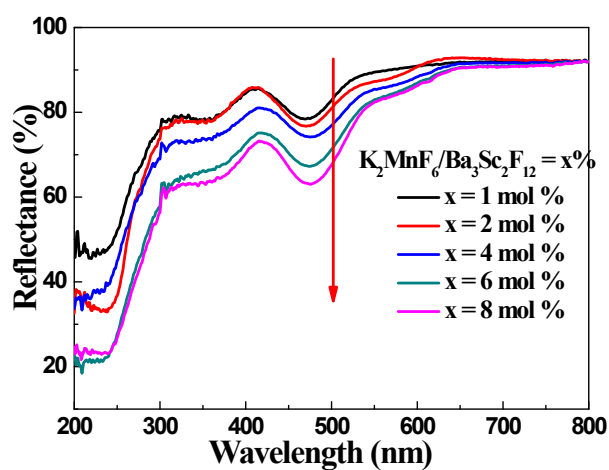


Figure S3 The powder diffuse reflectance spectra of $\text{Ba}_3\text{Sc}_2\text{F}_{12}:\text{Mn}^{4+}$ with various concentrations of K_2MnF_6 .

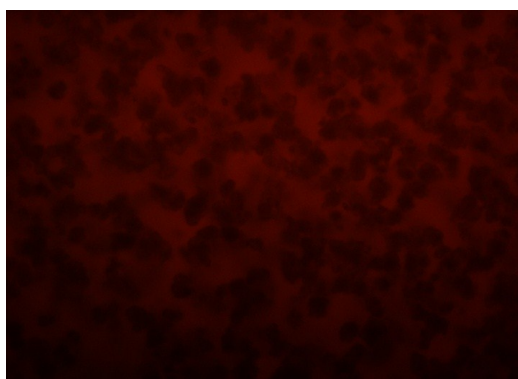


Figure S4 The fluorescent microscopic image of $\text{Ba}_3\text{Sc}_2\text{F}_{12}:\text{Mn}^{4+}$ taken by a Lecia DMI3000B inverted optical micro-scope.

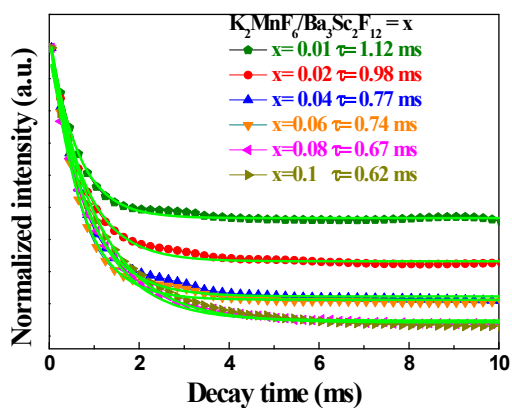


Figure S5 Decay curves (detected at 629 nm with excitation at 467 nm) of

$\text{Ba}_3\text{Sc}_2\text{F}_{12}:\text{Mn}^{4+}$ samples with various concentrations of K_2MnF_6 .

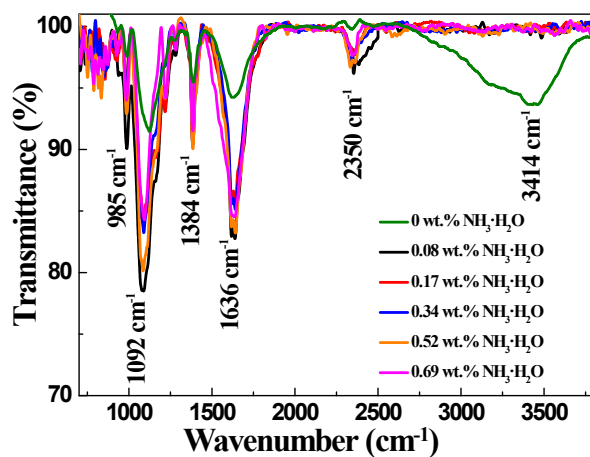


Figure S6 FT-IR spectra of red phosphors $\text{Ba}_3\text{Sc}_2\text{F}_{12}:\text{Mn}^{4+}$ synthesized with the concentrations of $\text{NH}_3\cdot\text{H}_2\text{O}$ in reaction system.

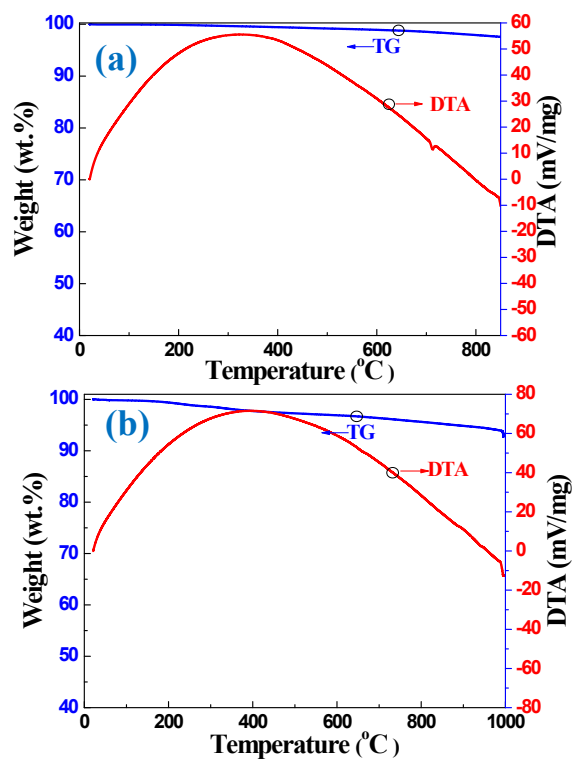


Figure S7 (a) Thermogravimetrics (TG) and differential thermal analysis (DTA)

graphs of as synthesized red phosphors $\text{Ba}_3\text{Sc}_2\text{F}_{12}:\text{Mn}^{4+}$ with concentrations of K_2MnF_6 at (a) 1 mol% and (b) 6 mol% under N_2 atmosphere;