

Supporting information

Title: Tunable luminescence and energy transfer properties in $\text{Ca}_5(\text{PO}_4)_2\text{SiO}_4$: $\text{Ce}^{3+}/\text{Tb}^{3+}/\text{Mn}^{2+}$ phosphors

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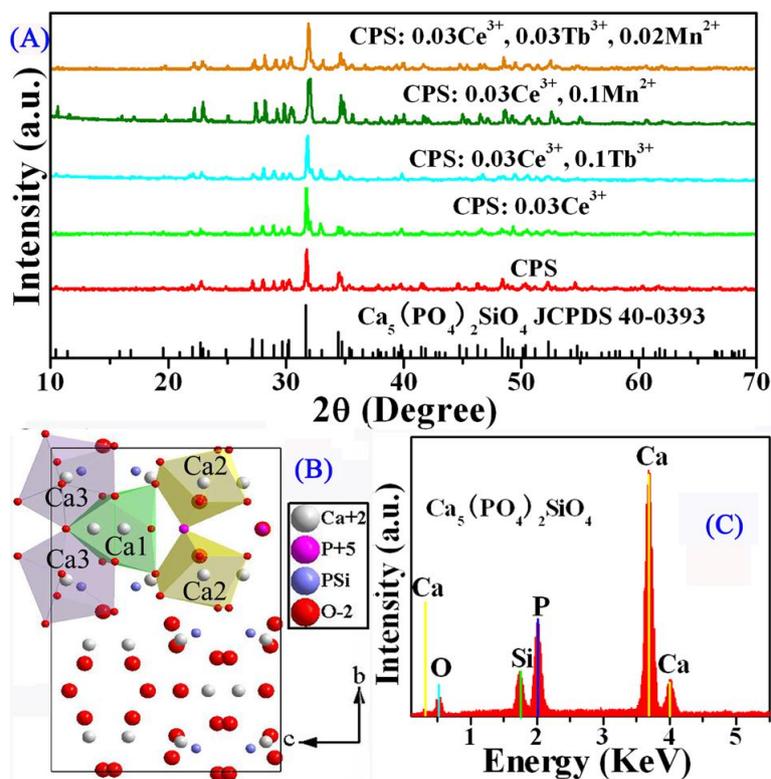


Fig. S1 (A) The representative XRD patterns for CPS and $\text{Ce}^{3+}/\text{Tb}^{3+}/\text{Mn}^{2+}$ doped CPS samples annealed at 1350 °C for 3 h; (B) the crystal structure along the *a*-axis direction and (C) the EDX spectrum of CPS.

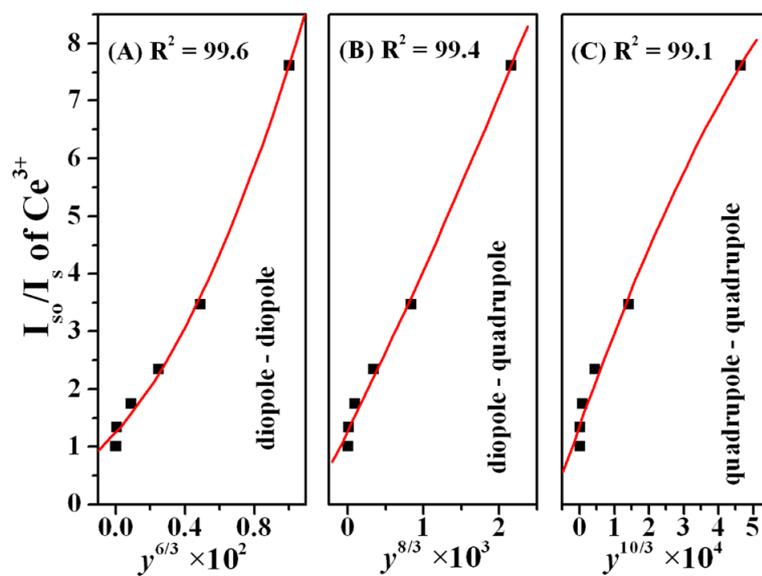


Fig. S2 Dependence of I_{so}/I_s of Ce^{3+} on (A) $y^{6/3}$ (B) $y^{8/3}$ (C) $y^{10/3}$ in the CPS: $0.03Ce^{3+}$, yTb^{3+} samples ($y = 0 - 0.10$).

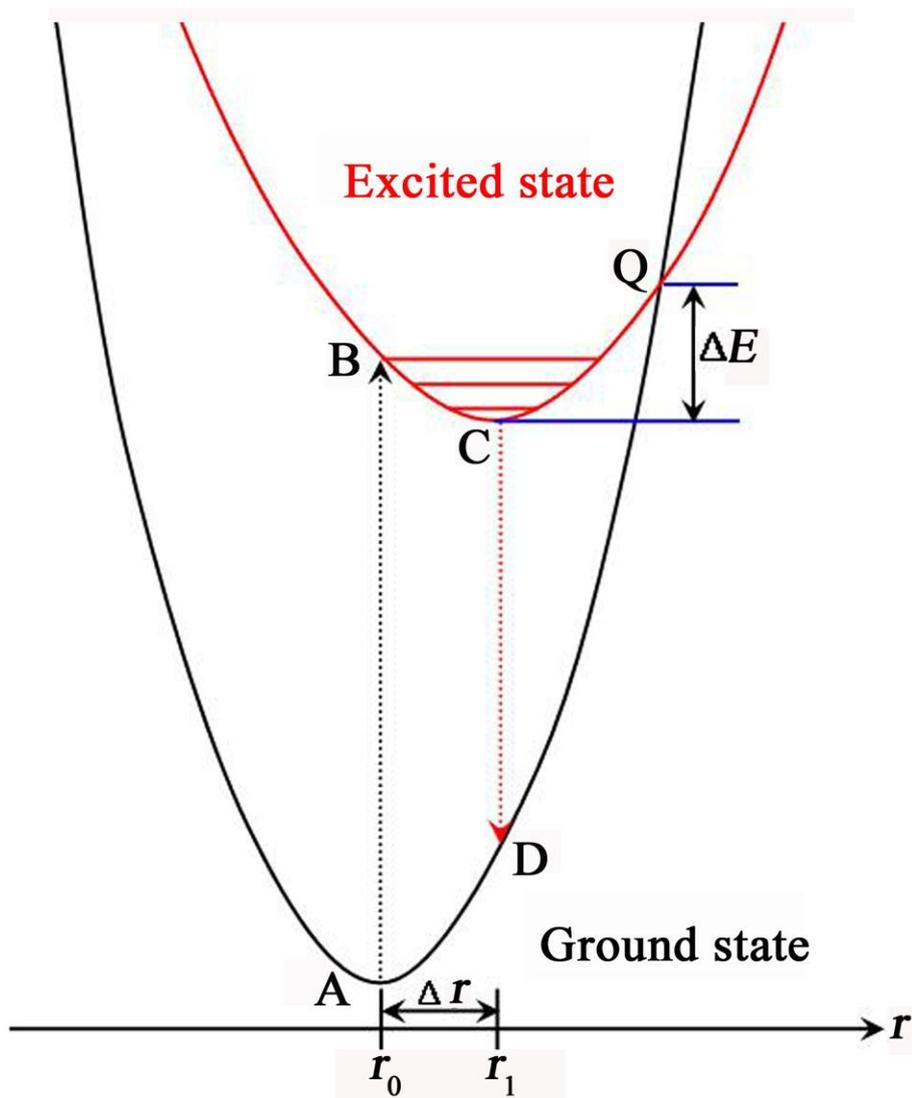


Fig. S3 The schematic of configurational coordinate diagram for general mechanism of temperature-dependent emission of phosphor.

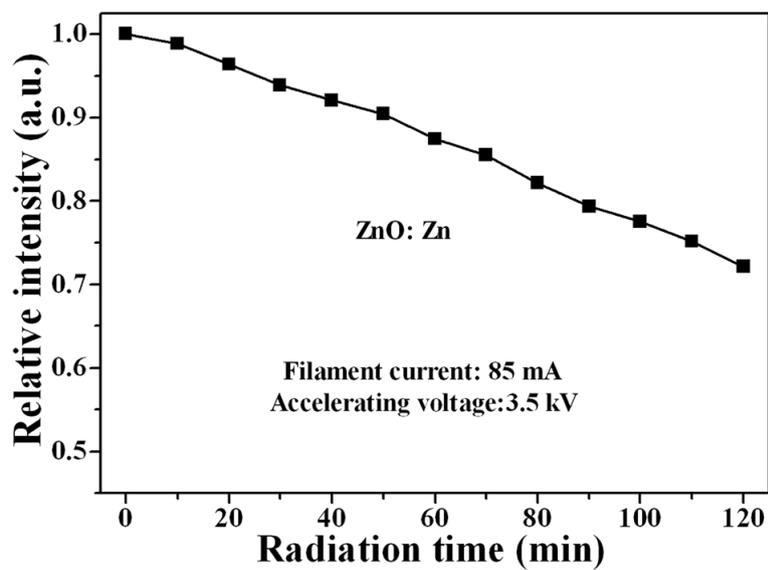


Fig. S4 The dependence CL intensity of ZnO: Zn phosphor on radiation time. (Accelerating voltage = 3.5 kV, filament current = 85 mA)

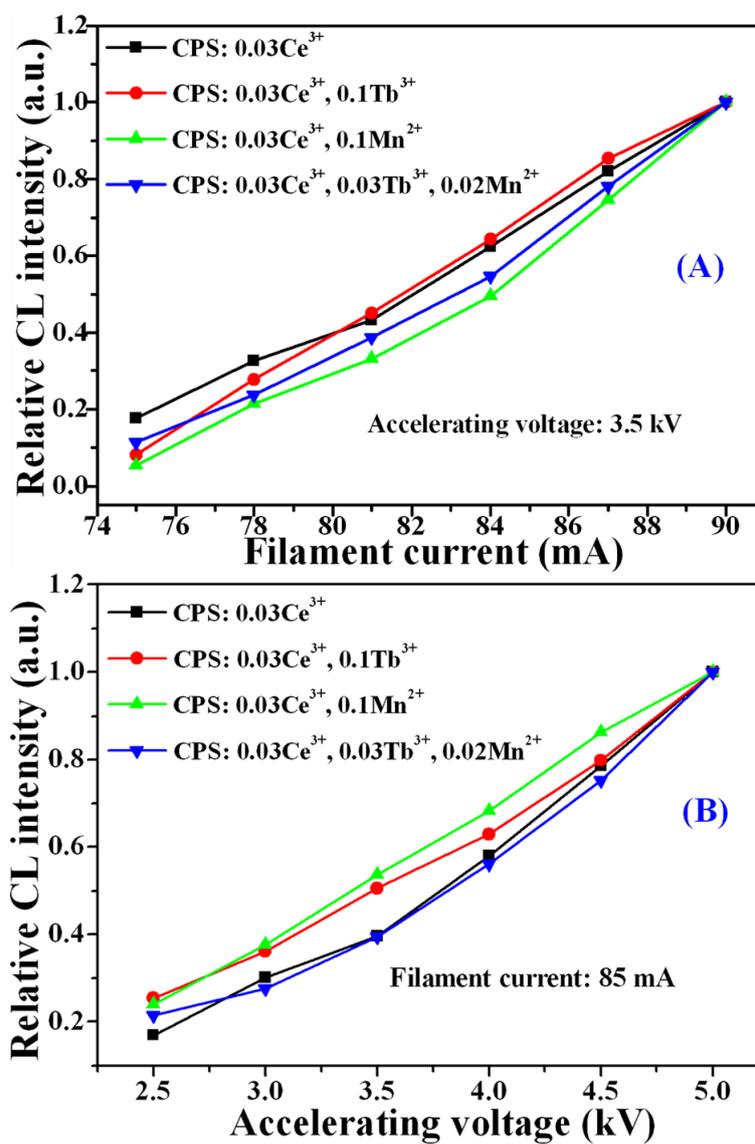


Fig. S5 CL intensities of CPS: 0.03Ce³⁺, yTb³⁺, zMn²⁺ samples as a function of filament current (A) and accelerating voltage (B).

Table S1 Cell parameters of CPS and Ce³⁺/Tb³⁺/Mn²⁺-doped CPS samples.

Sample \ Cell parameter	<i>a</i> (Å)	<i>b</i> (Å)	<i>c</i> (Å)	<i>V</i> (Å ³)
CPS	6.7241	15.4899	10.0975	1051.71
CPS: 0.01Ce ³⁺	6.7246	15.4898	10.0984	1051.88
CPS: 0.05Ce ³⁺	6.7262	15.4908	10.0988	1052.24
CPS: 0.03 Ce ³⁺ , 0.01Tb ³⁺	6.7252	15.4896	10.0969	1051.80
CPS: 0.03 Ce ³⁺ , 0.05Tb ³⁺	6.7261	15.4895	10.0954	1051.78
CPS: 0.03Ce ³⁺ , 0.03Mn ²⁺	6.7259	15.4893	10.0936	1051.55
CPS: 0.03Ce ³⁺ , 0.07Mn ²⁺	6.7266	15.4892	10.0891	1051.18
CPS: 0.03Ce ³⁺ , 0.1Mn ²⁺	6.7266	15.4885	10.0885	1051.07
CPS: 0.03Ce ³⁺ , 0.01Tb ³⁺ , 0.05Mn ²⁺	6.7255	15.4889	10.0918	1051.27
CPS: 0.03Ce ³⁺ , 0.02Tb ³⁺ , 0.05Mn ²⁺	6.7257	15.4876	10.0878	1050.79