

Electronic Supplementary Information (ESI)

Dual energy transfer controlled photoluminescence evolution in Eu and Mn co-activated β -Ca_{2.7}Sr_{0.3}(PO₄)₂ phosphors for solid-state lighting

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Table S1. Refined structural parameters for $\text{Ca}_{2.7}\text{Sr}_{0.3}(\text{PO})_2$.^a

atom	site	x	y	z	Occ.	B ($\text{\AA}^2$)
Ca1	18	0.7187(5)	0.865(5)	0.1645(2)	0.9443	1.1320
Sr1	18	0.7187(5)	0.865(5)	0.1645(2)	0.0557	1.1320
Ca2	18	0.6130(5)	0.8286(6)	-0.0332(2)	0.9802	1.1320
Sr2	18	0.6130(5)	0.8286(6)	-0.0332(2)	0.0198	1.1320
Ca3	18	0.7280(3)	0.8539(5)	0.0616(2)	0.8079	1.1320
Sr3	18	0.7280(3)	0.8539(5)	0.0616(2)	0.1921	1.1320
Ca4	6	0	0	-0.0861(3)	0.2529	1.3534
Sr4	6	0	0	-0.0861(3)	0.2471	1.3534
Ca5	6	0	0	0.7361(3)	1	1.3534
P1	18	0	0	0	1	1.6401
P2	18	0.6880(4)	0.8607(4)	0.8659(2)	1	1.6401
P3	18	0.6518(5)	0.8491(6)	0.7657(2)	1	1.6401
O1	18	0.7130(8)	-0.113(1)	-0.1030(4)	1	1.3334
O2	18	0.747(2)	0.780(2)	0.8573(4)	1	1.3334
O3	18	0.733(1)	-0.001(1)	0.8451(3)	1	1.3334
O4	18	0.546(1)	0.783(1)	0.8624(3)	1	1.3334
O5	18	0.600(1)	-0.052(2)	0.7811(4)	1	1.3334
O6	18	0.557(1)	0.681(1)	0.7792(4)	1	1.3334
O7	18	0.102(1)	0.931(2)	0.7794(3)	1	1.3334
O8	18	0.6322(9)	0.837(1)	0.7241(4)	1	1.3334
O9	18	0.001(2)	0.873(1)	-0.0112(2)	1	1.3334
O10	6	0	0	0.0405(6)	1	1.3334

^a Space group: $R\bar{3}c$ (trigonal), $Z = 18$, $a = 10.4772 \text{ \AA}$, $c = 37.4748 \text{ \AA}$, $V = 3562.5164 \text{ \AA}^3$, $R_p = 2.183\%$, $R_{wp} = 3.815\%$, $R_b = 3.483\%$.

Table S2 The decay lifetimes (τ) and constants (A) of sensitizer Eu^{2+} .

x	A_1		τ_1 (ns)		A_2		τ_2 (ns)		τ (ns)	
	Eu(I)	Eu(II)	Eu(I)	Eu(II)	Eu(I)	Eu(II)	Eu(I)	Eu(II)	Eu(I)	Eu(II)
0	0.68	0.49	491.65	946.06	1.73	0.78	74.86	99.34	374.87	824.73
0.03	0.51	0.44	439.57	839.12	4.52	1.01	51.71	73.37	241.82	711.08
0.06	0.37	0.38	416.05	700.50	7.08	1.43	46.85	51.01	164.29	560.89
0.12	0.25	0.24	267.66	523.53	21.33	3.34	33.32	30.27	53.30	302.89
0.24	0.68	0.08	67.33	223.55	113.71	14.77	22.26	16.34	23.06	30.24

Table S3 The CIE color coordinate and calculated correlated color temperature (CCT) of TCSP:0.008 Eu^{2+} , x Mn^{2+} phosphors

No.	Composition	CIE (x, y)	CCT (K)
1	TCSP:0.008 Eu^{2+}	(0.211, 0.281)	22995 K
2	TCSP:0.008 Eu^{2+} , 0.03 Mn^{2+}	(0.332, 0.290)	5450 K
3	TCSP:0.008 Eu^{2+} , 0.06 Mn^{2+}	(0.397, 0.292)	2404 K
4	TCSP:0.008 Eu^{2+} , 0.12 Mn^{2+}	(0.474, 0.296)	2485 K
5	TCSP:0.008 Eu^{2+} , 0.24 Mn^{2+}	(0.543, 0.276)	19667 K