

**A single-component white-light-emitting fluorescent material
with high color rendering index based on resonance energy
transfer**

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Table S1 XRD Rietveld refinements parameters for $\text{Ca}_8\text{ZnGa}_{0.4}\text{La}_{0.6}(\text{PO}_4)_7: 0.003\text{Eu}^{2+}, 0.02\text{Mn}^{2+}$.

CZGL:0.003Eu ²⁺ ,0.02Mn ²⁺	
a=b (Å)	10.40355
c (Å)	37.4514
V (Å ³)	3510.44
R _p (%)	4.55
R _{wp} (%)	6.28
Rexp(%)	3.38
gof	1.85
Space group	R $\bar{3}$ c
crystal type	trigonal

Table S2 CIE values of $\text{Ca}_8\text{ZnGa}_{0.4}\text{La}_{0.6}(\text{PO}_4)_7: 0.003\text{Eu}^{2+}, y\text{Mn}^{2+}$ solid solutions

Mn ²⁺ amount (y)	CIE coordinates		Peak
	x	y	Wavelength (nm)
0	0.2305	0.3269	490.0
0.008	0.2608	0.2514	425.0
0.01	0.2741	0.2579	424.2
0.02	0.3093	0.2634	424.4
0.04	0.3601	0.2670	631.2
0.05	0.3814	0.2957	631.2
0.06	0.3891	0.3053	630.2

Table S3 CIE values of fabricated WLEDs at different currents.

IF(mA)	CIE coordinates		Tc(K)	Ra	Average wavelength (nm)
	x	y			
60	0.3715	0.3504	4058	83.3	575
120	0.3719	0.3622	4136	88.2	574.5
180	0.3717	0.3705	4203	91.4	572.9
240	0.3707	0.3752	4265	93.4	571.2
300	0.3709	0.3780	4277	94.7	570.1

Table S4 The luminous efficacy of the fabricated WLEDs at different currents

IF (mA)	luminous efficacy (lm/W)
60	1.11
120	0.99
180	0.91
240	0.84
300	0.79

Table S5 The R1-R15 values of the fabricated WLEDs

IF (mA)	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
60	78.3	87.3	97	77.8	78	81.7	92.4	74.1	37.1	72.7	72.8	64.8	79.7	97.3	75.1
120	84.7	91.7	97.3	84.1	84.9	87.4	94	81.7	56.3	82	80.4	76.2	86	97.6	83.3
180	89	94.6	97.1	88.2	89.5	91.1	94.9	86.9	69.9	88.3	85.5	83.8	90.3	97.8	88.8
240	91.7	96.2	97.1	90.9	92.3	93	95.6	90.5	79.1	91.7	88.6	88.1	92.8	97.9	92.4
300	93.4	97.1	97.1	92.5	94.1	94.1	96.2	93.1	86	93.7	90.6	90.4	94.4	98.1	94.7

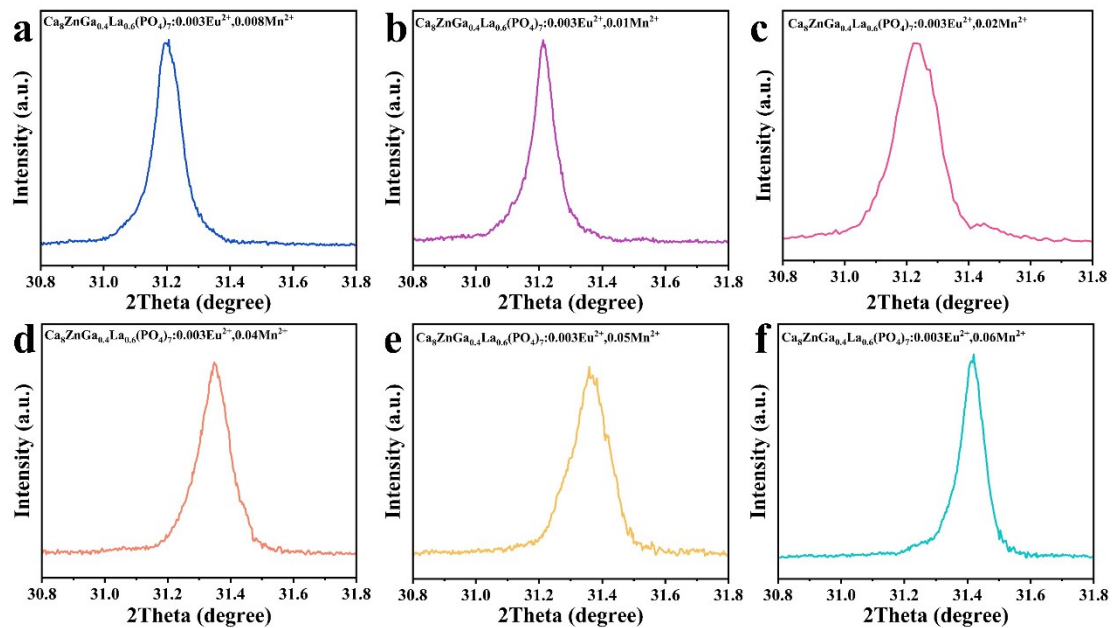


Figure S1. Higher precision XRD patterns of CZGL: 0.003Eu^{2+} , $y\text{Mn}^{2+}$ in the range of $30.8^\circ\sim 31.8^\circ$.

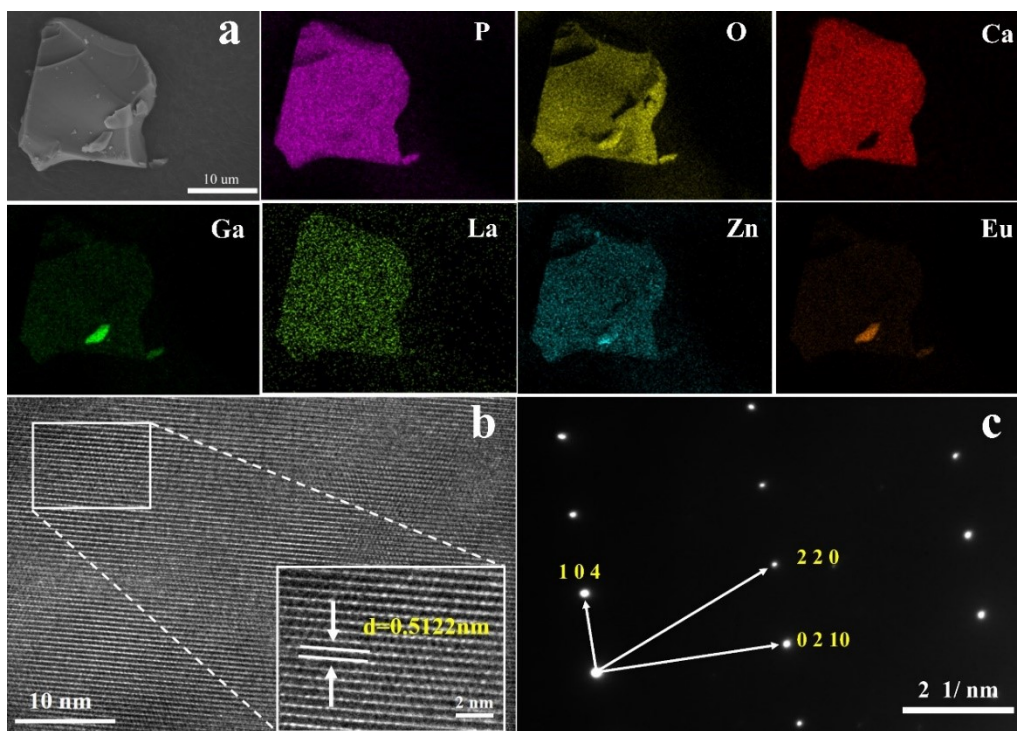


Figure S2. (a) SEM and elemental mapping patterns of CZGL:0.003Eu²⁺; (b) HRTEM image of CZGL:0.003Eu²⁺ and (c) selected area electron diffraction pattern.

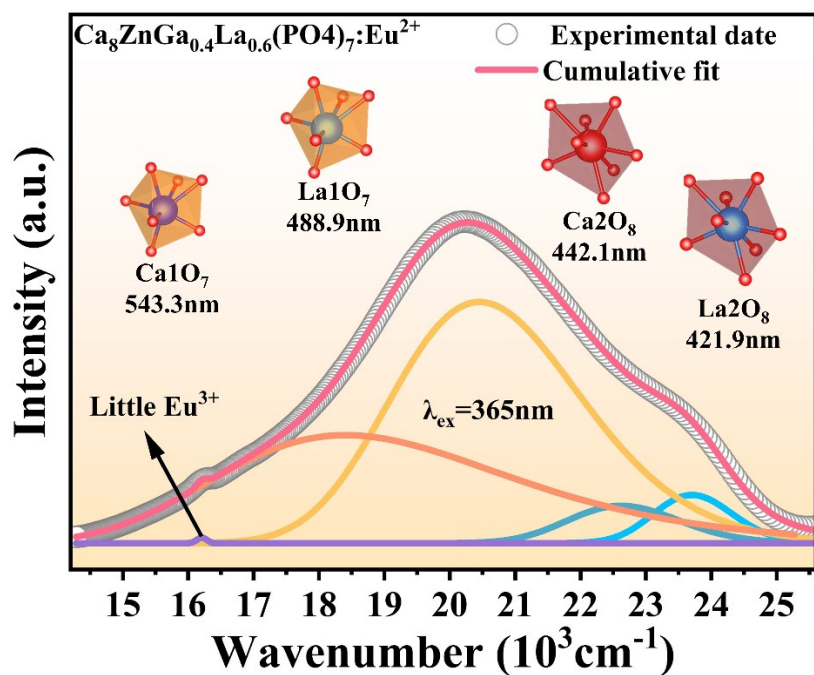


Figure S3. Gaussian fitting results of the PL peaks for Eu^{2+} doped $\text{Ca}_8\text{ZnGa}_{0.4}\text{La}_{0.6}(\text{PO}_4)_7$.

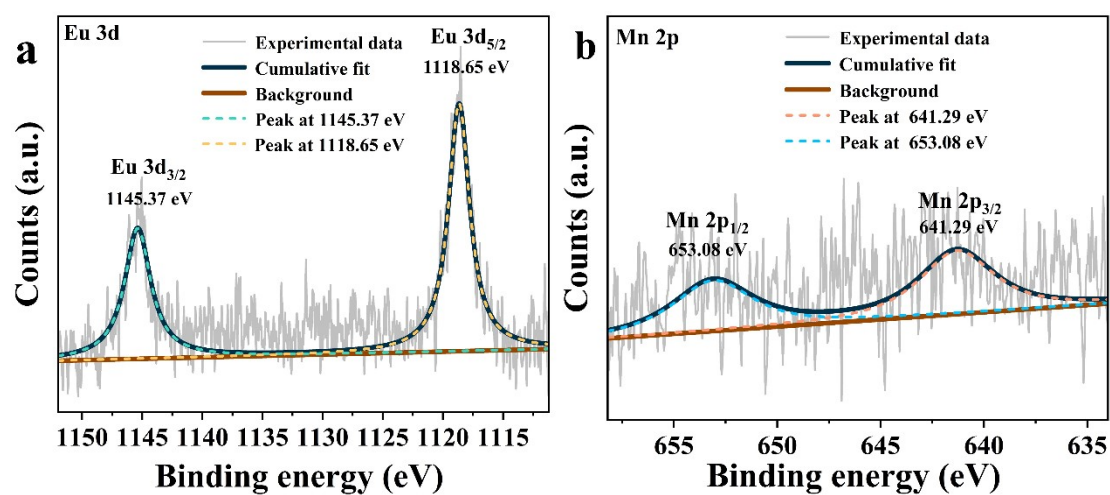


Figure S4. High-resolution XPS spectra at Eu 3d and Mn 2p position of CZGL: 0.003Eu^{2+} , 0.02Mn^{2+} phosphors.

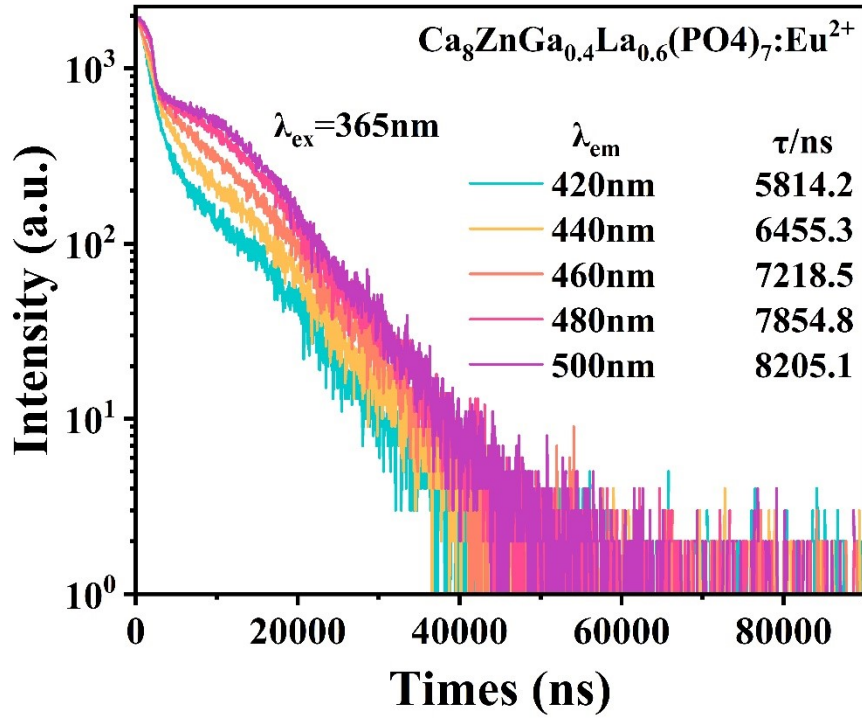


Figure S5. Wavelength-dependent PL decay curves of CZGL: Eu^{2+} by 365 nm excitation at room temperature.

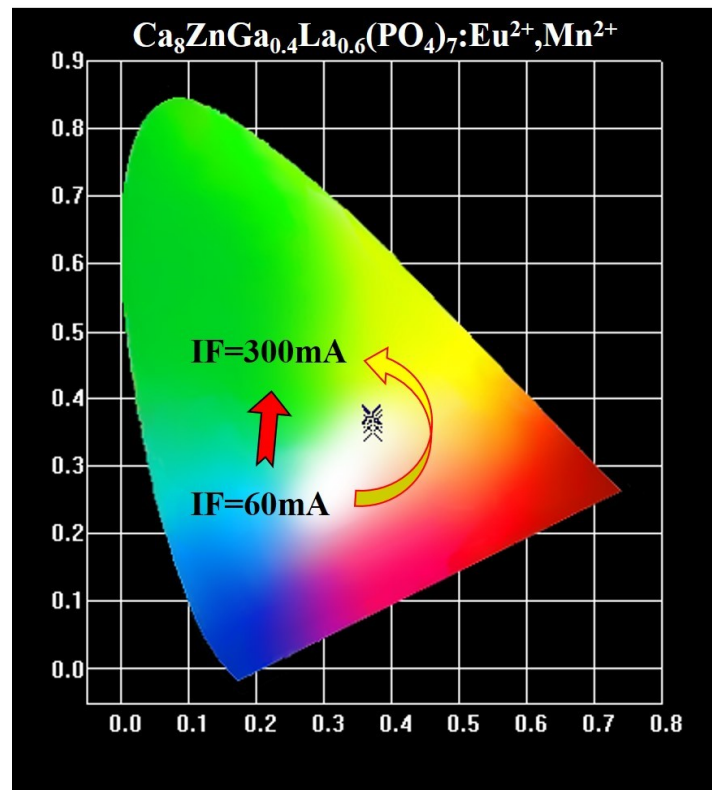


Figure S6. Color coordinates of WLED device under different operating currents.