

Supporting Information

A novel Eu³⁺ activated Ca₃Zn₃Te₂O₁₂ tellurate red phosphor for white LEDs with high color stability and color purity

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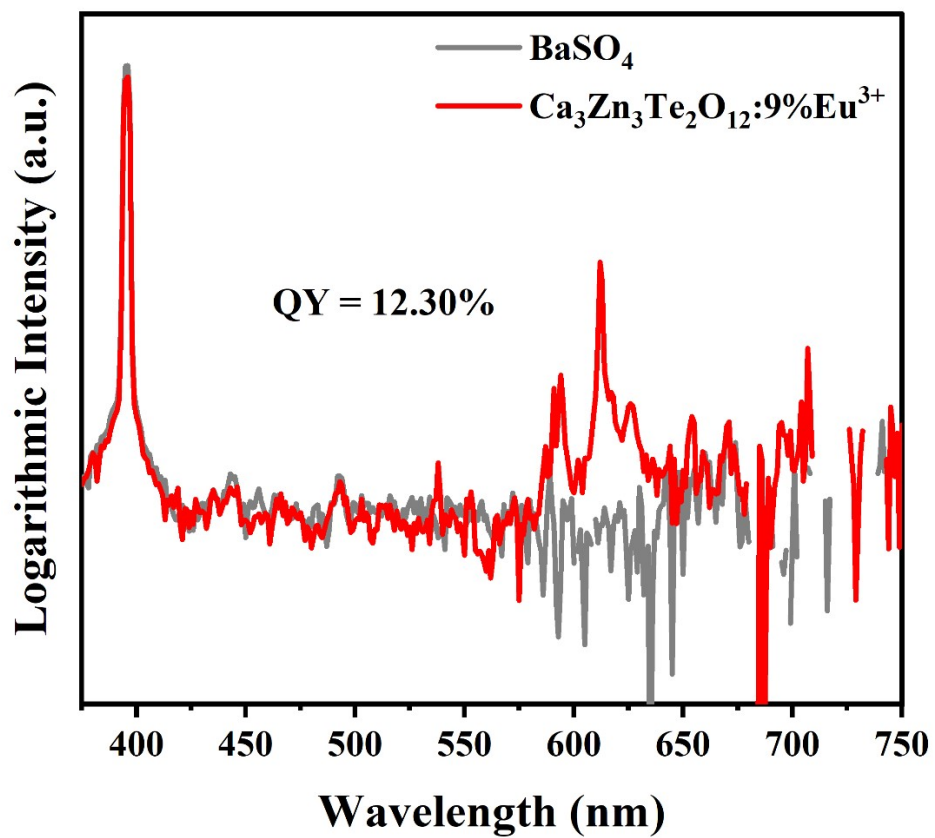


Figure S1. Quantum yield of Ca₃Zn₃Te₂O₁₂:9%Eu³⁺ phosphor.

Table 1 The refined crystallographic parameters of $\text{Ca}_3\text{Zn}_3\text{Te}_2\text{O}_{12}$ host and $\text{Ca}_3\text{Zn}_3\text{Te}_2\text{O}_{12}:9\%\text{Eu}^{3+}$ phosphor.

Compound	$\text{Ca}_3\text{Zn}_3\text{Te}_2\text{O}_{12}$ host	$\text{Ca}_3\text{Zn}_3\text{Te}_2\text{O}_{12}:9\%\text{Eu}^{3+}$
Crystal structure	Cubic	Cubic
Space group	<i>Ia-3d</i>	<i>Ia-3d</i>
Lattice parameters	$a = b = c = 12.5696 \text{ \AA}$	$a = b = c = 12.5664 \text{ \AA}$
	$\alpha = \beta = \gamma = 90^\circ$	$\alpha = \beta = \gamma = 90^\circ$
Unit cell volume	$V = 1985.93 \text{ \AA}^3$	$V = 1984.39 \text{ \AA}^3$
R_p	13.62%	14.36%
R_{wp}	8.94%	9.12%
χ^2	0.91	0.96

Table 2 Elemental compositions of $\text{Ca}_3\text{Zn}_3\text{Te}_2\text{O}_{12}:9\%\text{Eu}^{3+}$ phosphor.

Element	Theoretical ratio (%)	Atomic ratio (%)
Ca	13.65	11.42
Zn	15	17.94
Te	10	9.49
O	60	58.97
Eu	1.35	2.18

Table 3 CIE chromaticity coordinates, CCT and color purity of $\text{Ca}_3\text{Zn}_3\text{Te}_2\text{O}_{12}:x\text{Eu}^{3+}$ ($x = 3\%, 6\%, 9\%, 12\%, 15\%$) phosphors.

$\text{Ca}_3\text{Zn}_3\text{Te}_2\text{O}_{12}:x\text{Eu}^{3+}$	CIE(x,y)	CCT(K)	Color purity(%)
$x = 3\%$	(0.658,0.341)	2575	96.56
$x = 6\%$	(0.658,0.341)	2577	96.56
$x = 9\%$	(0.659,0.341)	2593	96.70
$x = 12\%$	(0.659,0.340)	2620	96.88
$x = 15\%$	(0.659,0.340)	2622	96.88

Table 4 CIE chromaticity coordinates, CRI and CCT of $\text{Ca}_3\text{Zn}_3\text{Te}_2\text{O}_{12}:9\%\text{Eu}^{3+}$ phosphor driven by different bias currents (20 - 320 mA).

Current (mA)	CIE(x, y)	CRI	CCT (K)
20	(0.353, 0.367)	80.2	4785
40	(0.353, 0.368)	79.4	4784
60	(0.354, 0.371)	78.8	4765
80	(0.354, 0.372)	78.3	4774
100	(0.354, 0.374)	77.9	4789
120	(0.354, 0.374)	77.8	4784
160	(0.352, 0.373)	77.4	4851
200	(0.351, 0.373)	77.4	4875
240	(0.349, 0.369)	79.6	4923
280	(0.347, 0.369)	77.1	4999
320	(0.344, 0.365)	80	5076