

## Supplementary Information for

**Design of highly efficient deep-red emission in Mn<sup>4+</sup> doped new-type structure**

**CaMgAl<sub>10</sub>O<sub>17</sub> for plant growth LED light**

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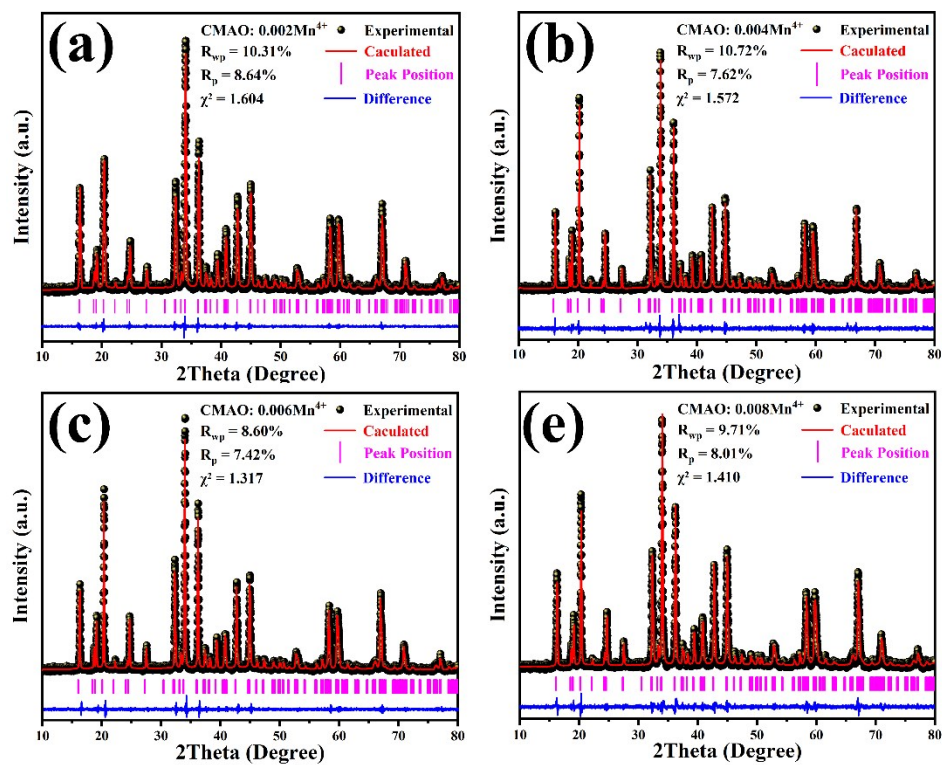
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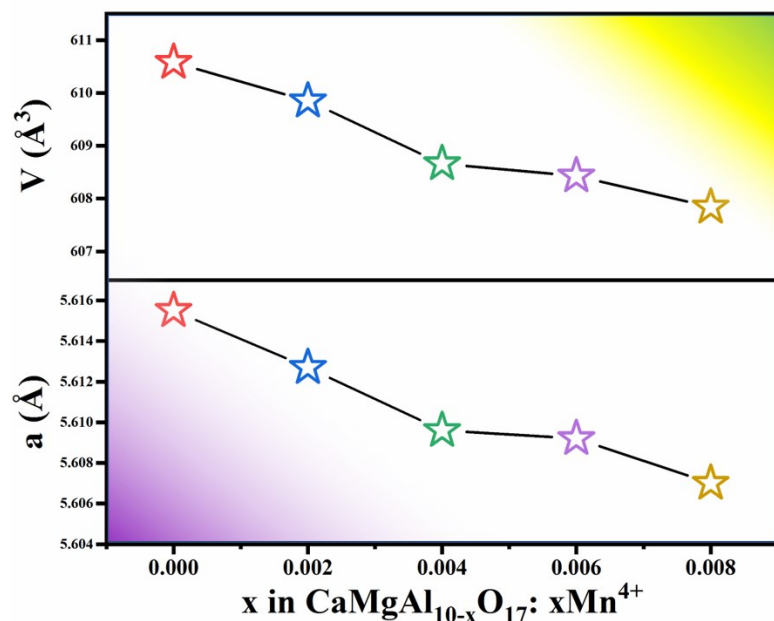
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This supporting information contains 5 pages, 5 figures, and 2 tables.



**Figure S1.** The XRD Rietveld refinement spectrum of a) CAMO: 0.002Mn<sup>4+</sup>, b) CAMO: 0.004Mn<sup>4+</sup>, c) CAMO: 0.006Mn<sup>4+</sup> and d) CAMO: 0.008Mn<sup>4+</sup>.



**Figure S2.** The dependence of lattice parameters and cell volumes of CaMgAl<sub>10-x</sub>O<sub>17</sub>: xMn<sup>4+</sup> on the nominal Mn<sup>4+</sup> content x.

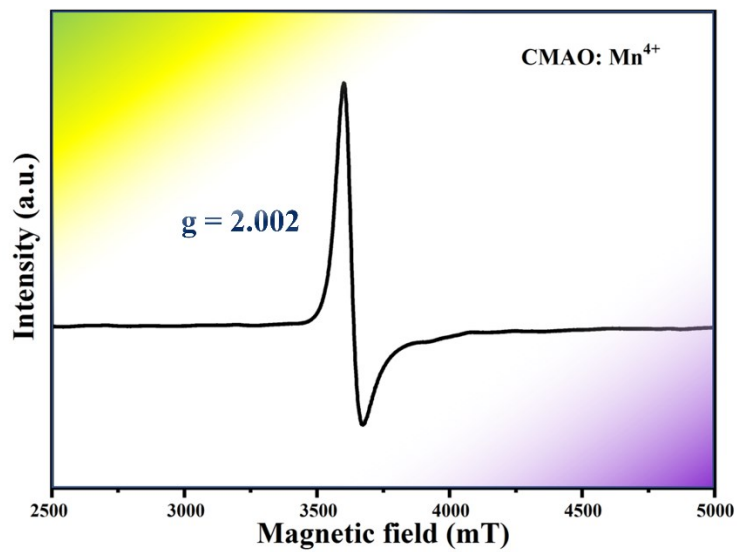


Figure S3. EPR spectrum of CMAO: Mn<sup>4+</sup>.

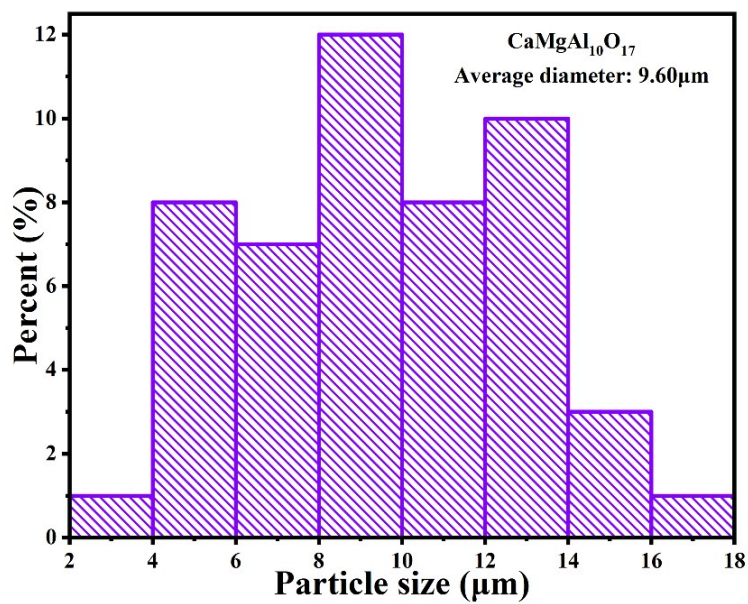
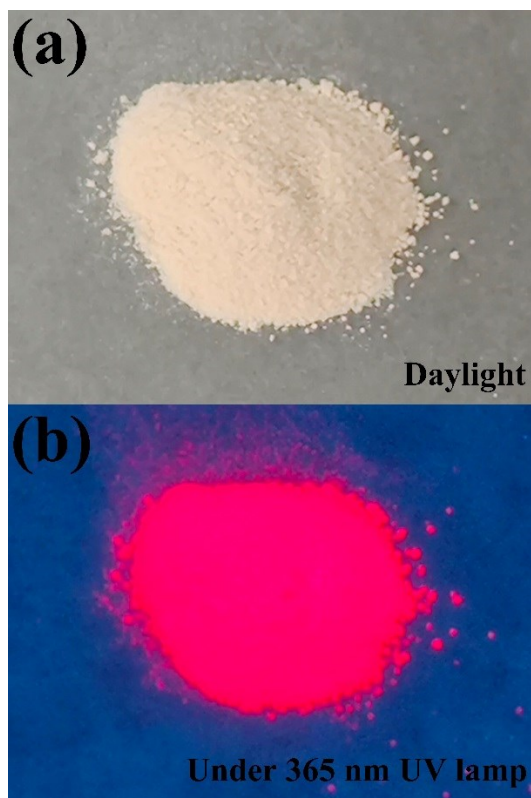


Figure S4. SEM particle size distribution.



**Figure S5.** The pictures of CMAO: Mn<sup>4+</sup> phosphor a) in daylight and b) under 365 nm UV lamp.

**Table S1.** Crystallographic data for CaMgAl<sub>10</sub>O<sub>17</sub>

Formula	CaMgAl <sub>10</sub> O <sub>17</sub>
Crystal system	hexagonal
Space-group	<i>P6<sub>3</sub>/mmc (194)</i>
V	610.58(2) Å <sup>3</sup>
a	5.6155(1) Å
b	5.6155(1) Å
c	22.3582(4) Å
Calc. density	3.98177 g/cm <sup>3</sup>

**Table S2.** Atomic coordinates for  $\text{CaMgAl}_{10}\text{O}_{17}$ 

Atom	Wyckoff	x/a	y/b	z/c	U [ $\text{\AA}^2$ ]
Ca1	<i>2d</i>	2/3	1/3	1/4	0.0447(7)
Al1	<i>12k</i>	0.83337(23)	0.6668(5)	0.10632(7)	0.0513(6)
Al2	<i>4f</i>	1/3	2/3	0.02294(22)	0.0580(21)
Mg1	<i>4f</i>	1/3	2/3	0.02308(28)	0.0024(24)
Al3	<i>4f</i>	1/3	2/3	0.17450(15)	0.0294(13)
Al4	<i>2a</i>	0	0	0	0.0218(18)
O1	<i>12k</i>	0.15799(30)	0.3160(6)	0.04995(8)	0.0336(12)
O2	<i>12k</i>	0.5023(4)	0.0047(7)	0.14976(12)	0.0036(12)
O3	<i>4f</i>	2/3	1/3	0.05871(20)	0.0059(23)
O4	<i>4e</i>	0	0	0.14639(28)	0.0075(25)
O5	<i>2c</i>	1/3	2/3	1/4	0.036(4)