Electronic Supplementary Material (ESI) for RSC Advances

Supporting information

Single-phased White-light-emitting $KCaGd(PO_4)_2:Eu^{2+},Tb^{3+},Mn^{2+}$ Phosphors for LED Applications

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Materials and Methods

Characterization

Scanning Electron Microscope (SEM)

Surface morphology of as-synthesized $KCaGd(PO_4)_2$ host (Fig. S1) were performed on a JEOL-7000F field emission scanning electron microscope. Accelerating voltage of 5 kV and 50-s accumulation time were applied in data acquisition.

Laser Light Scattering

The particle distribution of CGP:Eu,Mn phosphor (Fig. S2) was measured by FRITSCH analysette 22.

Variable Temperature Photoluminescence

Variable Temperature PL spectra (Fig. S4) were carried out with a spectrophotometer (Jobin-Yvon Spex, Model FluoroMax-3).

The Commission International de I'Eclairage (CIE) chromaticity

CIE coordinates (Fig. S5) were measured by a Laiko DT-101 color analyzer equipped with a CCD detector (Laiko Co., Tokyo, Japan).

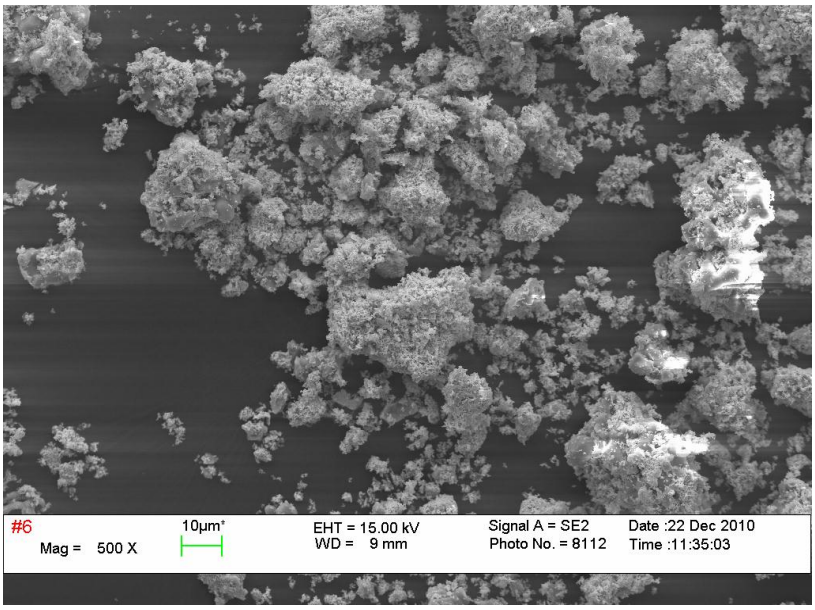

Fig. S1 SEM image of $KCaGd(PO_4)_2$.

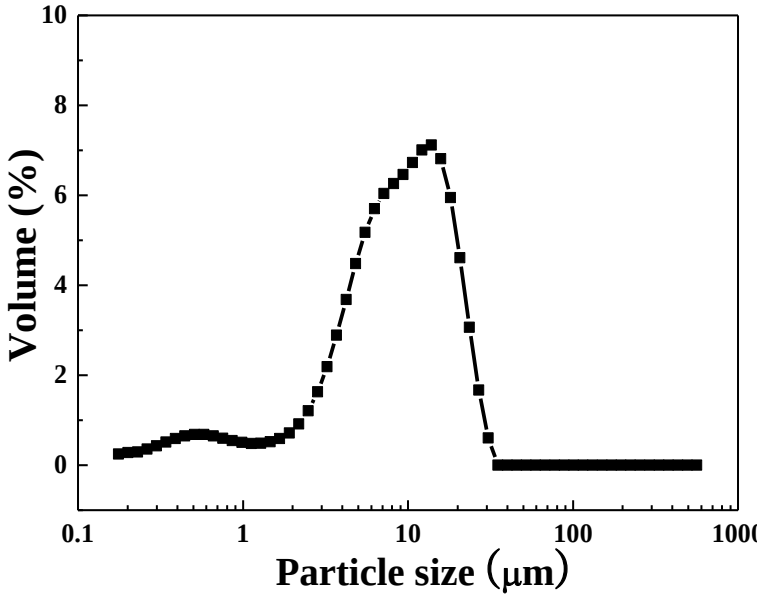

Fig. S2 Particle size distribution of $KCaGd(PO_4)_2$.

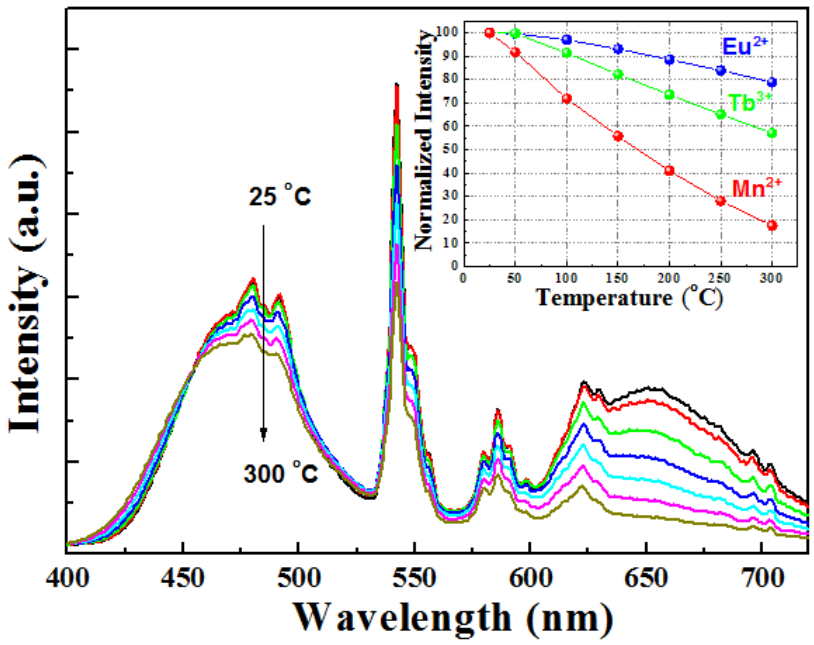

Fig. S3 Temperature dependence emission spectrum as λ_{ex} = 380 nm. The maximum intensity of Eu^{2+}, Tb^{3+} and Mn^{2+} dependence of temperature are shown in the inset (Jobin-Yvon Spex, Model FluoroMax-3).

Table S1. Decay life time of $KCaGd(PO_4)_2$:x%Eu (x = 1, 3, 5, 7, 10) phosphors.

Sample	Ex. (nm)	Em. (nm)	Lifetime
$KCaGd(PO_4)_2$:1%Eu	365	462	817 ns
$KCaGd(PO_4)_2$:3%Eu	365	462	758 ns
$KCaGd(PO_4)_2$:5%Eu	365	462	678 ns
$KCaGd(PO_4)_2$:7%Eu	365	462	631 ns
$KCaGd(PO_4)_2$:10%Eu	365	462	571 ns

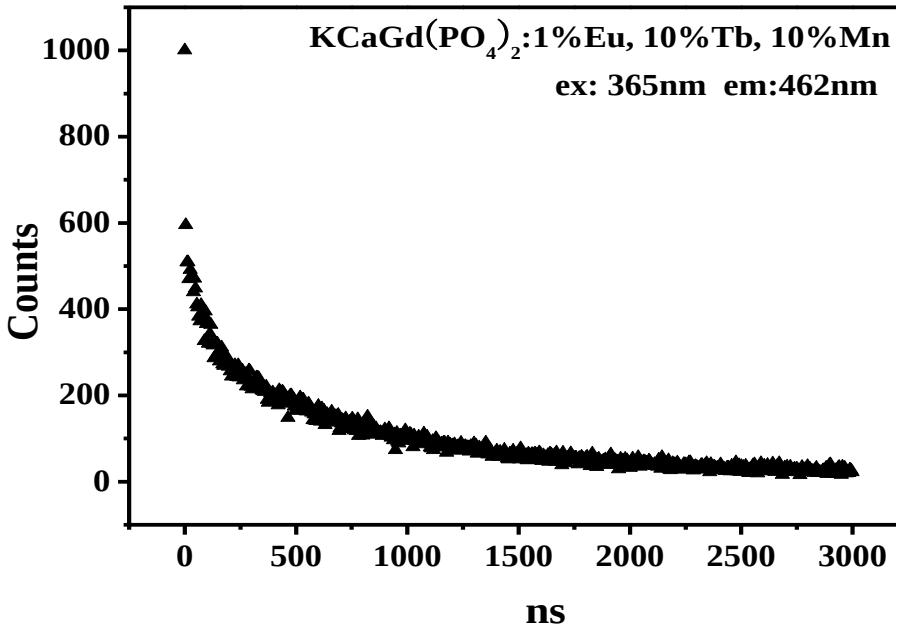

Fig. S4 Decay life time of KCaGd(PO4)2:1%Eu,10%Tb,10%Mn phosphor monitored at 462 nm.

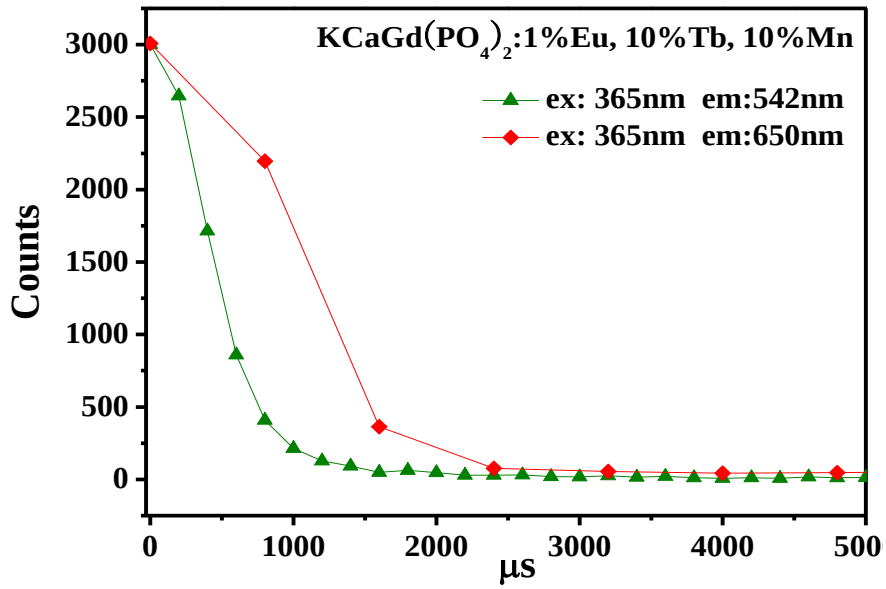

Fig. S5 Decay life time of KCaGd(PO4)$_2$:1%Eu,10%Tb,10%Mn phosphor monitored at 542 nm and 650 nm.

Table S2. Decay life time of $KCaGd(PO_4)_2$:1%Eu, 10%Tb and 10%Mn phosphor.

Sample	Ex. (nm)	Em. (nm)	Lifetime
$KCaGd(PO_4)_2$:1%Eu,10%Tb,10%Mn	365	462	810 ns
		542	836 ns
		650	1542 ns