

Supporting Information

High thermal stability phosphor with rigid structure similar to benzene ring and application in plant growth

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Table S1. Results of structure refinement and main parameters of the $\text{LiAl}_x\text{Ga}_{1-x}\text{GeO}_4:0.002\text{Cr}^{3+}$ samples.

x	Space group	Cell parameters(Å)	Volume(Å ³)	R _{wp} , R _p (%)
x=0	R-3 H	a=13.9338, c=9.2992	1563.572	8.51, 6.59
x=0.1	R-3 H	a=13.9225, c=9.2920	1559.804	6.99, 5.56
x=0.5	R 3 H	a=13.8745, c=9.2617	1546.821	8.11, 6.23
x=0.7	R 3 H	a=13.8598, c=9.2516	1539.075	5.59, 4.29
x=0.9	R-3 H	a=13.7866, c=9.2036	1514.962	6.52, 4.74

Table S2. The parameters of D_q , B and D_q/B of the $\text{LiAl}_x\text{Ga}_{1-x}\text{GeO}_4:0.002\text{Cr}^{3+}$ samples.

Host	$D_q(\text{cm}^{-1})$	$B(\text{cm}^{-1})$	D_q/B
LiGaGeO_4	1715	738	2.32
$\text{LiGa}_{0.9}\text{Al}_{0.1}\text{GeO}_4$	1709	730	2.34
$\text{LiGa}_{0.5}\text{Al}_{0.5}\text{GeO}_4$	1703	714	2.38
$\text{LiGa}_{0.3}\text{Al}_{0.7}\text{GeO}_4$	1692	701	2.41

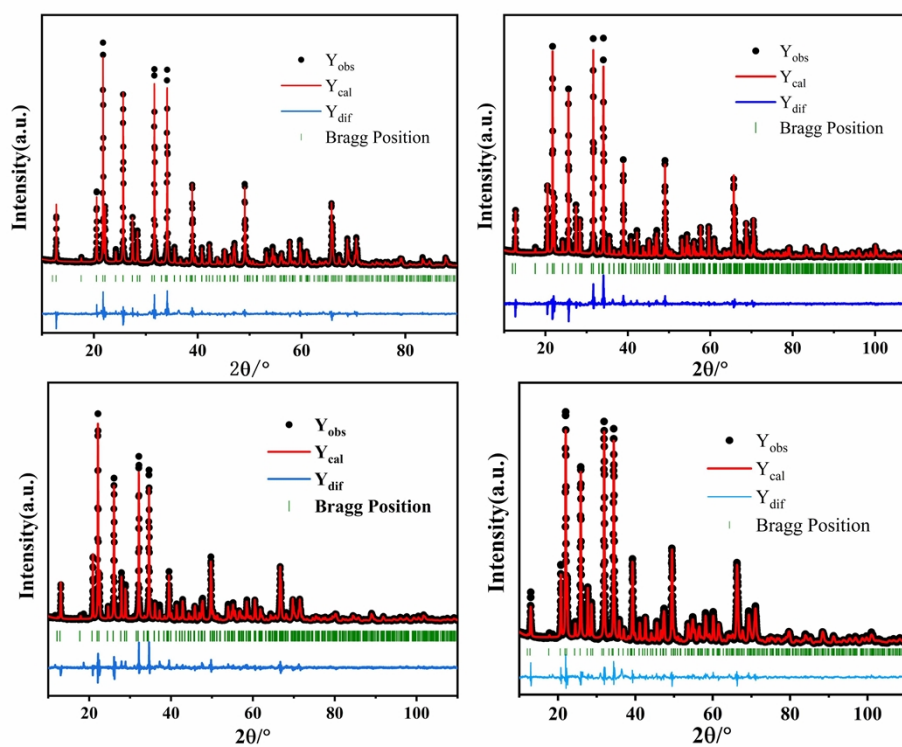


Figure S1. (a) Rietveld structure refinement results of $\text{LiAl}_x\text{Ga}_{1-x}\text{GeO}_4:0.002\text{Cr}^{3+}$ samples.

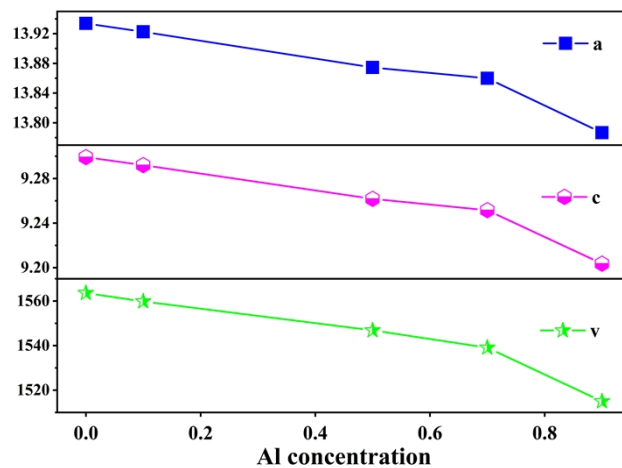


Figure S2. Relationship between Al³⁺ doping concentration and cell parameters.

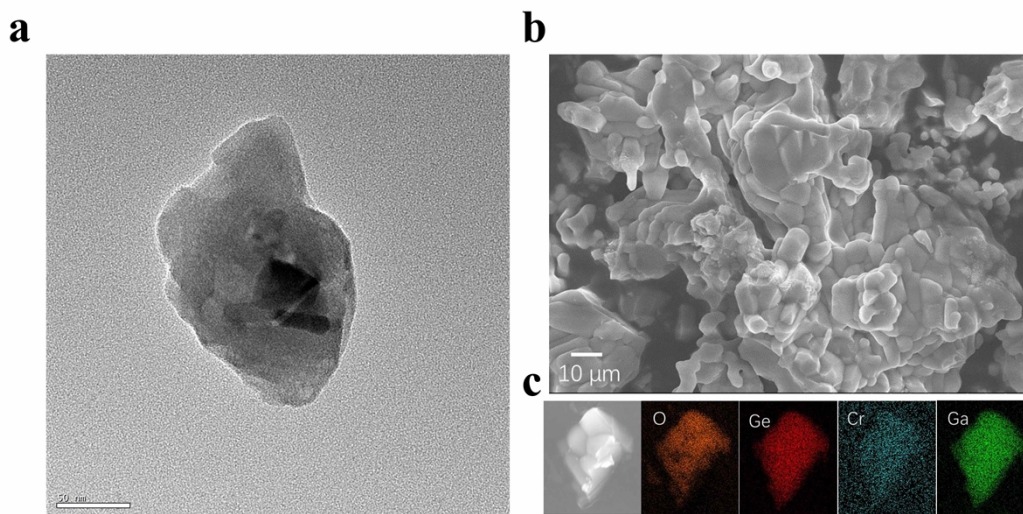


Figure S3. (a) TEM image of LiGaGeO₄:0.002Cr³⁺. (b) SEM result of LiGaGeO₄:0.002Cr³⁺. (c) EDS mapping result of LiGaGeO₄:0.002Cr³⁺.

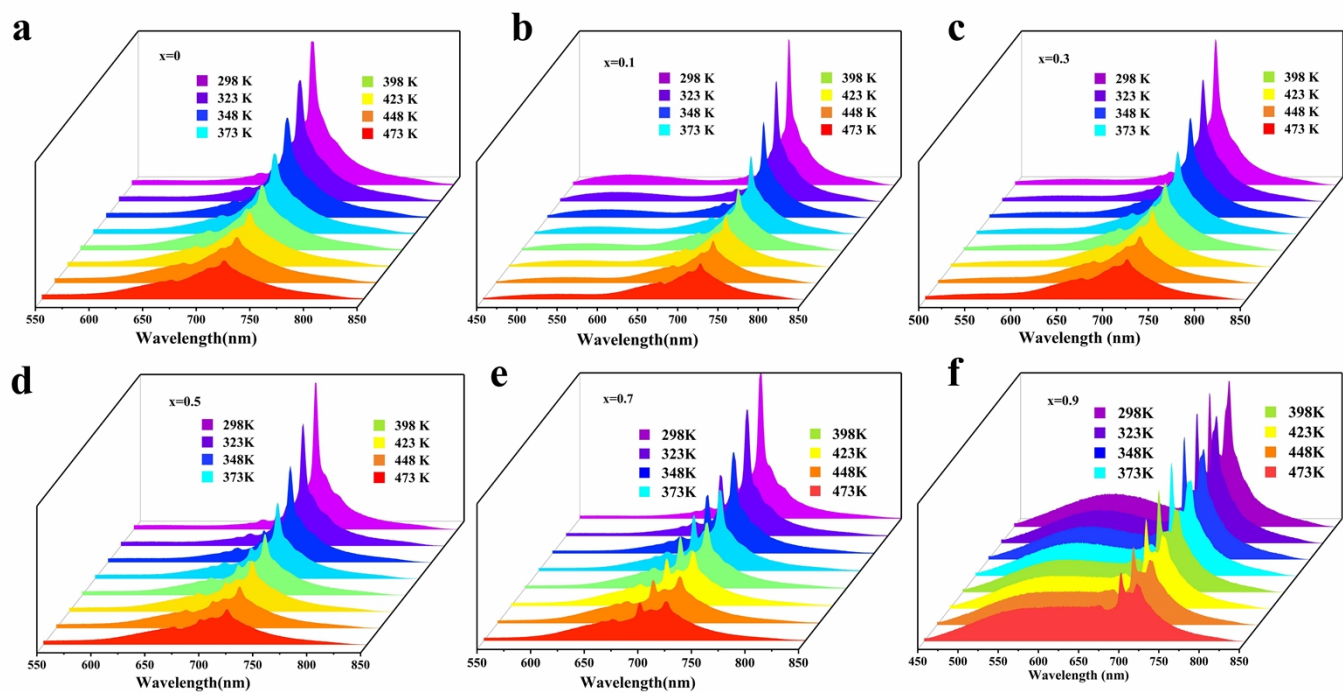


Figure S4. (a) Temperature-dependent PL spectra of $\text{LiGaGeO}_4:0.002\text{Cr}^{3+}$ and $\text{LiAl}_x\text{Ga}_{1-x}\text{GeO}_4:0.002\text{Cr}^{3+}$.

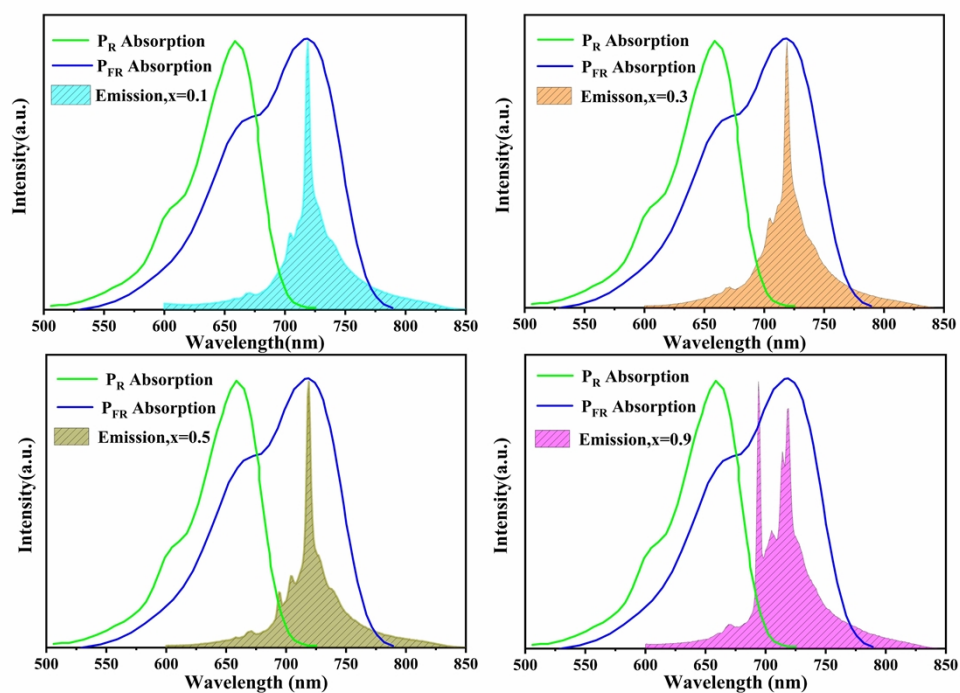


Figure S5. The absorption spectra of phytochrome and emission spectra of as-synthesized phosphors $\text{LiAl}_x\text{Ga}_{1-x}\text{GeO}_4:0.002\text{Cr}^{3+}$.

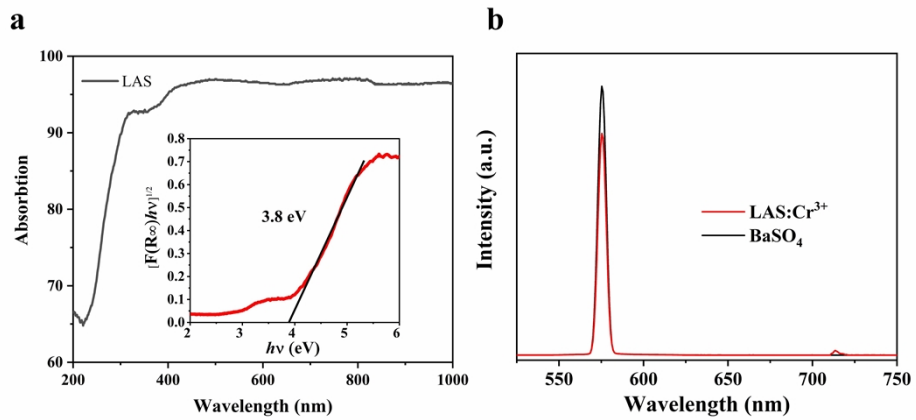


Figure S5. (a) The date of diffuse reflection spectra and band gap calculation. (b) Quantum efficiency of as-synthesized phosphors $\text{LiAlSiO}_4:0.002\text{Cr}^{3+}$.