

Supporting Information

Narrow-band green phosphor $\text{RbK}_2\text{Na}(\text{Li}_3\text{SiO}_4)_4:\text{Eu}^{2+}$ with excellent thermal stability and high efficiency for wide color gamut display

Weiguang Ran, Jiayi Geng, Ziyou Zhou, Chunyuan Zhou, Fukai Wang, Ming Zhao and Tingjiang Yan**

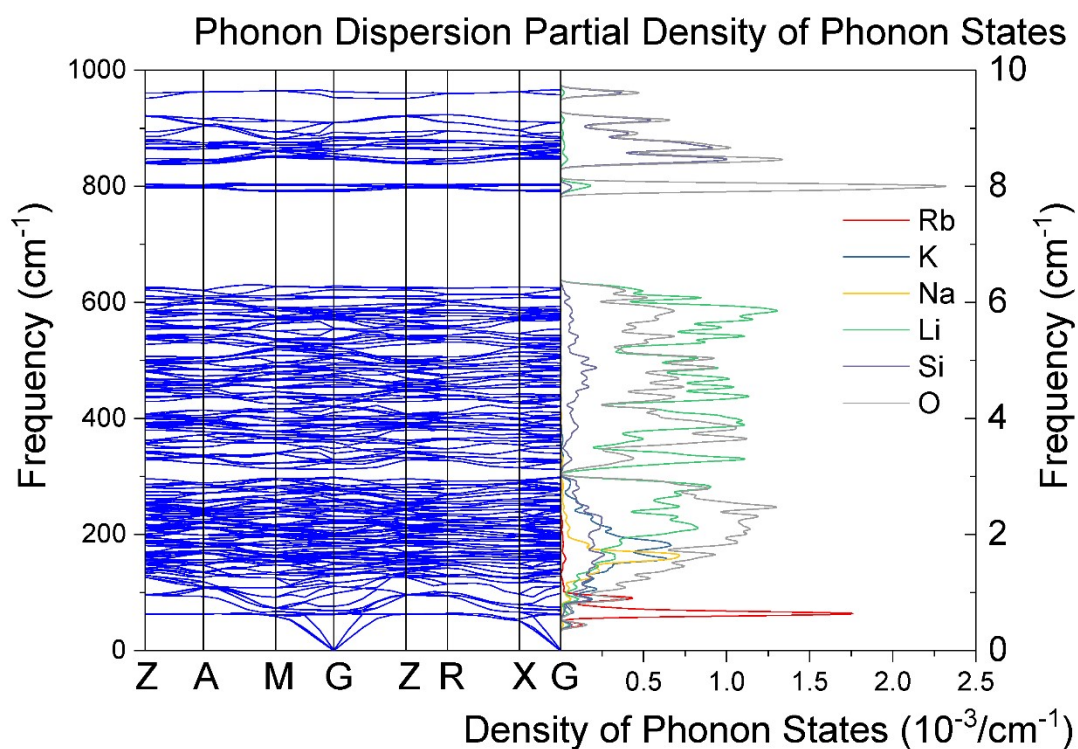


Figure S1 Phonon Dispersion and Partial Density of Phonon States of $\text{RbK}_2\text{Na}(\text{Li}_3\text{SiO}_4)_4$ host.

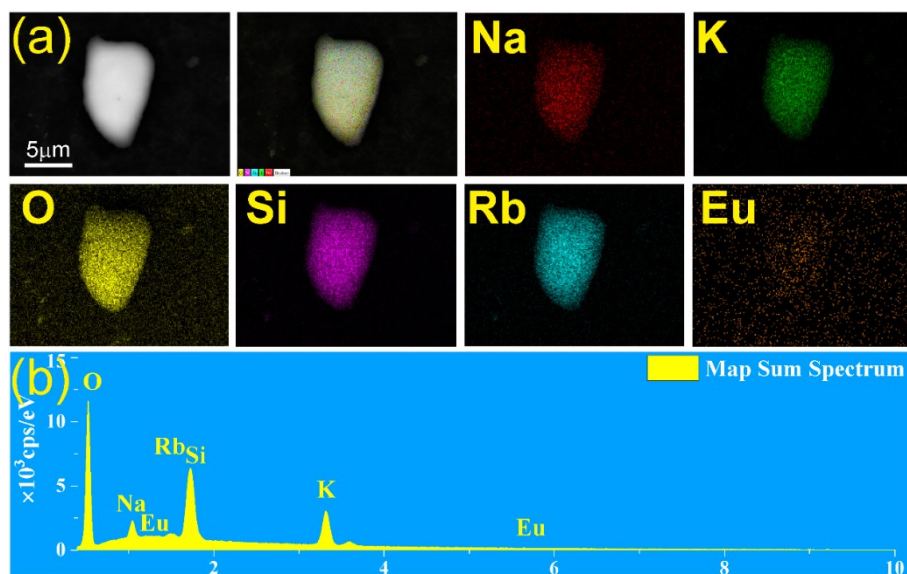


Figure S2 (a) SEM images of $\text{RbK}_2\text{Na}(\text{Li}_3\text{SiO}_4)_4:5\%\text{Eu}^{2+}$ and EDS elemental mapping images of Na, K, O, Si, Rb, and Eu. (b) EDS spectrum of $\text{RbK}_2\text{Na}(\text{Li}_3\text{SiO}_4)_4:5\%\text{Eu}^{2+}$ sample.

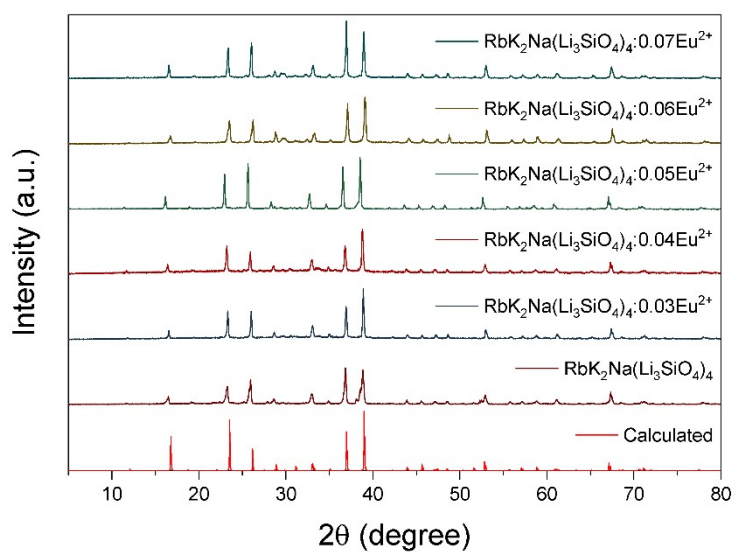


Figure S3 XRD patterns of $\text{RbK}_2\text{Na}(\text{Li}_3\text{SiO}_4)_4:x\text{Eu}^{2+}$ phosphors with different concentrations of Eu^{2+} .

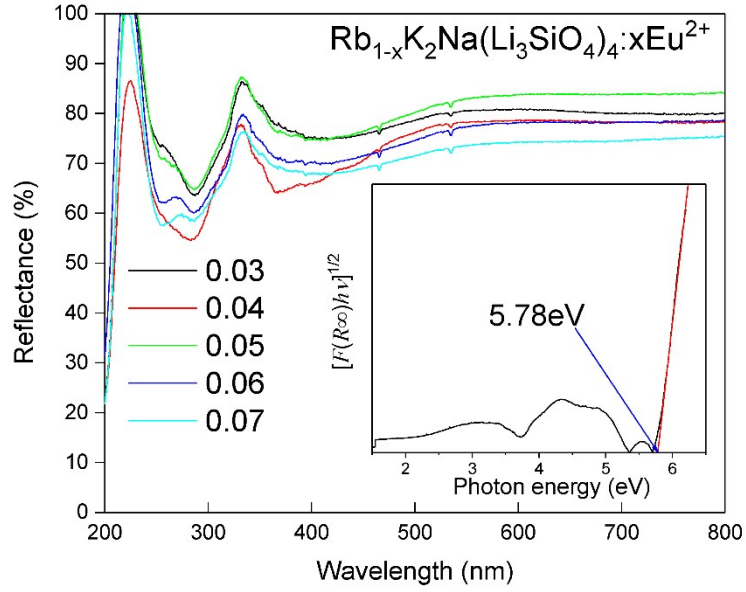


Figure S4 Diffuse reflectance spectrum of $\text{RbK}_2\text{Na}(\text{Li}_3\text{SiO}_4)_4:\text{xEu}^{2+}$; the inset shows the band gap of $\text{RbK}_2\text{Na}(\text{Li}_3\text{SiO}_4)_4$.

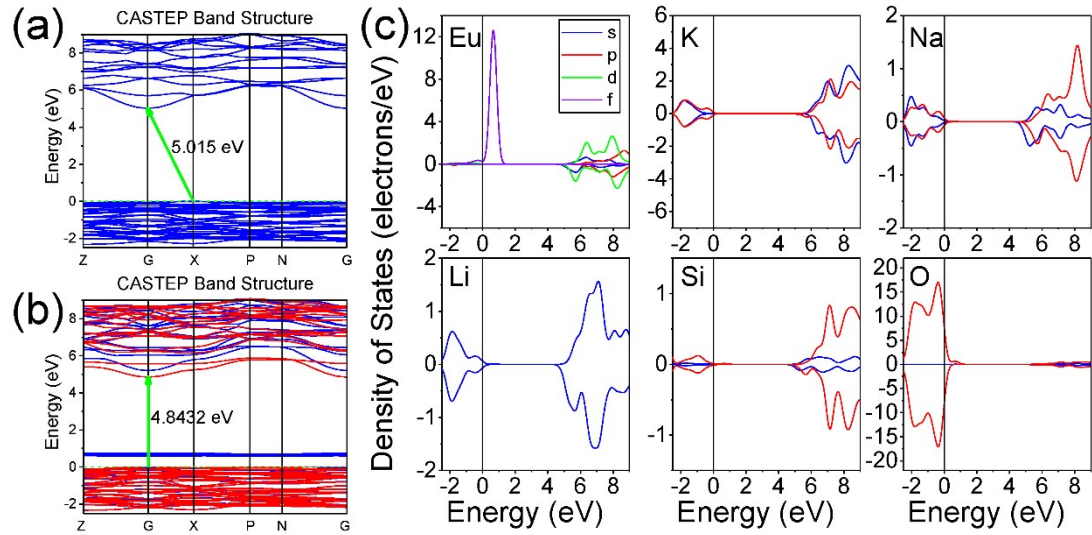


Figure S5 Band structure of a) $\text{RbK}_2\text{Na}(\text{Li}_3\text{SiO}_4)_4$ and b) Eu^{2+} doped $\text{RbK}_2\text{Na}(\text{Li}_3\text{SiO}_4)_4$ phosphors. c) Orbital projected DOS curves for Eu, K, Na, Li, Si, and O in Eu^{2+} doped $\text{RbK}_2\text{Na}(\text{Li}_3\text{SiO}_4)_4$ phosphors.

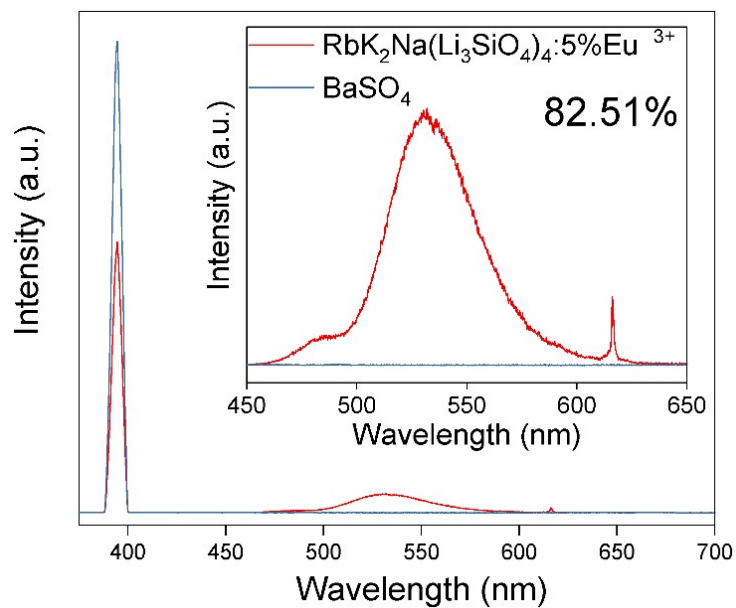


Figure S6 Quantum efficiency spectrum of RbK₂Na(Li₃SiO₄)₄:5%Eu²⁺.

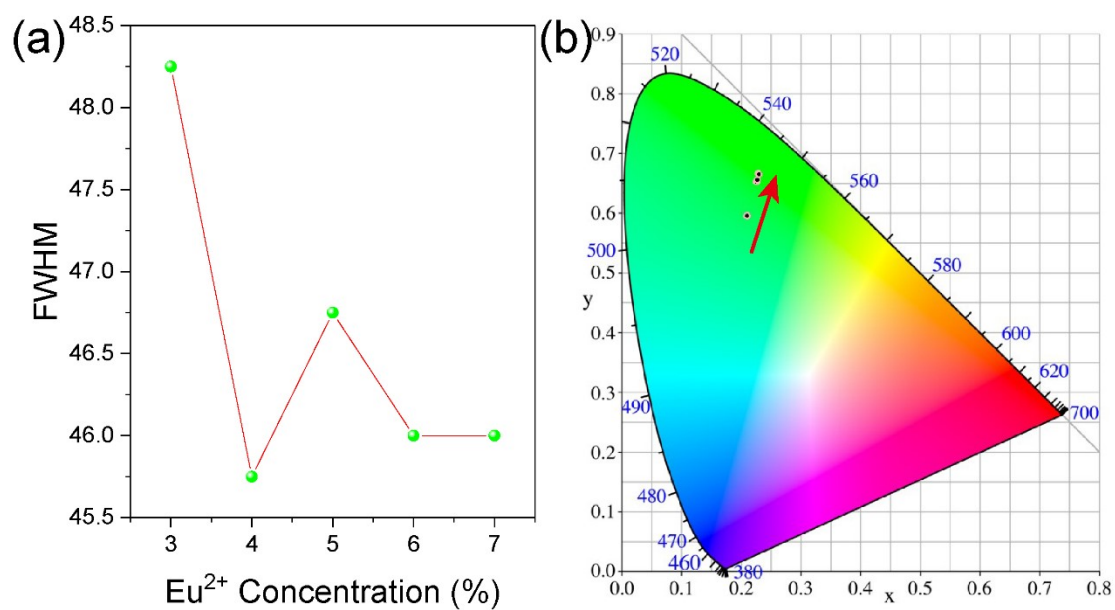


Figure S7 The variation of FWHM and color coordinates with Eu²⁺ doping concentration.

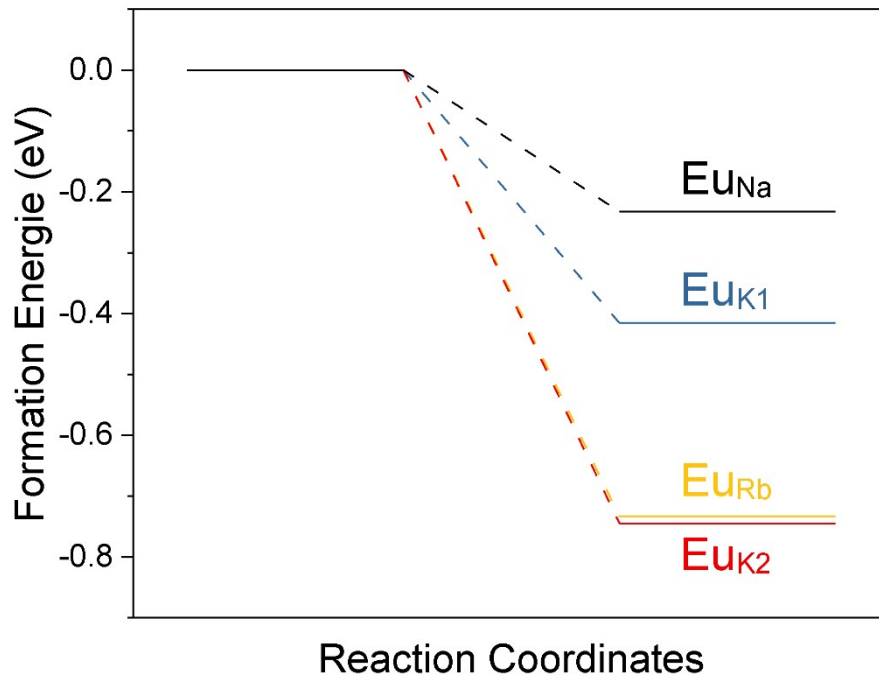


Figure S8 Formation energies of Rb, Na, and K sites after the incorporation of Eu^{2+} ions.

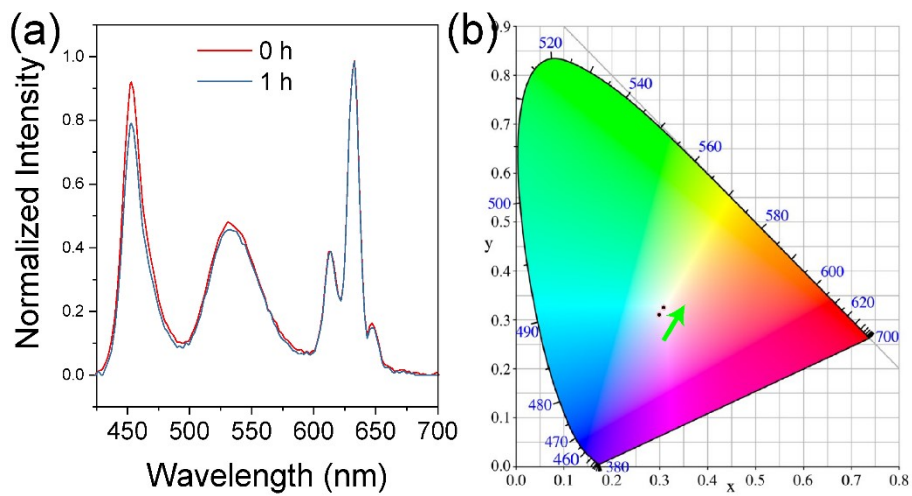


Figure S9 The operational stability of the WLED.

Table S1. Calculated chemical bond parameters of RbK₂Na(Li₃SiO₄)₄ phosphors.

Bond type	$f_c(i)$	$\alpha(i)$	$Q(i)$	he
Rb-O2	0.0782	0.3786	0.875	
Rb-O2	0.0782	0.3785	0.875	
Rb-O2	0.0782	0.3785	0.875	
Rb-O2	0.0782	0.3784	0.875	
Rb-O4	0.0782	0.3786	0.875	0.425709
Rb-O4	0.0782	0.3785	0.875	
Rb-O4	0.0781	0.3784	0.875	
Rb-O4	0.0781	0.3784	0.875	
K1-O4	0.0811	0.2480	0.875	
K1-O4	0.0811	0.2480	0.875	
K1-O4	0.0811	0.2479	0.875	
K1-O4	0.0811	0.2479	0.875	0.353407
K1-O2	0.0808	0.2562	0.875	
K1-O2	0.0807	0.2561	0.875	
K1-O2	0.0807	0.2561	0.875	
K1-O2	0.0807	0.2560	0.875	
K2-O7	0.1151	0.2402	0.750	
K2-O7	0.1151	0.2401	0.750	
K2-O7	0.1151	0.2401	0.750	
K2-O7	0.1151	0.2400	0.750	
K2-O8	0.1101	0.3427	0.750	0.383438
K2-O8	0.1101	0.3427	0.750	
K2-O8	0.1100	0.3426	0.750	
K2-O8	0.1100	0.3426	0.750	
Na-O7	0.1166	0.1979	0.750	
Na-O7	0.1166	0.1978	0.750	
Na-O7	0.1166	0.1978	0.75	
Na-O7	0.1165	0.1978	0.75	
Na-O8	0.1100	0.3109	0.750	0.358903
Na-O8	0.1100	0.3108	0.750	
Na-O8	0.1100	0.3108	0.750	
Na-O8	0.1100	0.3107	0.750	