

Table S1. Variation of Debye temperature in different sites

	Site K	Site Sr
U_{iso} (KSSS: 0.07Bi^{3+}) ⁺	0.0397	0.0242
U_{iso} (KSS _{0.6} C _{0.4} S: 0.07Bi^{3+})	0.0419	0.0121
$\theta_{D,i}$	increase	decrease
Local structural rigidity	reduce	improve

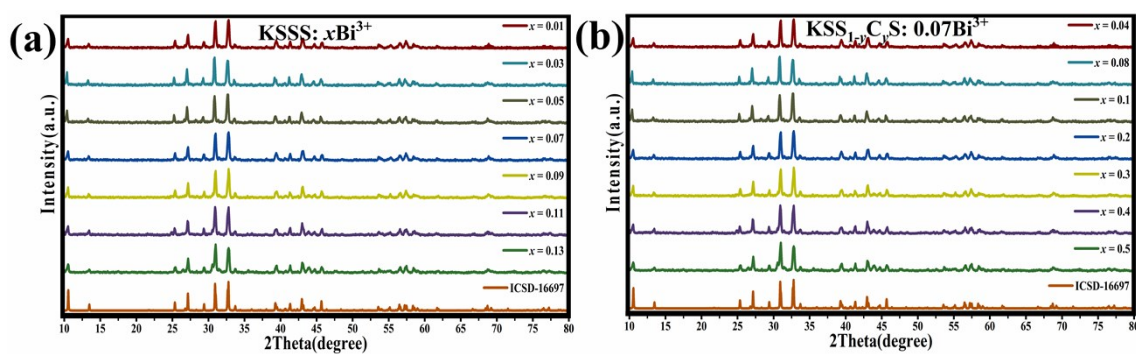


Figure S1. XRD patterns and the standard of KScSrSi₂O₇ (ICSD-166997): (a) KSSS: Bi³⁺ (0 < x < 0.13) ; (b) KSS_{1-y}C_yS: 0.07Bi³⁺ (0 < y < 0.5).

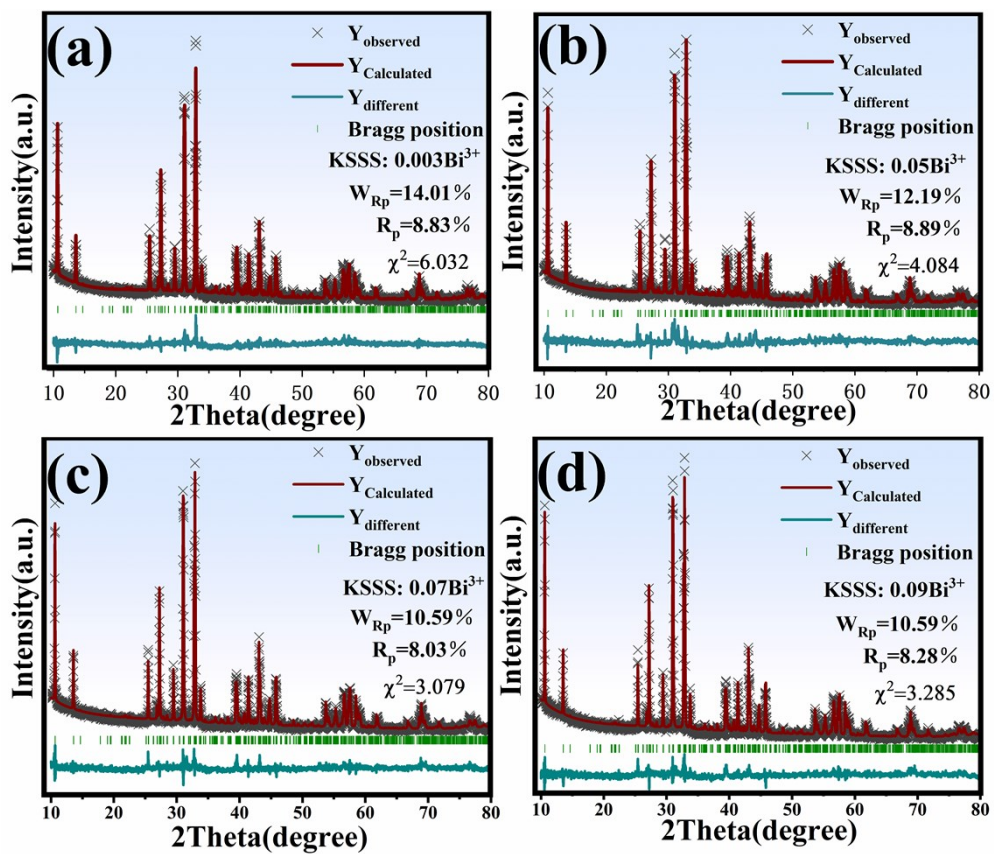


Figure S2. Rietveld refinement results of KSSS: $x\text{Bi}^{3+}$ with (a) $x = 0.003$, (b) $x = 0.05$, (c) $x = 0.07$, (d) $x = 0.09$.

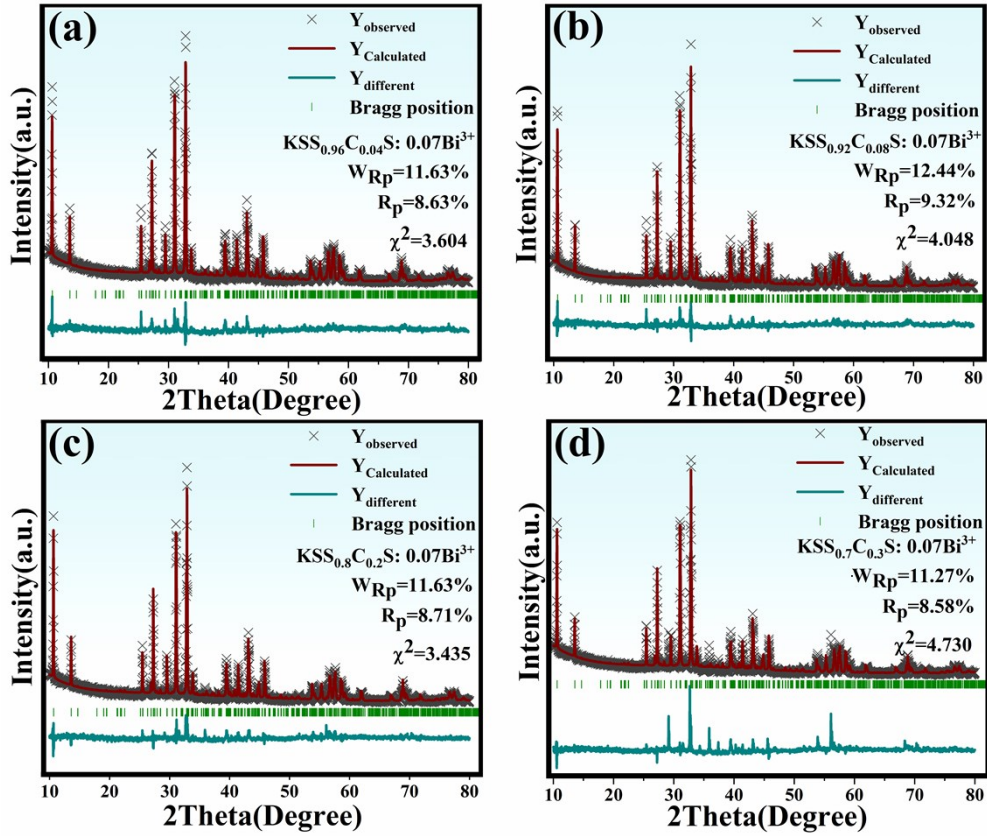


Figure S3. Rietveld refinement results of $\text{KSS}_{1-y}\text{C}_y\text{S}: 0.07\text{Bi}^{3+}$ with (a) $y = 0.04$, (b) $y = 0.08$, (c) $y = 0.2$, (d) $y = 0.3$.

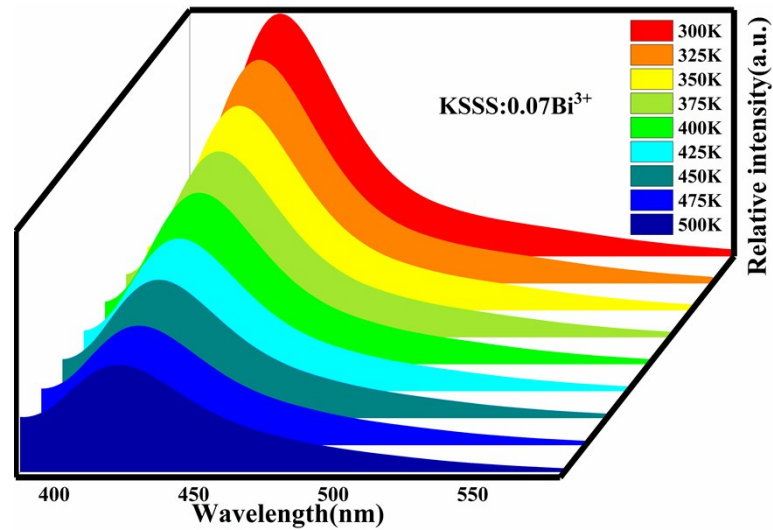


Figure S4. Temperature-dependent emission spectra of $\text{KSSS}: 0.07\text{Bi}^{3+}$ phosphors under 370 nm excitation.

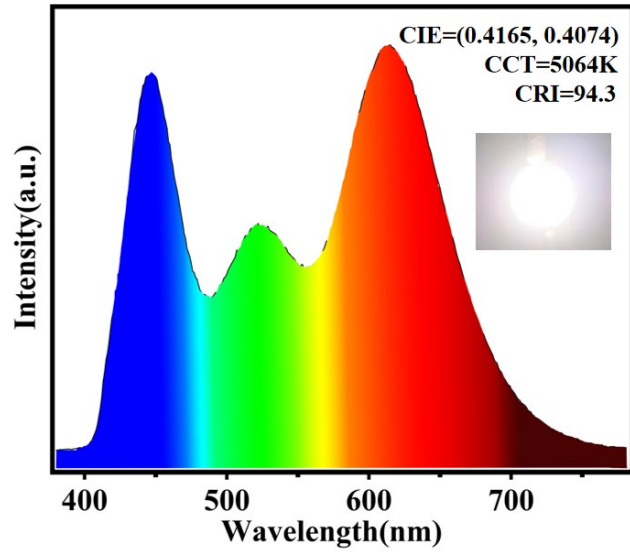


Figure S5. The EL spectrum of the LED device fabricated with the blue $\text{BaMgAl}_{10}\text{O}_{17}:\text{Eu}^{2+}$ phosphor and the commercial phosphor on an UV LED chip (370 nm) under a current of 5 mA.