

Supporting Information

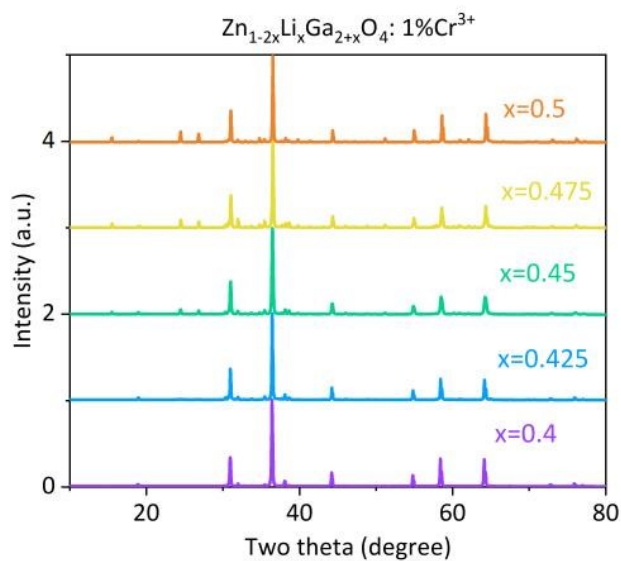


Figure S1. XRD patterns of $\text{Zn}_{1-2x}\text{Li}_x\text{Ga}_{2+x}\text{O}_4:\text{Cr}^{3+}$ solid solutions ($x = 0.4, 0.425, 0.45, 0.475, 0.5$).

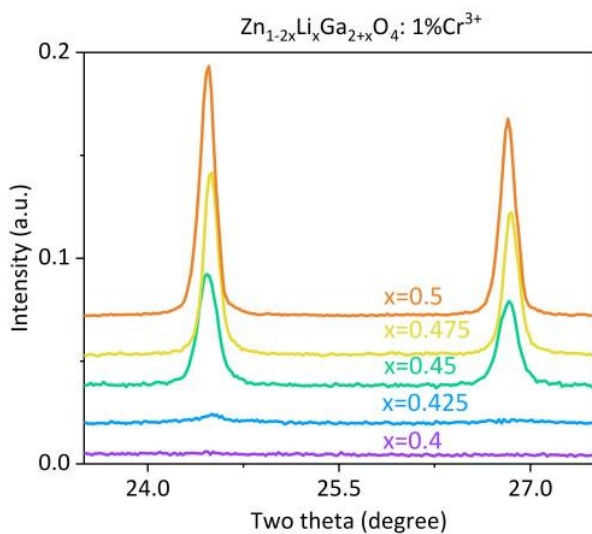


Figure S2. Zoom-in area of XRD patterns of $\text{Zn}_{1-2x}\text{Li}_x\text{Ga}_{2+x}\text{O}_4:\text{Cr}^{3+}$ solid solutions ($x = 0.4, 0.425, 0.45, 0.475, 0.5$) in the range from 24 ° to 27 °.

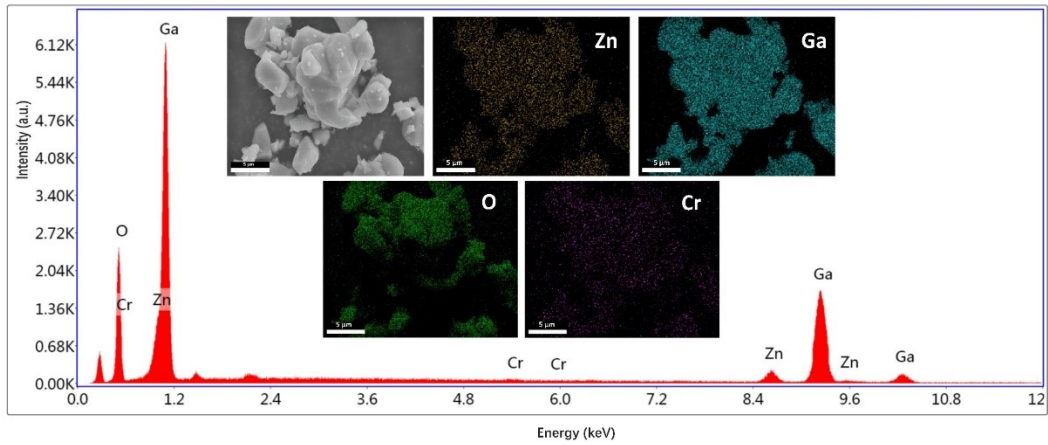


Figure S3. EDS analysis and the selected elemental distribution mappings of solid solution ($x = 0.25$)

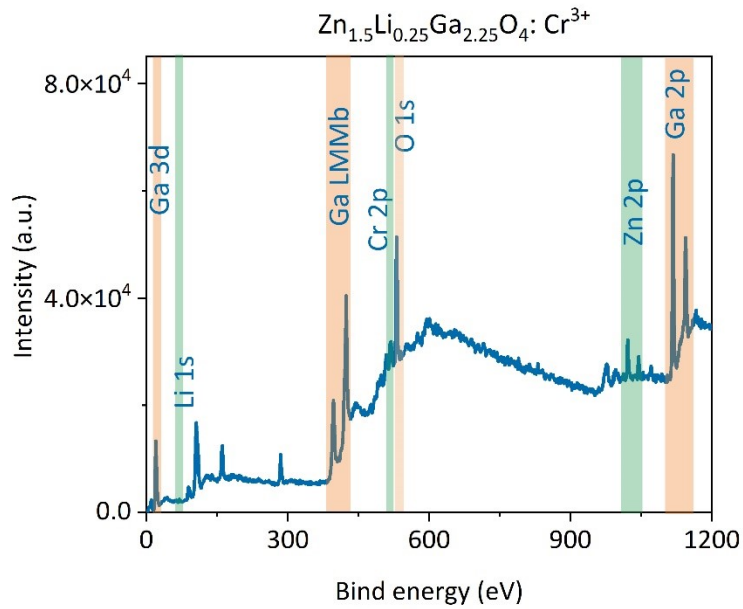


Figure S4 X-ray photoelectron spectroscopy survey of $\text{Zn}_{1-2x}\text{Li}_x\text{Ga}_{2+x}\text{O}_4:\text{Cr}^{3+}$ ($x = 0.25$) phosphor.

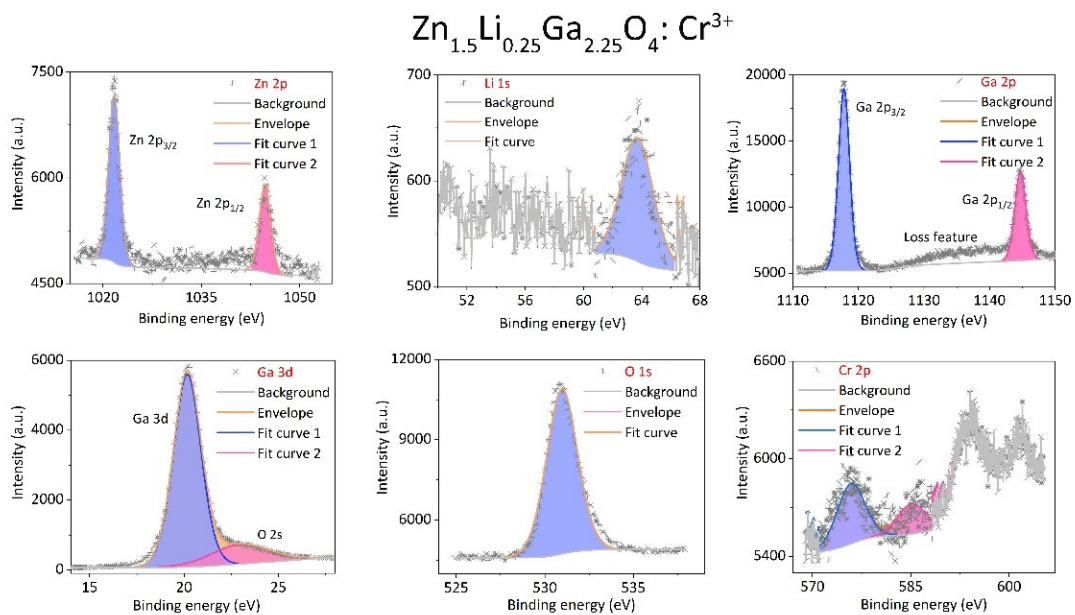


Figure S5. X-ray photoelectron spectroscopy analysis of the surface elemental contents. The corresponding fitting curves of each element were given.

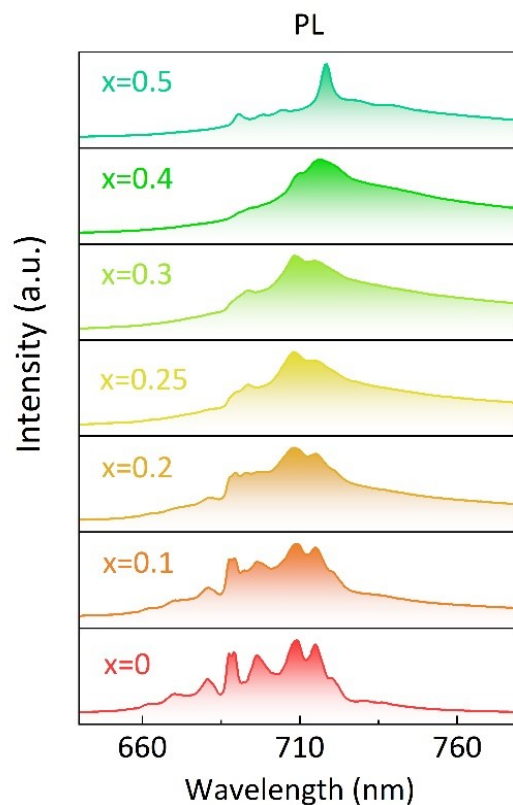


Figure S6. A comparison of photoluminescence (PL) spectra of $\text{Zn}_{1-2x}\text{Li}_x\text{Ga}_{2+x}\text{O}_4:\text{Cr}^{3+}$ solid solutions

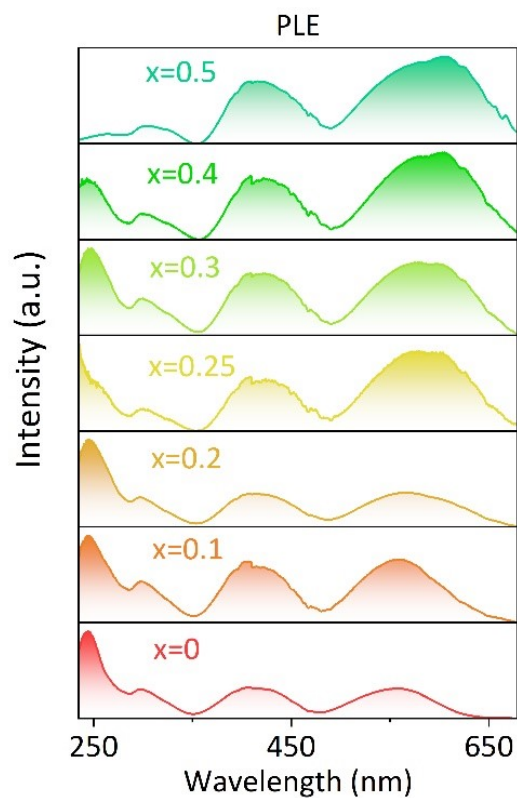


Figure S7. A comparison of photoluminescence excitation (PLE) spectra of $\text{Zn}_{1-2x}\text{Li}_x\text{Ga}_{2+x}\text{O}_4:\text{Cr}^{3+}$ solid solutions

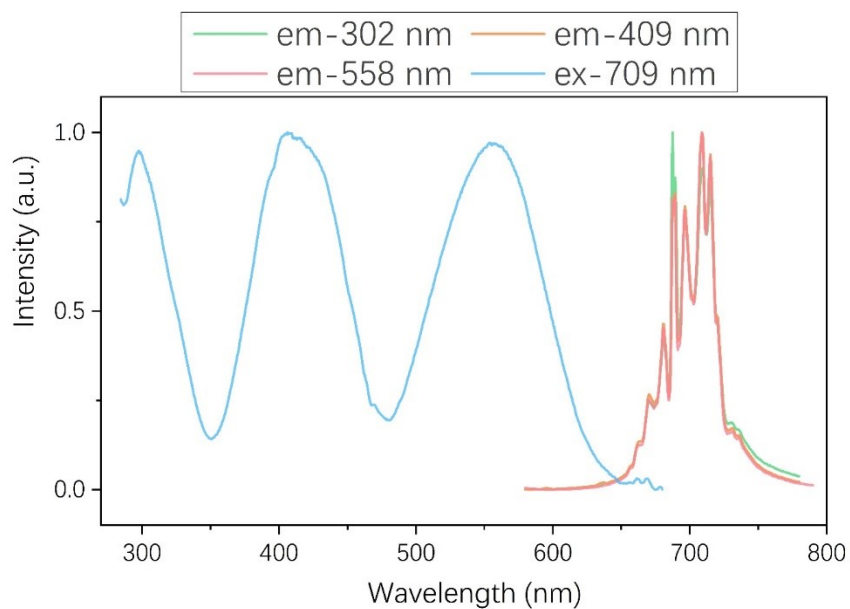


Figure S8. Photoluminescence excitation (PLE) spectrum and photoluminescence (PL) spectra of $\text{Zn}_{1-2x}\text{Li}_x\text{Ga}_{2+x}\text{O}_4:\text{Cr}^{3+}$ ($x = 0$). PLE spectrum was monitored at 709 nm. PL spectra were monitored at 302, 409 and 558 nm, respectively.

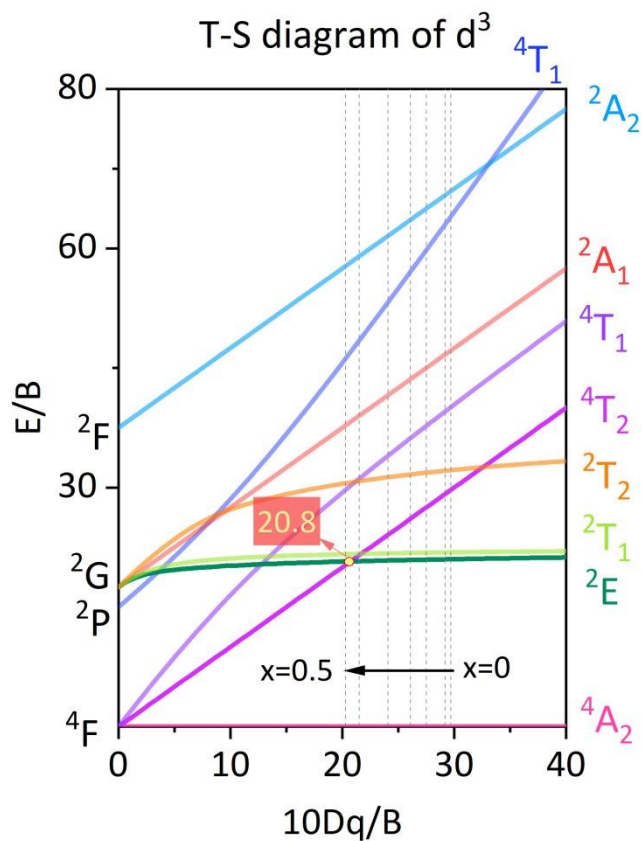


Figure S9. Tanabe–Sugano diagram of d^3 ions.

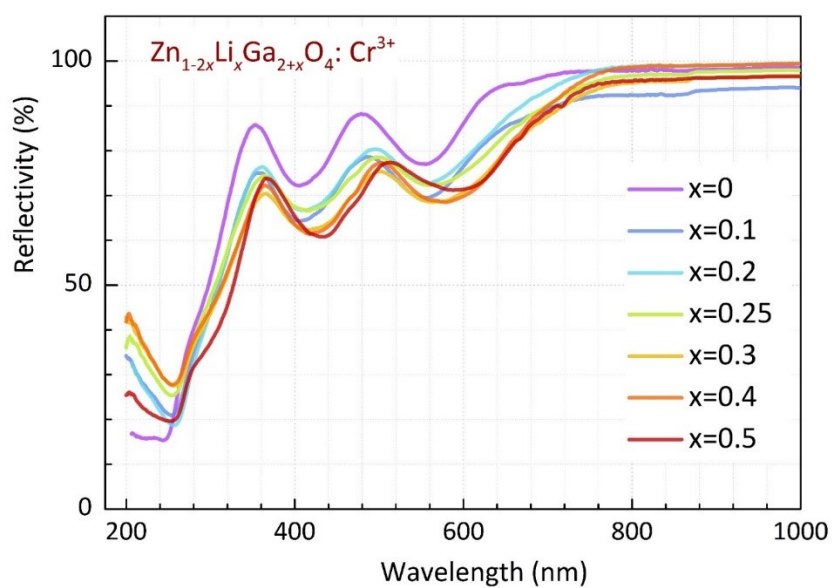


Figure S10. Diffuse reflection spectra of $Zn_{1-2x}Li_xGa_{2+x}O_4:Cr^{3+}$ solid solutions ($x = 0, 0.1, 0.2, 0.25,$

0.3, 0.4, 0.5).

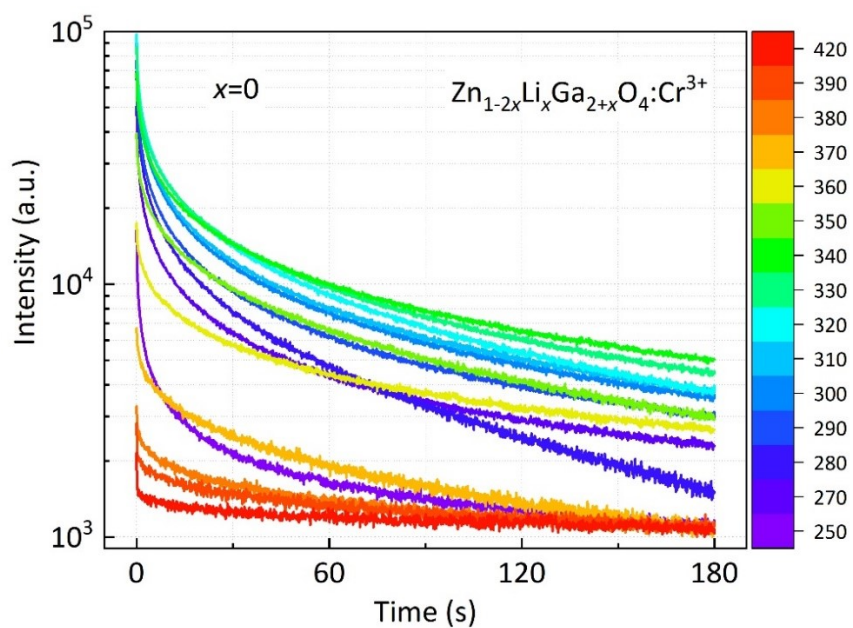


Figure S11. Charging-wavelength dependent persistent luminescence decay with $x = 0$

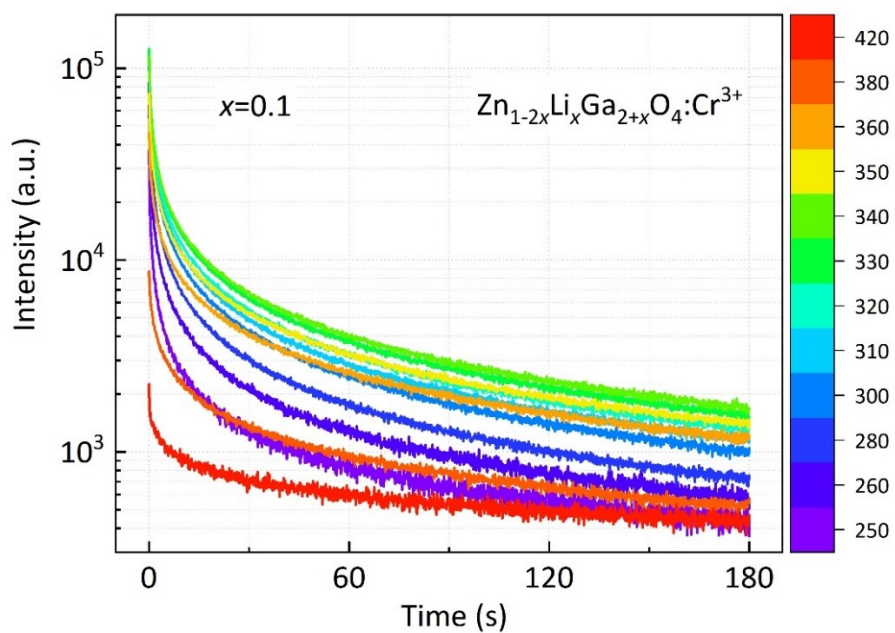


Figure S12. Charging-wavelength dependent persistent luminescence decay with $x = 0.1$

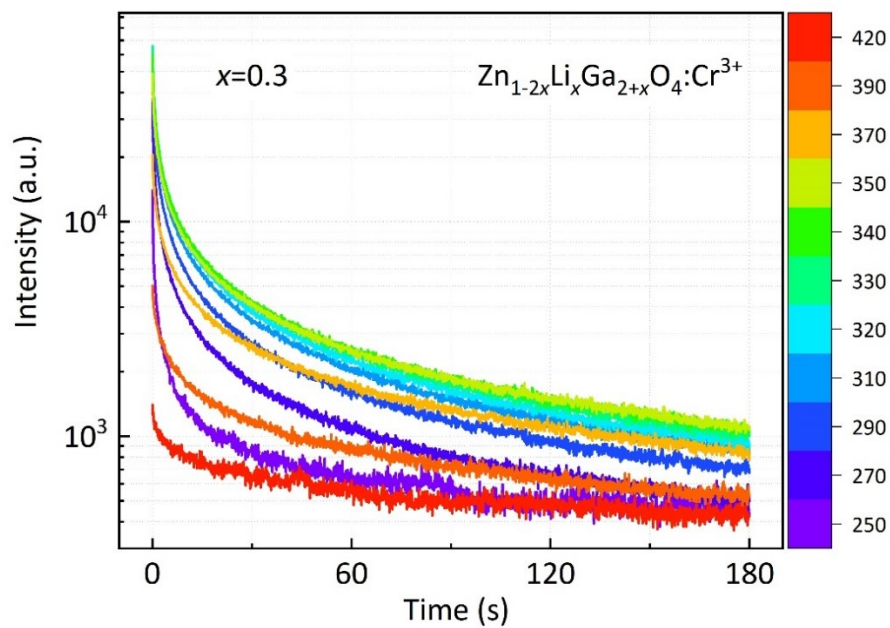


Figure S13. Charging-wavelength dependent persistent luminescence decay with $x = 0.3$

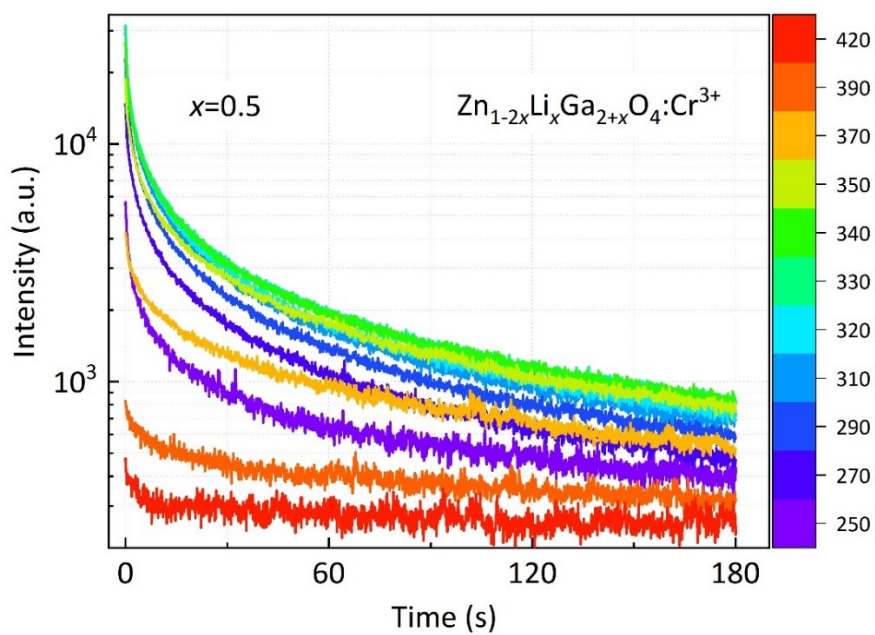


Figure S14. Charging-wavelength dependent persistent luminescence decay with $x = 0.5$

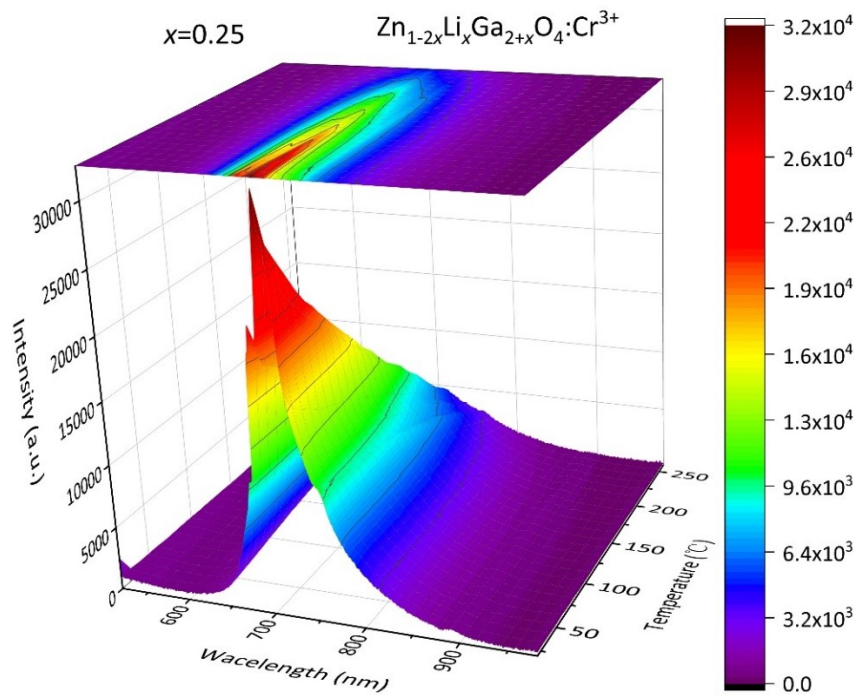


Figure S15. Temperature dependent PL spectra of $\text{Zn}_{1-2x}\text{Li}_x\text{Ga}_{2+x}\text{O}_4:\text{Cr}^{3+}$ ($x = 0.25$).

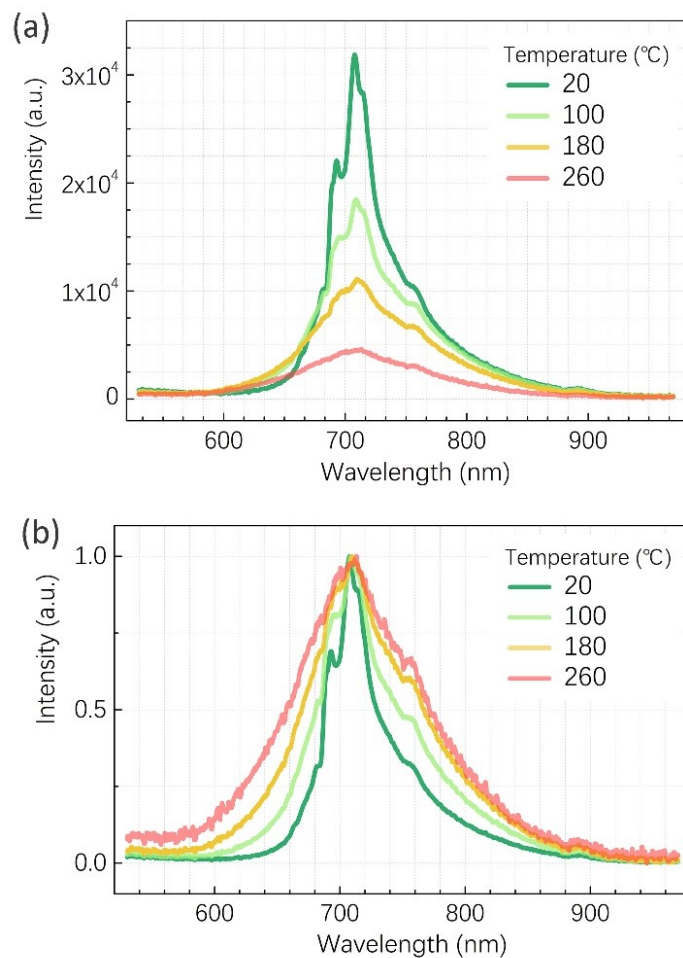


Figure S16. Comparison of PL spectra (a), normalized PL spectra (b) of $\text{Zn}_{1-2x}\text{Li}_x\text{Ga}_{2+x}\text{O}_4:\text{Cr}^{3+}$ ($x = 0.25$) at 20 °C, 100 °C, 180 °C, and 260 °C, respectively.

Table S1. The calculated crystal field parameters of each composition

	0	0.1	0.2	0.25	0.3	0.4	0.5
${}^4\text{T}_1$ (nm)	412	412	414	418	416	417	414
${}^4\text{T}_2$ (nm)	556	558	568	580	587	603	606
Dq (cm^{-1})	1799	1792	1761	1724	1704	1658	1650
x	3.4943	3.5439	3.7189	3.8760	4.1096	4.4614	4.6381
Dq/B	2.97	2.92	2.75	2.61	2.41	2.15	2.03