

Supporting Information

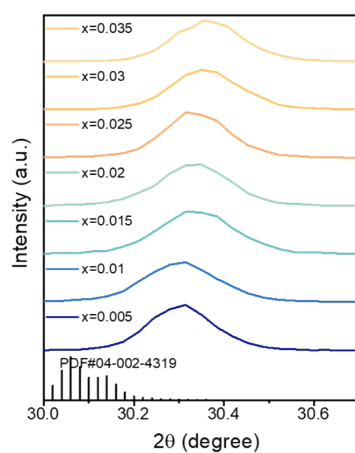


Fig. S1. Magnified diffraction patterns of $\text{CaZrTaGaO}_7:x\text{Cr}^{3+}$ in the region of 30.0° - 30.5° .

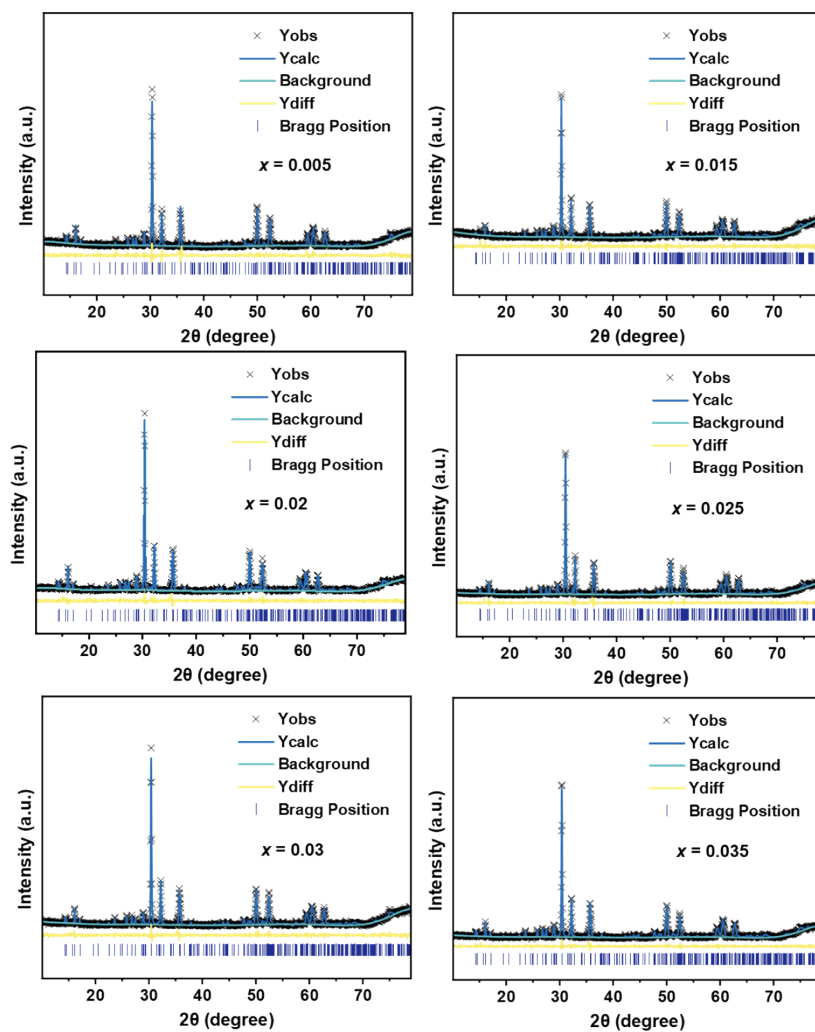


Fig. S2. Rietveld refinement results of $\text{CaZrTaGaO}_7:x\text{Cr}^{3+}$ ($x = 0.005$ - 0.035).

Table S1. Lattice structure, lattice parameters and refinement factors for $\text{CaZrTaGaO}_7:x\text{Cr}^{3+}$ ($x = 0.005\text{-}0.035$) samples based on the Rietveld refinement XRD patterns.

| Cr^{3+} concentration | χ^2 | R_p | R_{wp} | a | b | c | V |
|--------------------------------|----------|-------|----------|---------|--------|---------|------------------------|
| 0.005 | 1.949 | 7.34% | 9.65% | 12.709Å | 7.362Å | 11.458Å | 1051.77 Å ³ |
| 0.01 | 1.550 | 5.87% | 7.70% | 12.707Å | 7.360Å | 11.450Å | 1051.37Å ³ |
| 0.015 | 1.360 | 6.57% | 8.76% | 12.687Å | 7.354Å | 11.431Å | 1046.11Å ³ |
| 0.02 | 1.458 | 5.64% | 7.69% | 12.682Å | 7.350Å | 11.427Å | 1046.01Å ³ |
| 0.025 | 1.510 | 6.12% | 8.34% | 12.679Å | 7.349Å | 11.426Å | 1045.62Å ³ |
| 0.03 | 1.330 | 6.02% | 8.09% | 12.675Å | 7.348Å | 11.426Å | 1045.13Å ³ |
| 0.035 | 1.515 | 5.79% | 7.70% | 12.676Å | 7.347Å | 11.423Å | 1044.89Å ³ |

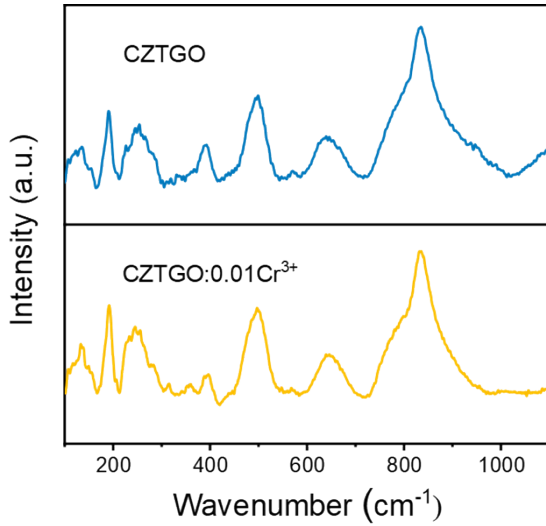


Fig. S3. Raman spectra of CZTGO and CZTGO:0.01Cr³⁺.

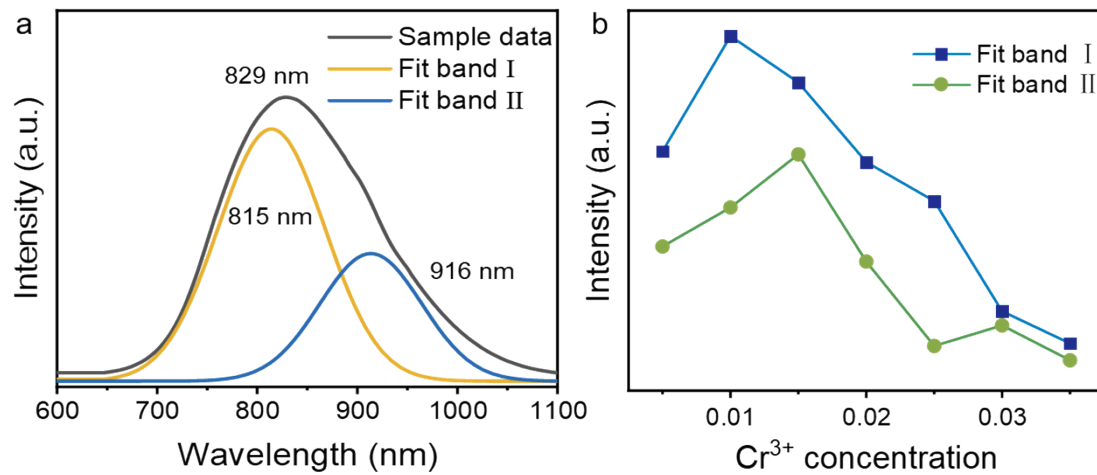


Fig. S4. (a) Gaussian fitting for PL spectra of CZTGO:0.01Cr³⁺. (b) Emission intensities of the two fitting band (815 and 916 nm) with Cr³⁺ concentrations.

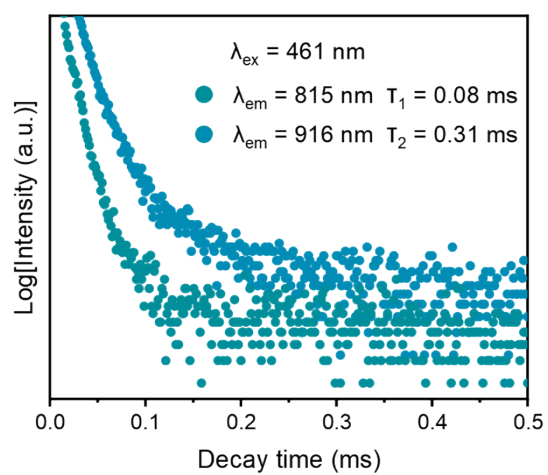


Fig. S5. Decay curves of $\text{CaZrTaGaO}_7:0.01\text{Cr}^{3+}$ ($\lambda_{\text{ex}} = 461 \text{ nm}$, $\lambda_{\text{em}} = 819 \text{ nm}$ and 866 nm).