

Electronic Supplementary Information for

**Complex crystal structure and photoluminescence of Bi³⁺-doped and
Bi³⁺/Eu³⁺ co-doped Ca₇Mg₂Ga₆O₁₈**

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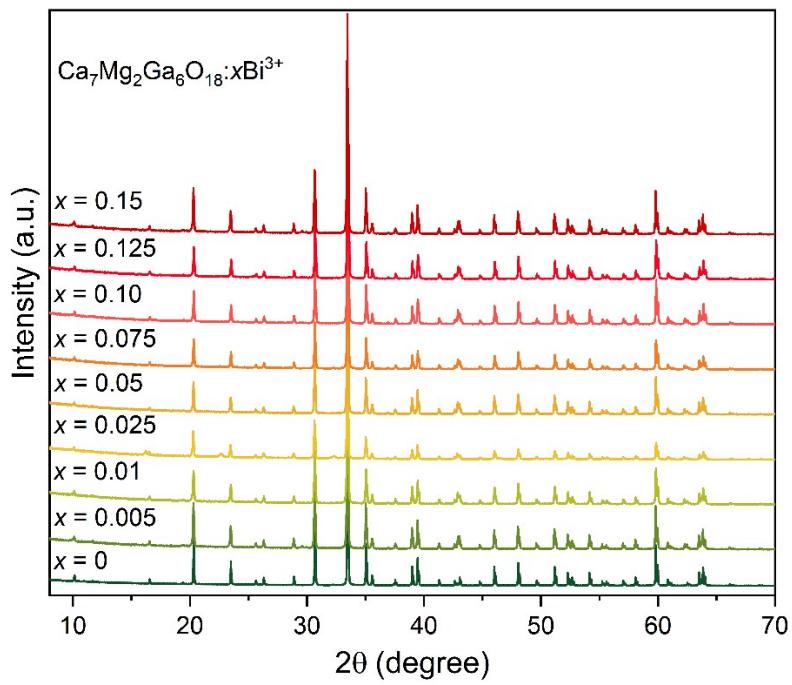


Figure S1. The PXRD patterns for $\text{Ca}_7\text{Mg}_2\text{Ga}_6\text{O}_{18}\text{:xBi}^{3+}$ ($x = 0, 0.005, 0.01, 0.025, 0.05, 0.075, 0.10, 0.125, 0.15$).

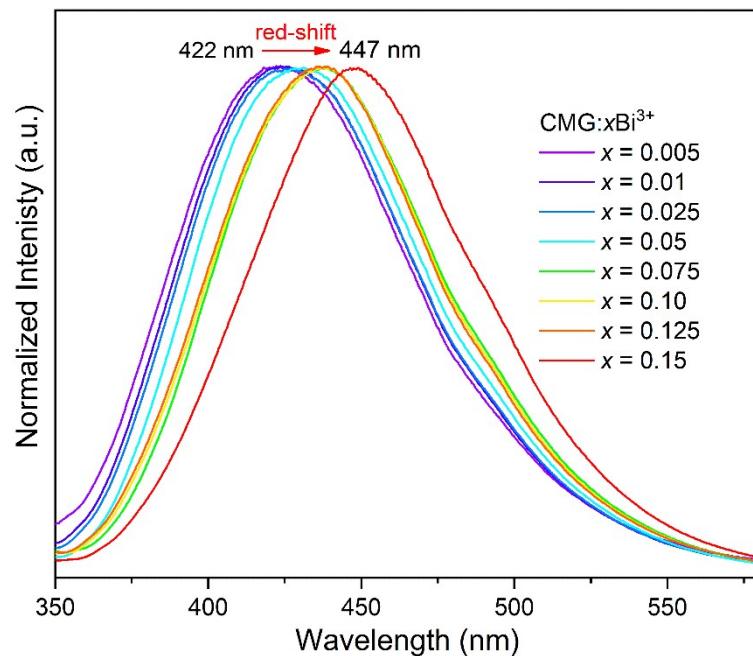


Figure S2. The normalized PL spectra of CMG:xBi³⁺ ($x = 0.005, 0.01, 0.025, 0.05, 0.075, 0.10, 0.125, 0.15$).

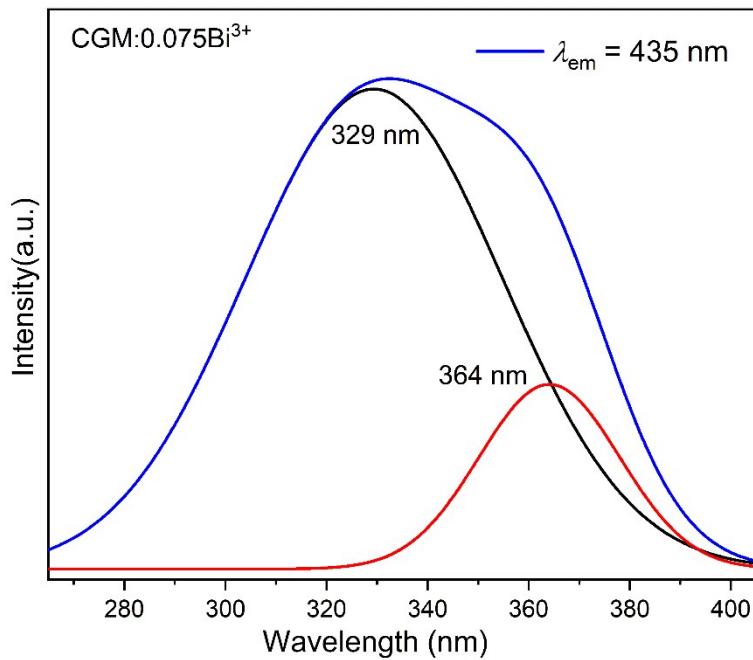


Figure S3. The Gaussian fitting of the excitation spectrum of CMG:0.075Bi³⁺.

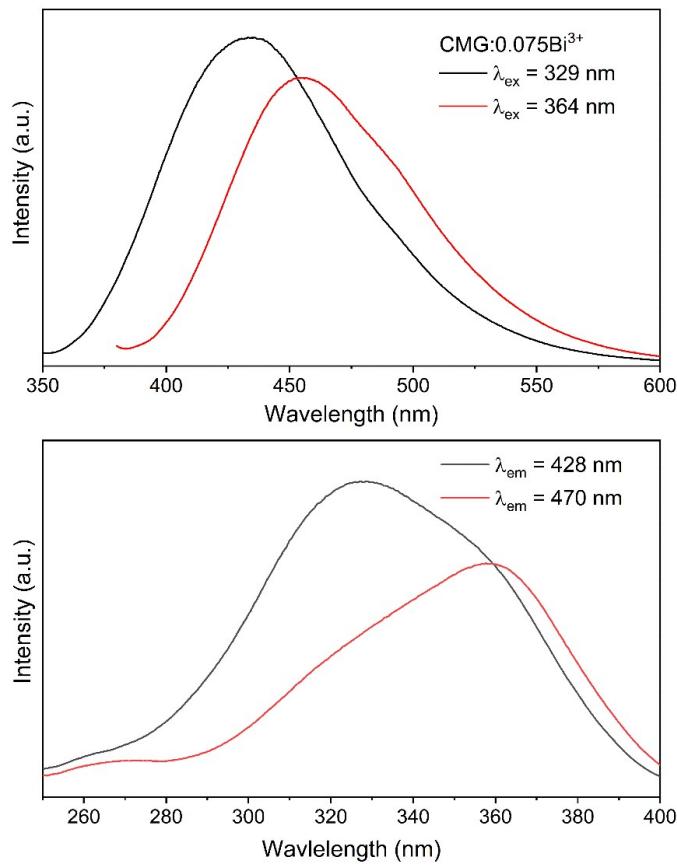


Figure S4. The emission and excitation spectra for CMG:0.075Bi³⁺.

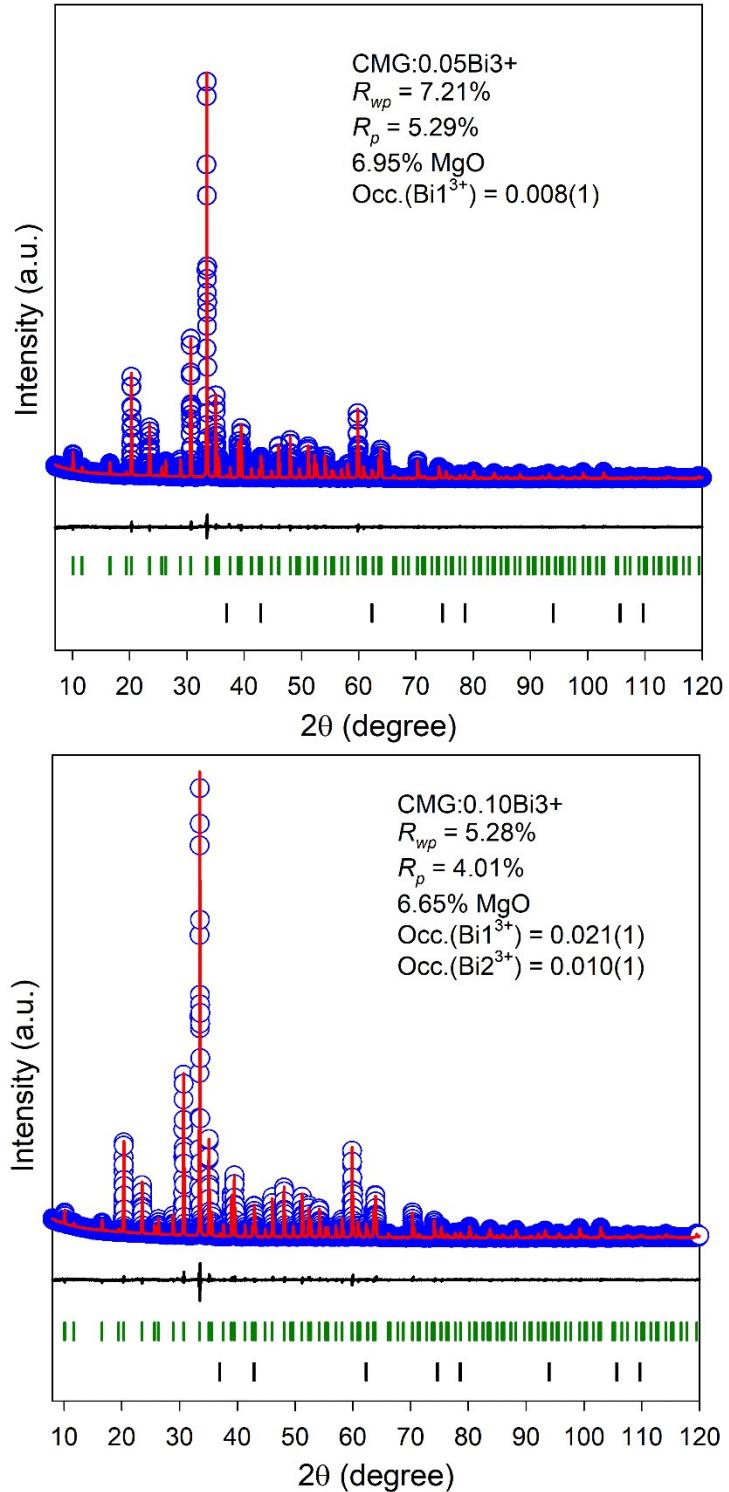


Figure S5. Rietveld refinement plots of XRD data of CMG: x Bi³⁺($x = 0.05, 0.1$). The black bars at the bottom of the patterns represent the Bragg peak positions of the MgO impurity phase. The occupancy factor of Bi³⁺ may not be very accurate by Rietveld refinements due to the relatively low doping contents of Bi³⁺ in CMG: x Bi³⁺, but the current results can show good guidance that Bi³⁺ ion prefers to occupy the Ca1 site first.

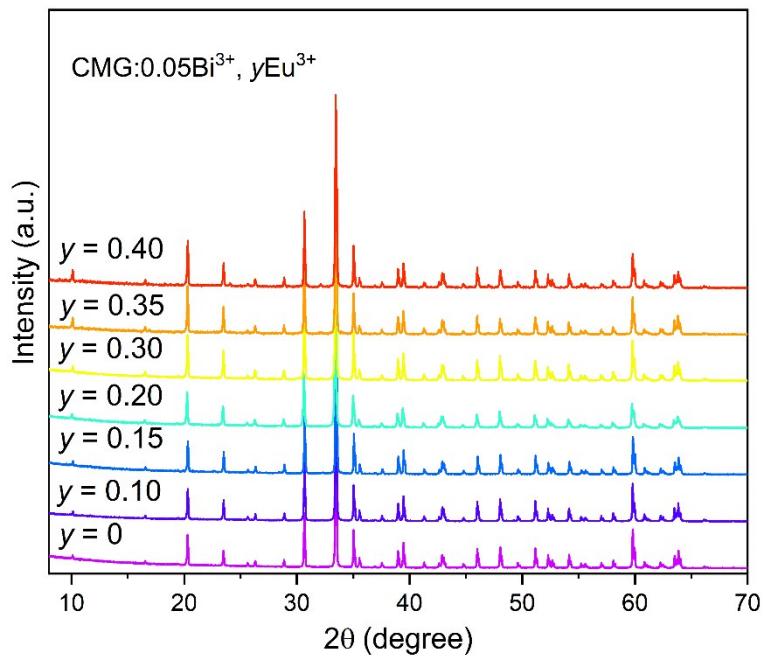


Figure S6. The PXRD patterns of CMG:0.05Bi³⁺, yEu³⁺ ($y = 0, 0.10, 0.15, 0.20, 0.30, 0.35, 0.40$).

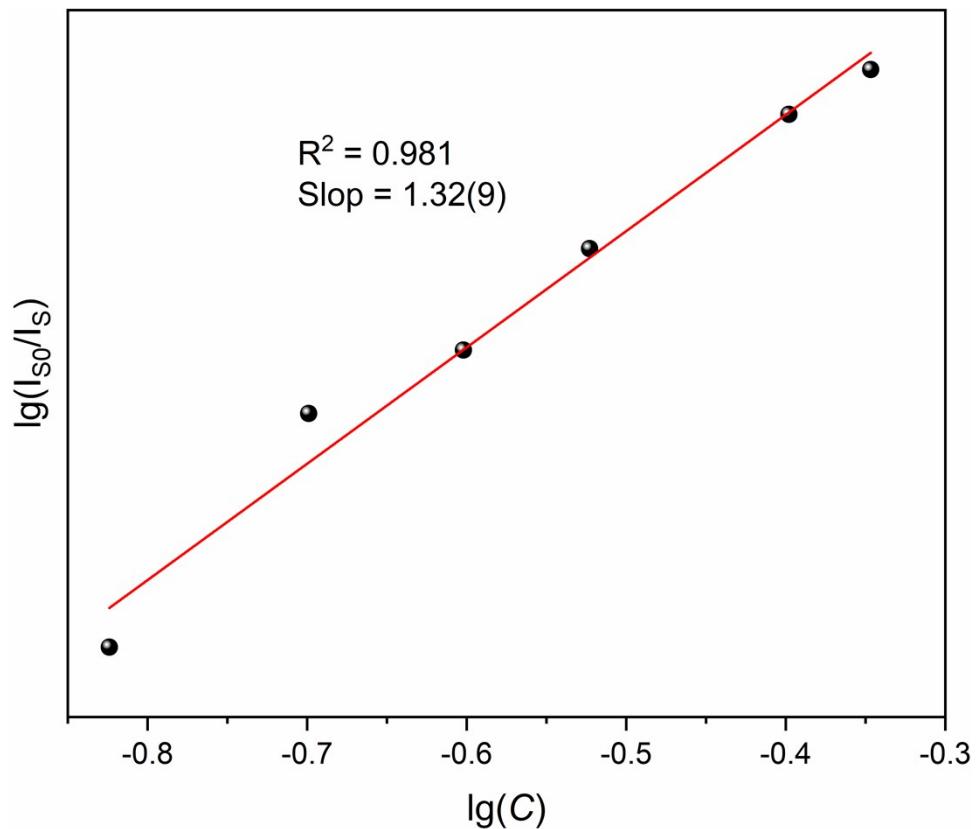


Figure S7. The linear fitting of $\lg(I_{S0}/I_S)$ - $\lg(C)$ curve.

Table S1. Selected interatomic distances (\AA) of $\text{Ca}_7\text{Mg}_2\text{Ga}_6\text{O}_{18}$.

| Bonds | Distances | Bonds | Distances |
|---------------------------------|-----------|--------------------------------|-----------|
| Ca1–O2 | 2.362(4) | Ga1–O1 | 1.946(2) |
| Ca1–O4 \times 4 | 2.548(2) | Ga1–O4 \times 3 | 1.976(3) |
| Ca1–O3 \times 2 | 2.6134(1) | Ga2–O4 \times 3 | 1.918(3) |
| $\langle \text{Ca1–O} \rangle$ | 2.540(2) | Ga2–O3 | 1.988(9) |
| Ca2–O4 \times 3 | 2.330(3) | $\langle \text{Ga2–O} \rangle$ | 1.936(5) |
| Ca2–O2 \times 3 | 2.3966(9) | Ga3–O3 \times 3 | 1.800(8) |
| $\langle \text{Ca2–O3} \rangle$ | 2.363(2) | Ga4–O4 \times 4 | 1.845(2) |
| | | Ga5–O2 \times 6 | 2.006(4) |