

Supplementary Information for:

Enhanced Deep-Blue Emission and Quantum Yield of $\text{Ca}_{0.995}\text{YGaO}_4:0.5\%\text{Bi}^{3+}$ via Lithium-Based Flux Additives

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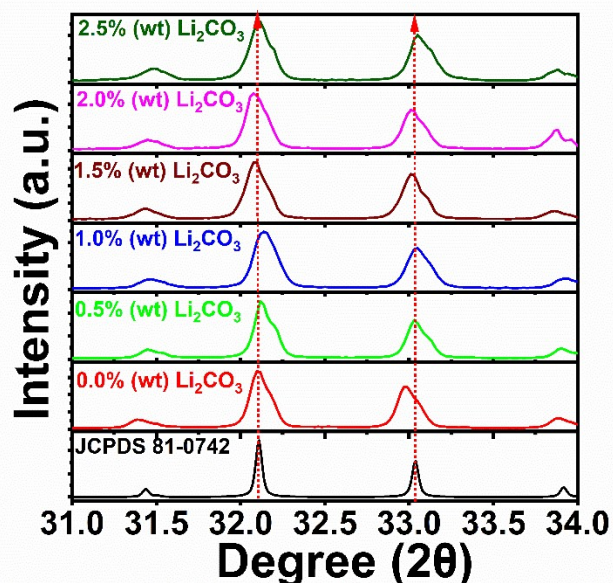


Figure S1. High-magnification Powder X-ray Diffraction (XRD) patterns of $\text{Ca}_{0.995}\text{YGaO}_4:0.5\%\text{Bi}^{3+}$ phosphor materials synthesized using Li_2CO_3 flux. The patterns show peak broadening.

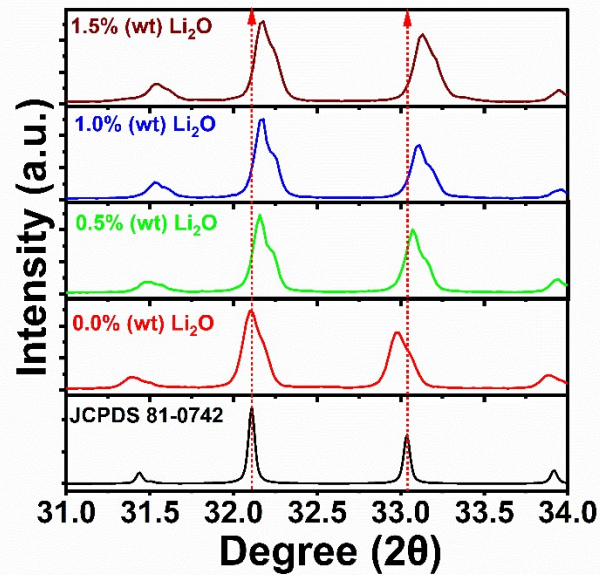


Figure S2. High-magnification Powder X-ray Diffraction (XRD) patterns of $\text{Ca}_{0.995}\text{YGaO}_4:0.5\%\text{Bi}^{3+}$ phosphor materials synthesized using Li_2O flux. The patterns show peak broadening, and a shift to higher diffraction angles with increasing flux content.

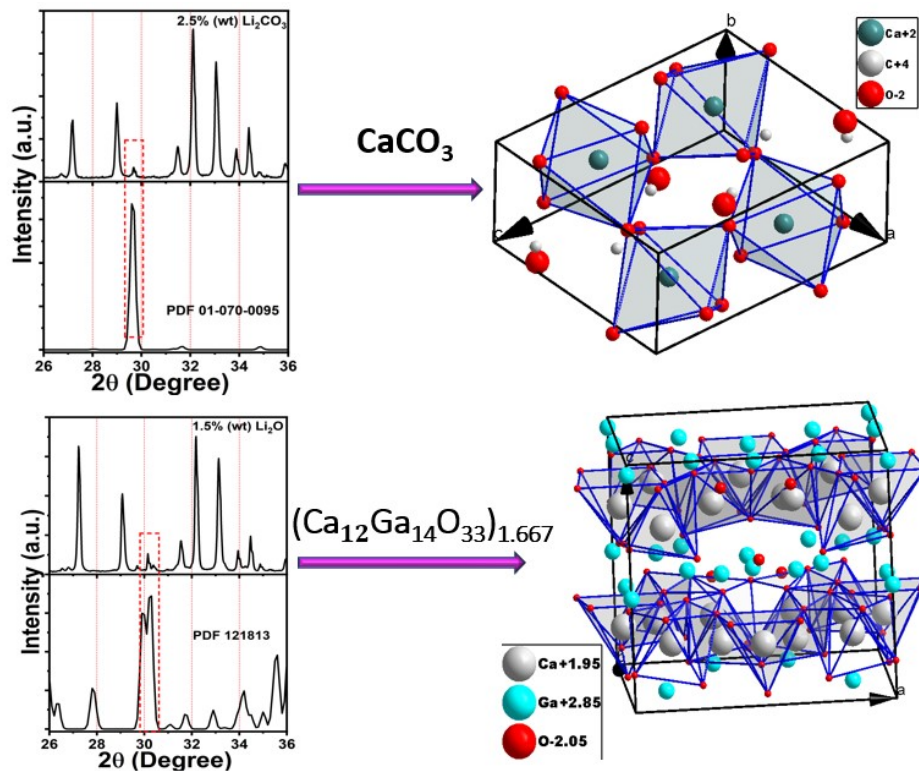


Figure S3. X-ray diffraction (XRD) patterns showing the formation of secondary phases induced by increased Li_2CO_3 and Li_2O flux content. The observed peak matches ICSD PDF no. 01-070-0095, corresponding to a CaCO_3 phase, while an additional emerging peak aligns with ICSD PDF no. 121813, attributed to the $(\text{Ca}_{12}\text{Ga}_{14}\text{O}_{33})_{1.667}$ phase.

Table S1. Crystallographic parameters and Rietveld refinement details for CYGO:0.5% Bi³⁺ samples synthesized using two different fluxes (Li₂CO₃ and Li₂O).

Material	CaYGO4:0.5%Bi3+	
Flux Used	Li ₂ CO ₃	Li ₂ O
Crystal System	Orthorhombic	Orthorhombic
Space group (IT number, Z)	P n m a	P n m a
constant a, b, c (Å)	a = 11.3538, b = 6.5718, c = 5.2890	A = 11.3512, b = 6.5672, c = 5.2888
α, β, γ (deg.)	$\alpha = 90, \beta = 90, \gamma = 90$	$\alpha = 90, \beta = 90, \gamma = 90$
density (g/cm ³) Lattice	4.341 g/cm ³	4.304 g/cm ³
Volume(Å ³)	394.6422	394.2607
2 θ range (deg.)	20° - 60°	20° - 60°
2 θ step Radiations	0.020302	0.020302
Rietveld Parameters	Rexp = 7.67 %, $\chi^2 = 4.26$	Rexp = 6.69%, $\chi^2 = 6.81$
Refinement software	Full-Prof Rietveld refinement	

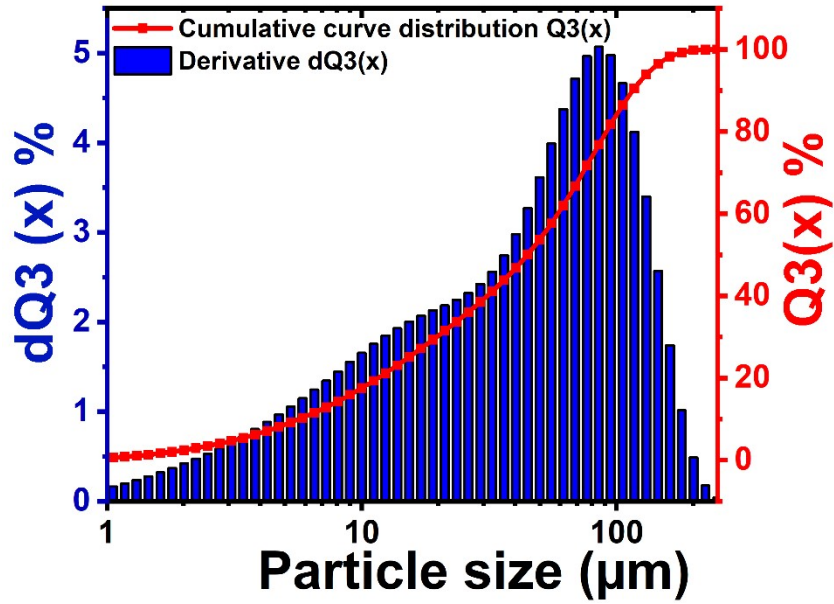


Figure S 4. illustrates the particle size distribution for the sample synthesized with Li_2O flux assistance, highlighting the emergence of a secondary population of larger particles.