

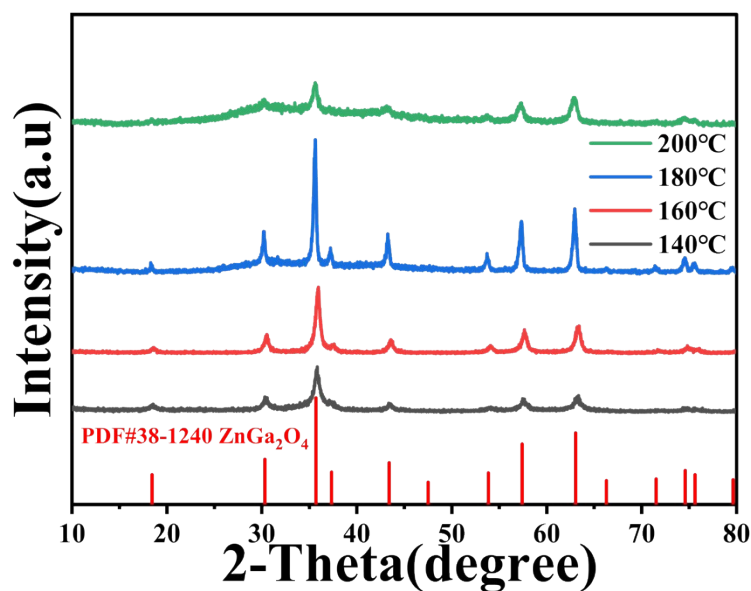
## Supporting Information

### Hydrothermal Synthesis of $\text{ZnGa}_2\text{O}_4$ Nanophosphors with High Internal Quantum Efficiency for Near-Infrared pc-LED

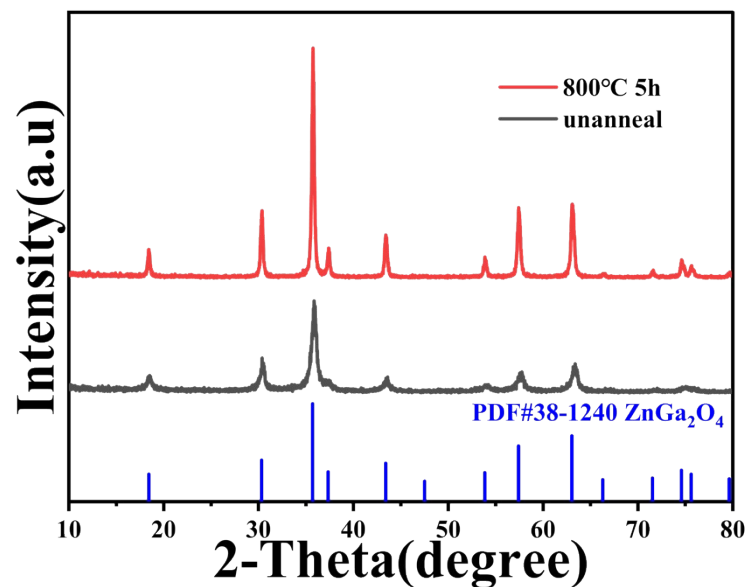
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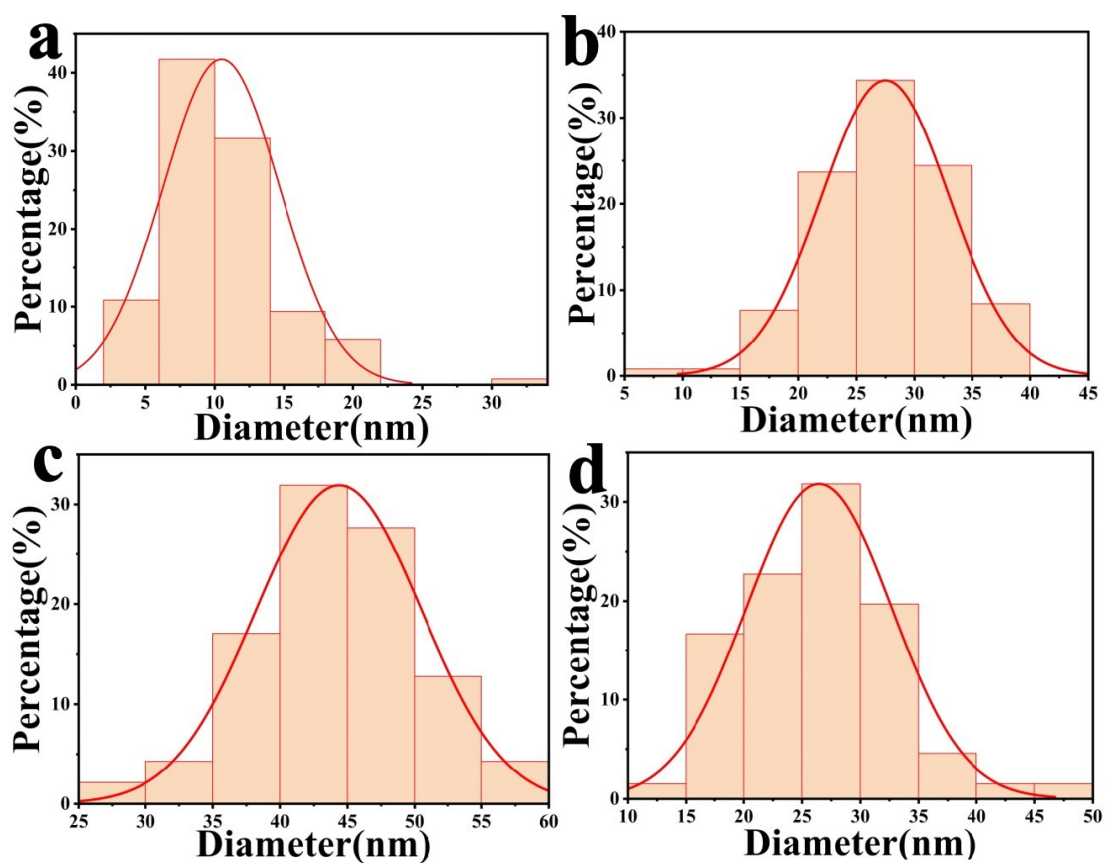
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**Figure S1.** XRD image of  $\text{ZnGa}_2\text{O}_4: 0.8\%\text{Cr}^{3+}$  at different hydrothermal temperature



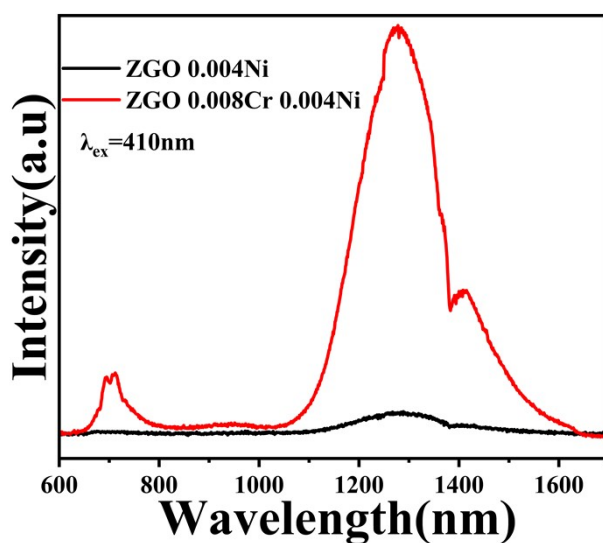
**Figure S2.** XRD comparison pattern before and after annealing of  $\text{ZnGa}_2\text{O}_4:0.8\%\text{Cr}^{3+}$  phosphor at hydrothermal temperature of  $180^\circ\text{C}$ .



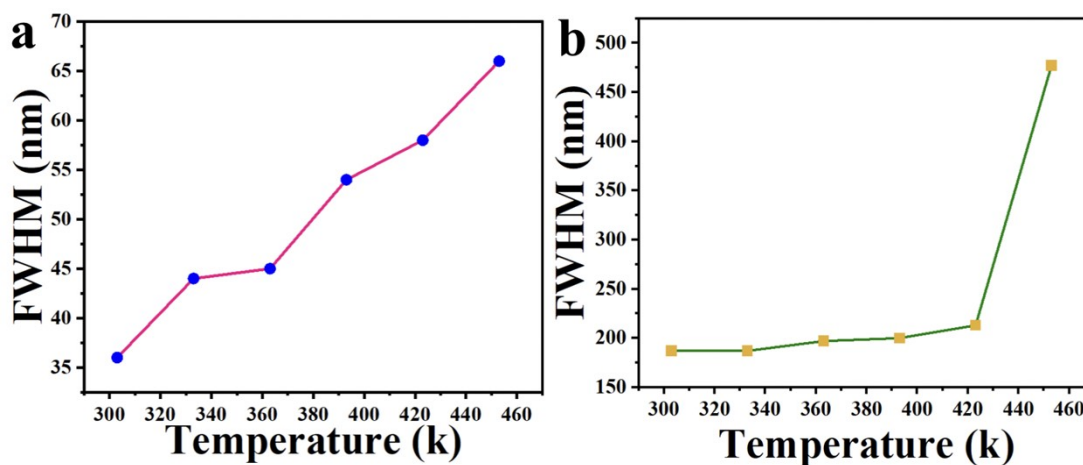
**Figure S3.** Histogram of particle size distribution of  $\text{ZnGa}_2\text{O}_4:0.8\%\text{Cr}^{3+}$  at hydrothermal temperature of  $140^\circ\text{C}$  (b).  $160^\circ\text{C}$  (c).  $180^\circ\text{C}$  (d).  $200^\circ\text{C}$

**Table S1** Related NIR phosphors performance comparison.

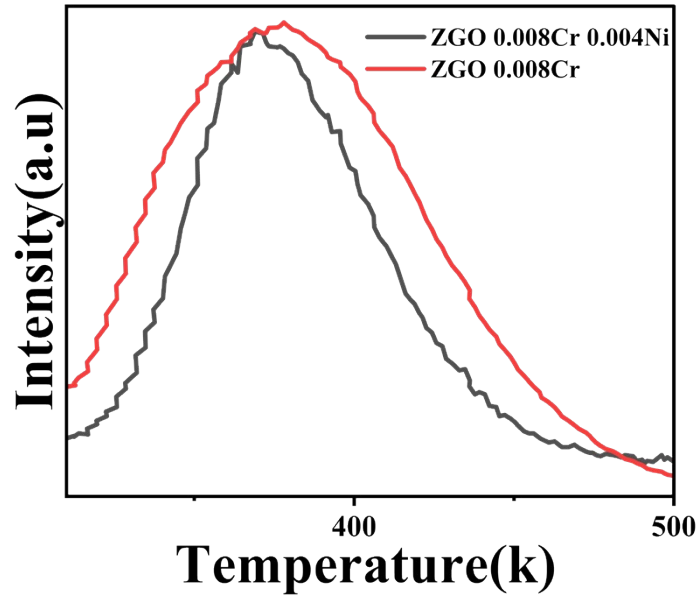
Phosphors	IQE (%)	EQE (%)	Ref.
ZnGa <sub>2</sub> O <sub>4</sub> :Cr <sup>3+</sup>	19.2	/	1
MgGa <sub>2</sub> O <sub>4</sub> :Cr <sup>3+</sup>	94	/	2
MgGa <sub>2</sub> O <sub>4</sub> :Cr <sup>3+</sup>	85.6	24.6	3
Zn <sub>3</sub> Ga <sub>2</sub> GeO <sub>8</sub> :Cr <sup>3+</sup>	88.5	18.7	4
LiGa <sub>5</sub> O <sub>8</sub> :Cr <sup>3+</sup>	60	/	5
Mg <sub>7</sub> Ga <sub>2</sub> GeO <sub>12</sub> :Cr <sup>3+</sup>	86	37	6
<b>ZnGa<sub>2</sub>O<sub>4</sub>:Cr<sup>3+</sup></b>	<b>90.24</b>	<b>23.32</b>	<b>this work</b>



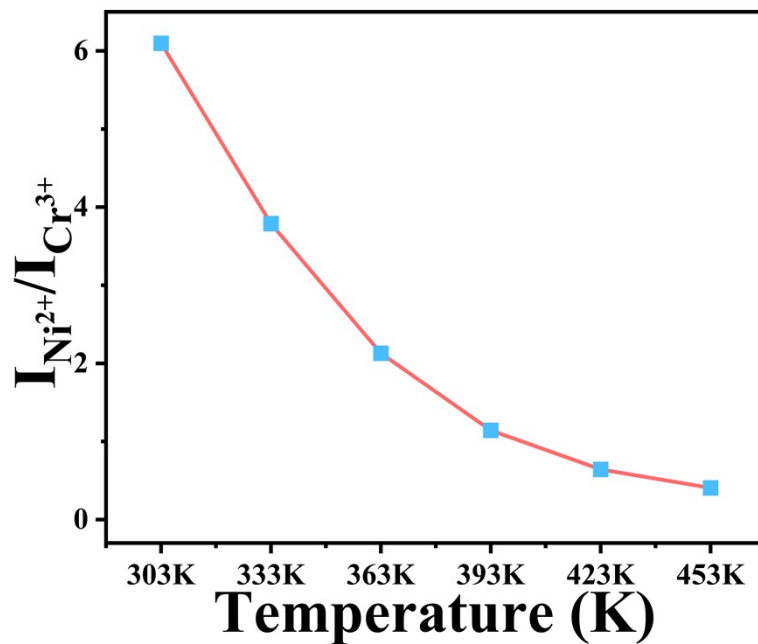
**Figure S4.** PL spectra of the ZnGa<sub>2</sub>O<sub>4</sub>:Ni<sup>2+</sup> and ZnGa<sub>2</sub>O<sub>4</sub>:Cr<sup>3+</sup>,Ni<sup>2+</sup>



**Figure S5.** Values of FWHM of (a) ZnGa<sub>2</sub>O<sub>4</sub>:0.8%Cr<sup>3+</sup> and (b) ZnGa<sub>2</sub>O<sub>4</sub>:0.8%Cr<sup>3+</sup>,0.4%Ni<sup>2+</sup> phosphors.



**Figure S6.** TL curves of  $\text{ZnGa}_2\text{O}_4:0.8\%\text{Cr}^{3+}$  and  $\text{ZnGa}_2\text{O}_4:0.8\%\text{Cr}^{3+}$ , 0.4%  $\text{Ni}^{2+}$  phosphors. The samples were pre-irradiated with a 356 nm-laser for 2 min.



**Figure S7.** The relative intensity ratio of  $\text{Ni}^{2+}$  to  $\text{Cr}^{3+}$  with increasing temperature.

## References

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