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# Alcohol-mediated solvothermal synthesis of persistent luminescence $Cr^{3+}$-doped Zinc gallate nanoparticles for bioimaging applications

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Chromium-doped zinc gallate ($ZnGa_2O_4^+$) stands out for its intense persistent luminescence in the first optical window of biological transparency (around 700 nm), which provides advantages in biomedical applications, including reduced need for continuous excitation, enhanced tissue penetration, minimized autofluorescence, and improved signal-to-noise ratio for biological imaging and sensing. These features make it a promising material for advancing diagnostics and therapies within biological systems. [1], [2] The synthesis of $ZnGa_2O_4$:$Cr^{3+}$ has been explored using various methodologies, but the precise control of morphological and optical properties still represents a major challenge.
This study explores the synthesis of $ZnGa_2O_4$:$Cr^{3+}$ nanoparticles via solvothermal method, investigating different ethanol/methanol ratios in the presence of oleic acid as a stabilizing agent. Crystallization of $ZnGa_2O_4$ cubic phase, with crystallite size varying according to the ethanol/methanol ratio is evidenced by X-ray diffractograms. Transmission electron microscopy of samples synthesized with ethanol reveals quasi-spherical nanoparticles approximately 6 nm in diameter, consistent with crystallite size calculations. Broad-band emission centered at 697 nm, attributed to $^4T_2 \rightarrow {}^4A_2$ transition has been detected for all samples, with variations in intensity and persistent luminescence dynamics linked to synthesis parameters.

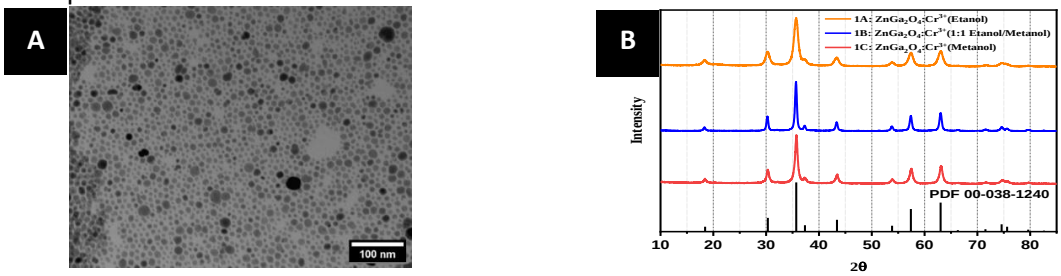


**Fig 1. A)** TEM image of the sample ($ZnGa_2O_4$:$Cr^{3+}$) synthesized only with ethanol. **B)** XRD of samples 1A, 1B and 1C.

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**References**

[1] X. Wei *et al.*, "Longer and Stronger: Improving Persistent Luminescence in Size-Tuned Zinc Gallate Nanoparticles by Alcohol-Mediated Chromium Doping", *ACS Nano*, vol. 14, nº 9, p. 12113–12124, set. 2020, doi: 10.1021/acsnano.0c05655.

[2] Y. E. Serge-Correales *et al.*, "Size Control and Improved Aqueous Colloidal Stability of Surface-Functionalized $ZnGa_2O_4$:$Cr^{3+}$ Bright Persistent Luminescent Nanoparticles", *Langmuir*, vol. 39, nº 4, p. 1495–1506, jan. 2023, doi: 10.1021/acs.langmuir.2c02871.