

## A new recipe for the rapid microwave synthesis of high quantum yield Mn<sup>2+</sup>-doped ZnGa<sub>2</sub>O<sub>4</sub> phosphors for potential forensic applications

Samvit G. Menon\*, Arup Kumar Kunti\*, David E. Motaung, Hendrik C. Swart\*

<sup>a</sup> Department of Physics, University of the Free State, Bloemfontein 9301, Republic of South Africa

\* Corresponding authors: [samvit.menon@gmail.com](mailto:samvit.menon@gmail.com); [arupkunti@gmail.com](mailto:arupkunti@gmail.com); [swarthc@ufs.ac.za](mailto:swarthc@ufs.ac.za)

### Calculations for internal and external quantum yields

Excitation wavelength,  $\lambda_{\text{ex}} = 243 \text{ nm}$

Number of photons incident on the Spectralon® reference sample ( $I_{\text{in}}$  or  $E_{\text{R}}$ ) =  $2.48 \times 10^7$

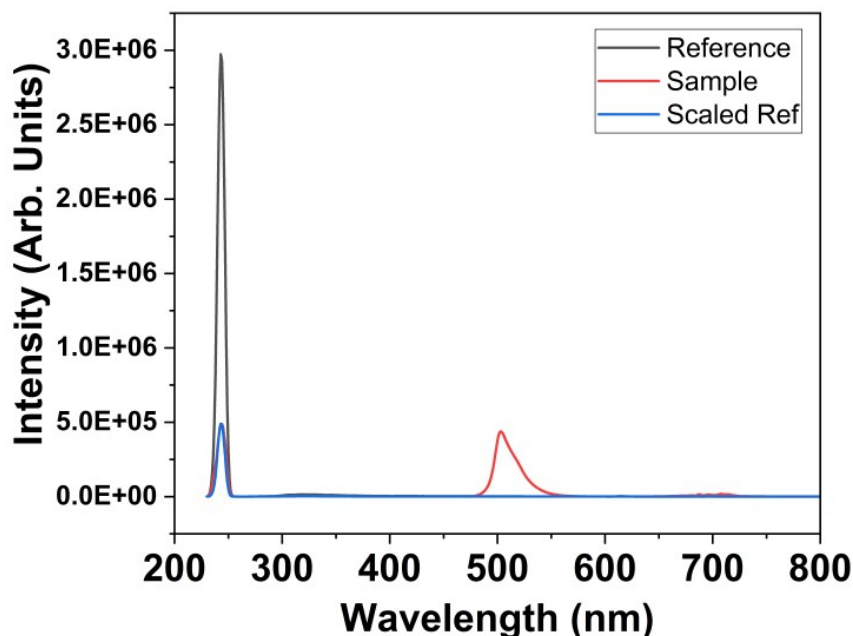
Number of photons incident on the sample ( $E_{\text{S}}$ ) =  $4.91 \times 10^6$

Number of photons absorbed ( $I_{\text{ab}}$ ) =  $1.98 \times 10^7$

Number of photons emitted ( $I_{\text{em}}$  or  $L_{\text{S}}$ ) =  $1.27 \times 10^7$

Internal quantum yield (IQY) =  $I_{\text{em}}/I_{\text{ab}} = L_{\text{S}}/(E_{\text{R}} - E_{\text{S}}) = 64\%$

External quantum yield (EQY) =  $I_{\text{em}}/I_{\text{in}} = L_{\text{S}}/E_{\text{R}} = 47\%$



**Fig. S1** Plots used in evaluating the quantum yields of the Mn<sup>2+</sup>-doped ZnGa<sub>2</sub>O<sub>4</sub> sample annealed at 1200 °C for 2 h