Supporting Information for

Structure and luminescence properties of Dy^{3+} doped quaternary tungstate $Li_3Ba_2Gd_3(WO_4)_8$ for applications in wLEDs

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1-DTA analysis:

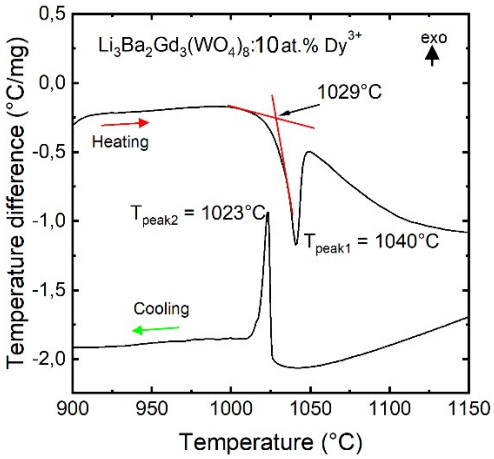

Fig.S1. Differential thermal analysis (DTA) curves for $Li_3Ba_2Gd_3(WO_4)_8$:10 at.% Dy^{3+}

2-RAMAN and FTIR spectroscopy:

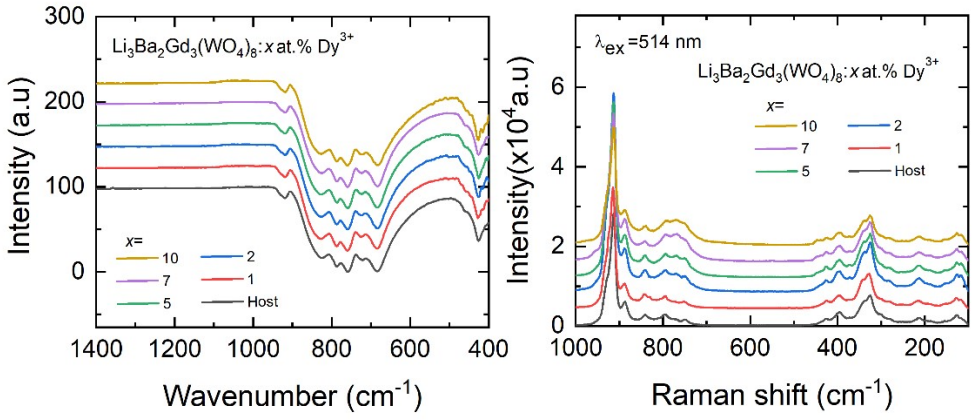

Fig.S2. (a) FTIR spectra (b) Raman spectra of $Li_3Ba_2Gd_3(WO_4)_8$ doped at different concentration levels of Dy^{3+} ions

3- Bandgap and electronic structure:

The Kubelka-Munk (K-M) relation is employed to evaluate the optical band gap values of the fabricated powder [39]:

$$F(R_\infty) = \frac{(1-R_\infty)^2}{2R_\infty} = K/S \quad , \qquad \text{(Eq.S1)}$$

where $R_\infty = R_{sample}/R_{standard}$; K is the absorption coefficient and and S is the scattering coefficient. On the other hand, the band gap E_g of the material and the linear absorption coefficient α of the material are correlated by the Tauc equation:

$$\alpha h\nu = C1 \times (h\nu - E_g)^{1/2} \quad , \qquad \text{(Eq.S2)}$$

whereby, hν is the energy of the photon and C1 represents the proportionality constant. In the case where, the photons scatter from the surface of the material in a perfectly diffuse manner, then the value of the absorption coefficient K becomes almost equal to 2α. Assuming that S is constant with respect to the wavelength λ, the relationship between F(R_∞) and E_g can be obtained using equations (2) and (3), as follows:

$$[F(R_\infty)h\nu]^2 = C2 \times (h\nu - E_g) \quad , \qquad \text{(Eq.S3)}$$

3- Calculation of the chromaticity coordinates:

In the case of the CIE 1931-XYZ tri-chromatic system, the tri-stimulus values are defined as follow:

$$X = \int \bar{x}(\lambda) I(\lambda) d\lambda \quad , \qquad \text{(Eq.S4)}$$

$$Y = \int \bar{y}(\lambda) I(\lambda) d\lambda \quad , \qquad \text{(Eq.S5)}$$

$$Z = \int \bar{z}(\lambda) I(\lambda) d\lambda \quad , \qquad \text{(Eq.S6)}$$

where $\bar{x}(\lambda), \bar{y}(\lambda), \bar{z}(\lambda)$ are the observer's colour functions defined by the CIEI(λ) and $I(\lambda)$ is the spectral intensity of the material. The chromaticity coordinates are determined as follows:

$$x = \frac{X}{X+Y+Z} \quad , \qquad \text{(Eq.S7)}$$

$$y = \frac{Y}{X+Y+Z} \quad , \qquad \text{(Eq.S8)}$$

$$z = \frac{Z}{X+Y+Z} \quad , \qquad \text{(Eq.S9)}$$

where $x + y + z = 1$, so it is sufficient to define chromaticity with two numbers, usually x and y.