Supporting Information for:

Improving performance of luminescent nanothermometers based on non-thermally and thermally coupled levels of lanthanides by modulating laser power

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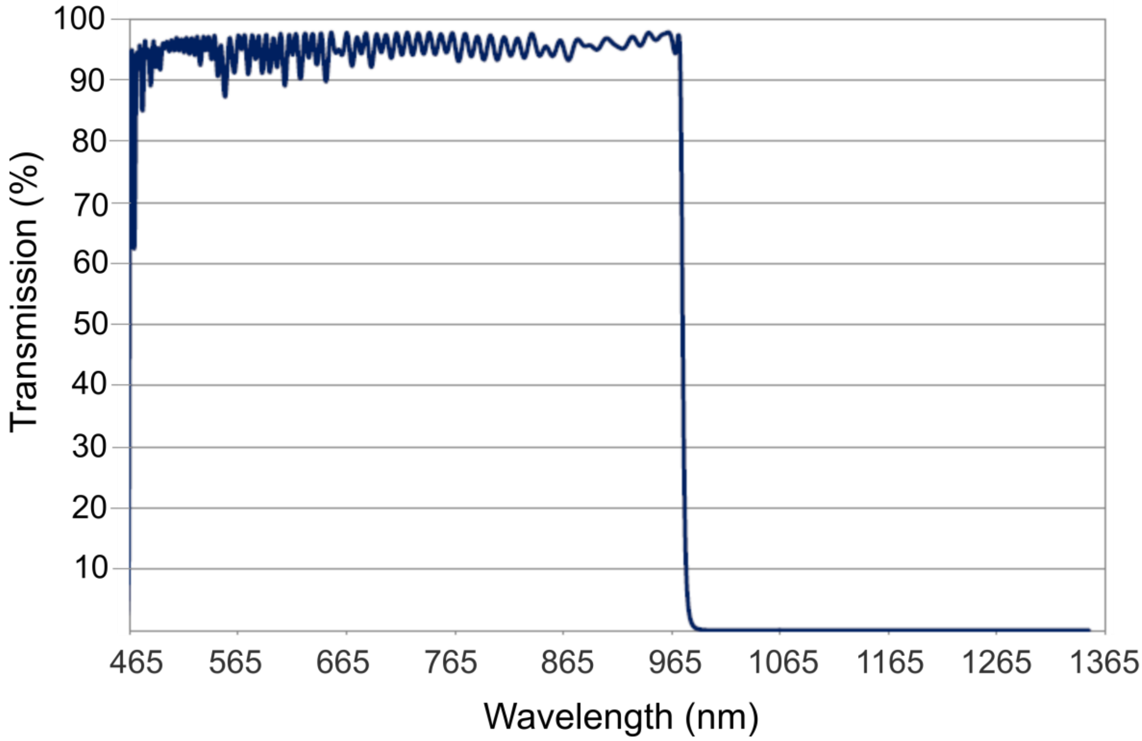

Figure S1. Transmission data for the optical filter used, i.e. short-pass 950 nm.

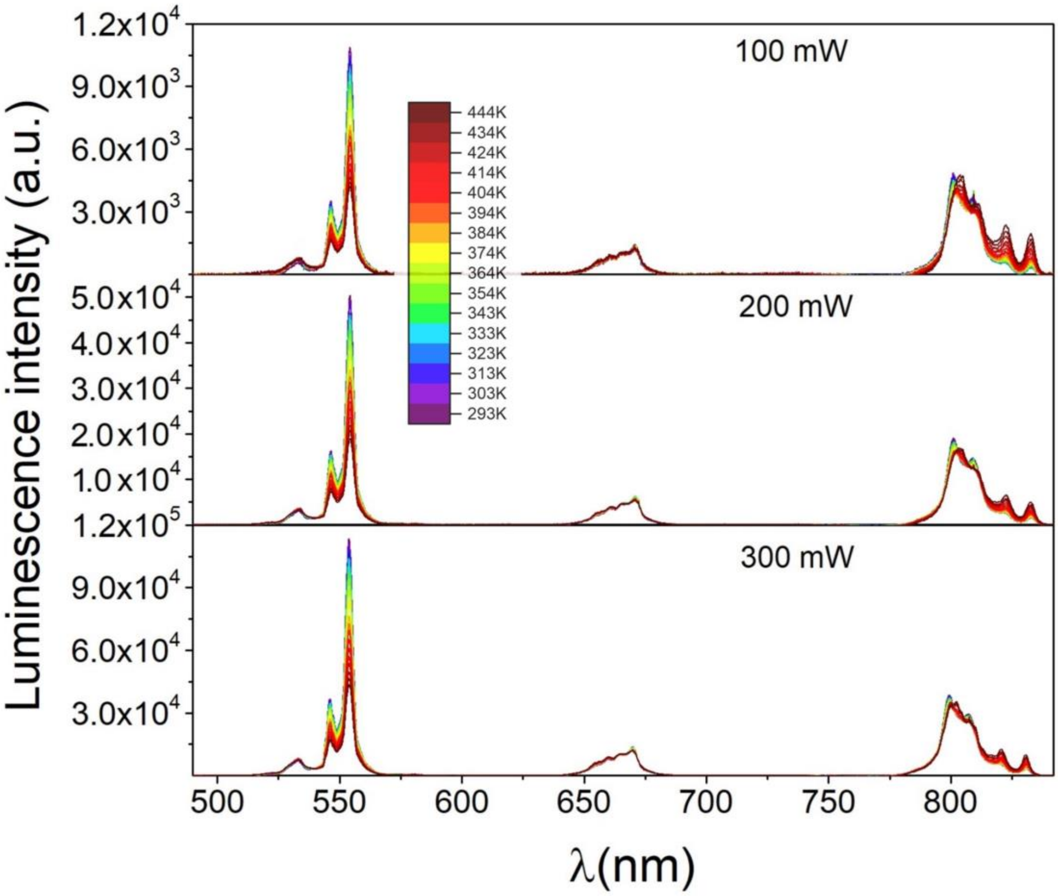

Figure S2. Non-normalized up-conversion emission spectra for the sample YVO_4: Yb^{3+}, Er^{3+}, measured at increasing temperature values, and with different laser power (100, 200 and 300 mW); λ_{ex} = 975 nm.

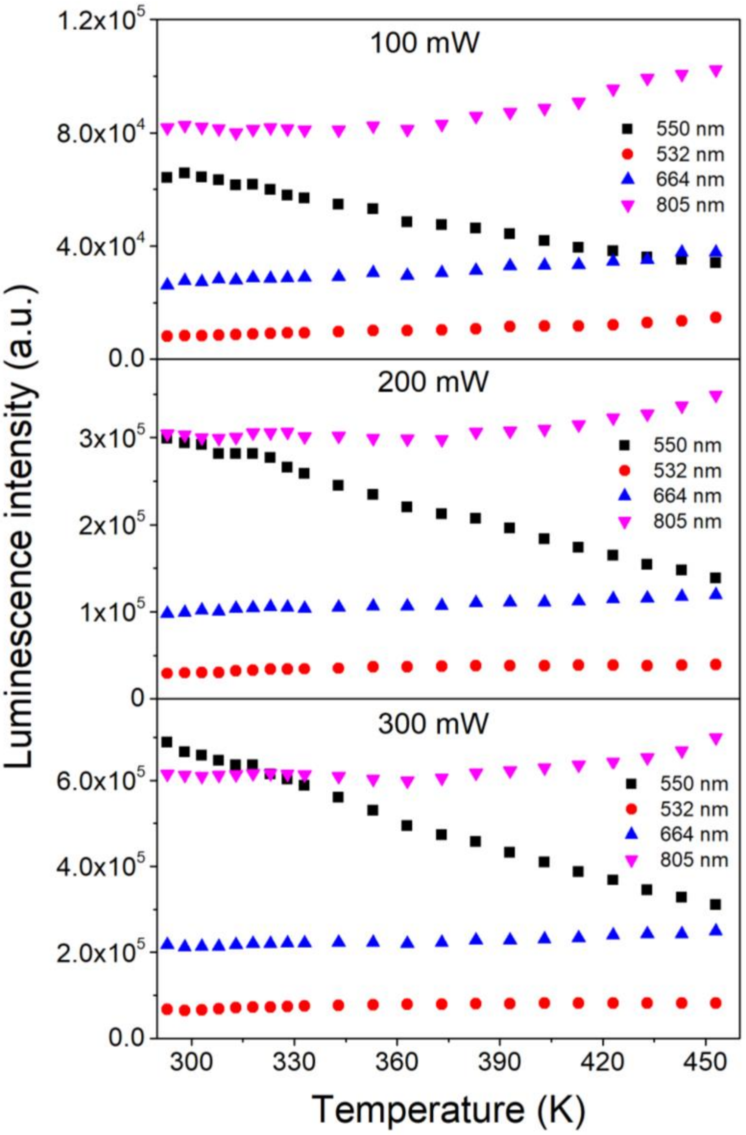

Figure S3. Integrated up-conversion luminescence intensities as a function of temperature.

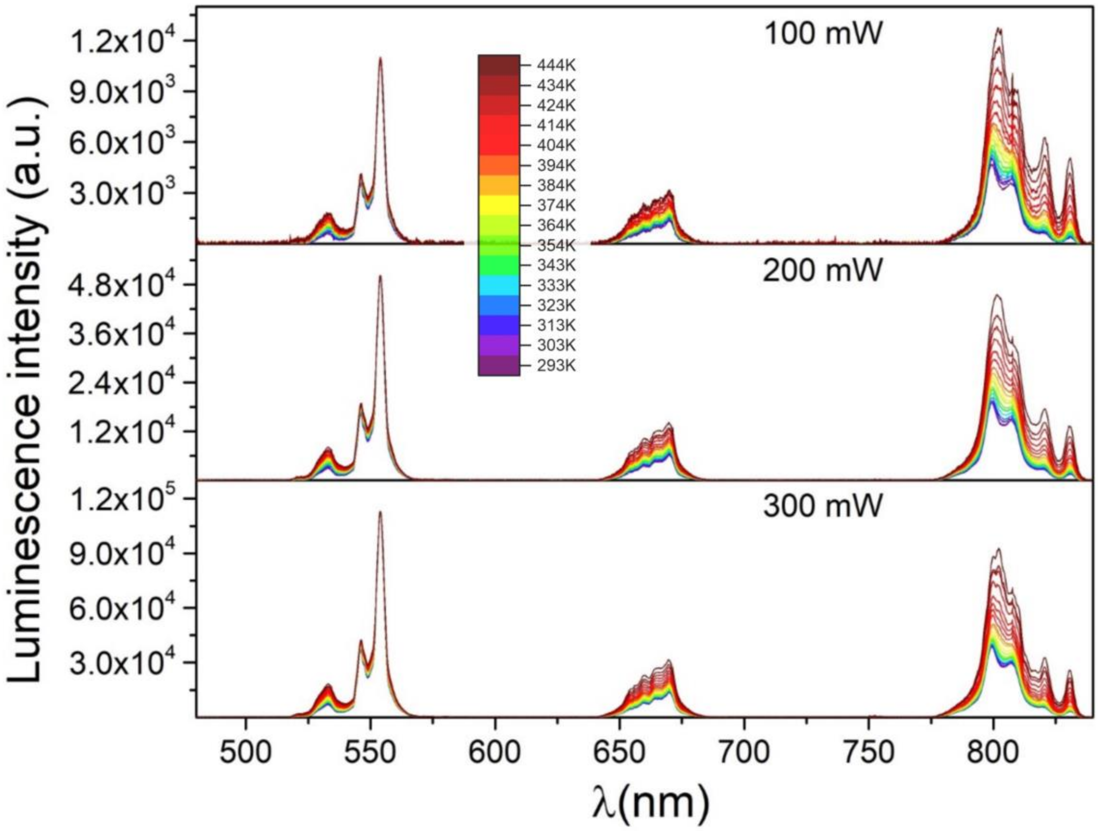

Figure S4. Normalized up-conversion emission spectra for the sample YVO_4: Yb^{3+}, Er^{3+}, measured at increasing temperature values, and with different laser power (100, 200 and 300 mW); λ_{ex} = 975 nm; all spectra are normalized to the band centered around 550 nm.

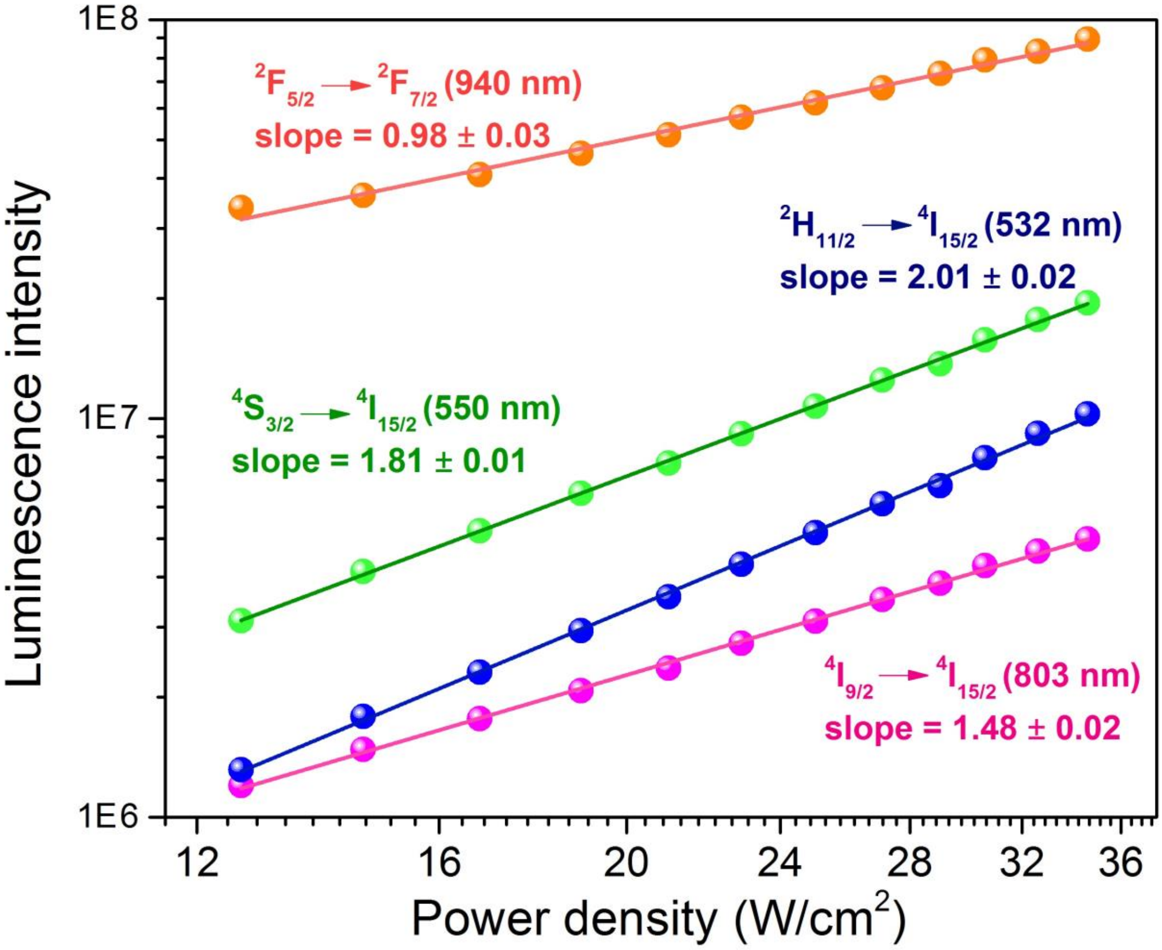

Figure S5. The log-log dependence of the luminescence intensity on the pump power for the sample YVO_4: Yb^{3+}, Er^{3+}; λ_{ex} = 975 nm.

According to Brites et al. (*C. D. S. Brites, A. Millán and L. D. Carlos. Lanthanides in Luminescent Thermometry, in Handbook on the Physics and Chemistry of Rare Earths, 2016, vol. 49, pp. 339–427*) temperature resolution δT (also known as temperature uncertainty) is the smallest change of temperature that gives a detectable change of the measured signal (spectroscopic parameter). Due to the fact that temperature resolution parameter, δT is exclusively associated with changes in LIR values, temperature uncertainty can be expressed by the Taylor's series expansion of the temperature variation with LIR, namely:

$$\delta T = \frac{\partial T}{\partial LIR}\delta LIR + \frac{1\partial^2 T}{2!\partial LIR^2}(\delta LIR)^2 + \cdots + \frac{1\partial^n T}{n!\partial LIR^n}(\delta LIR)^n \quad (1)$$

where δLIR is the uncertainty in the determination of luminescence intensity ratio (LIR). Assuming the expansion in T is dominated by the first part of the Eq. 1 (*Baker, S.N., McCleskey, T.M., Baker, G.A., 2005. An ionic liquid-based optical thermometer. Ionic liquids IIIB: Fundamentals, Progress, Challenges and Opportunities, vol. 902. American Chemical Society, Washington, DC171 – 181, Chapter 14*), it can be expressed in terms of relative sensitivity (S_r):

$$\delta T = \frac{1}{S_r}\frac{\delta LIR}{LIR} \quad (2)$$

Please note, that δT depends on two factors, namely: I) the performance of the thermometer, expressed as the relative sensitivity; and II) the experimental setup (that obviously limits δLIR/LIR).

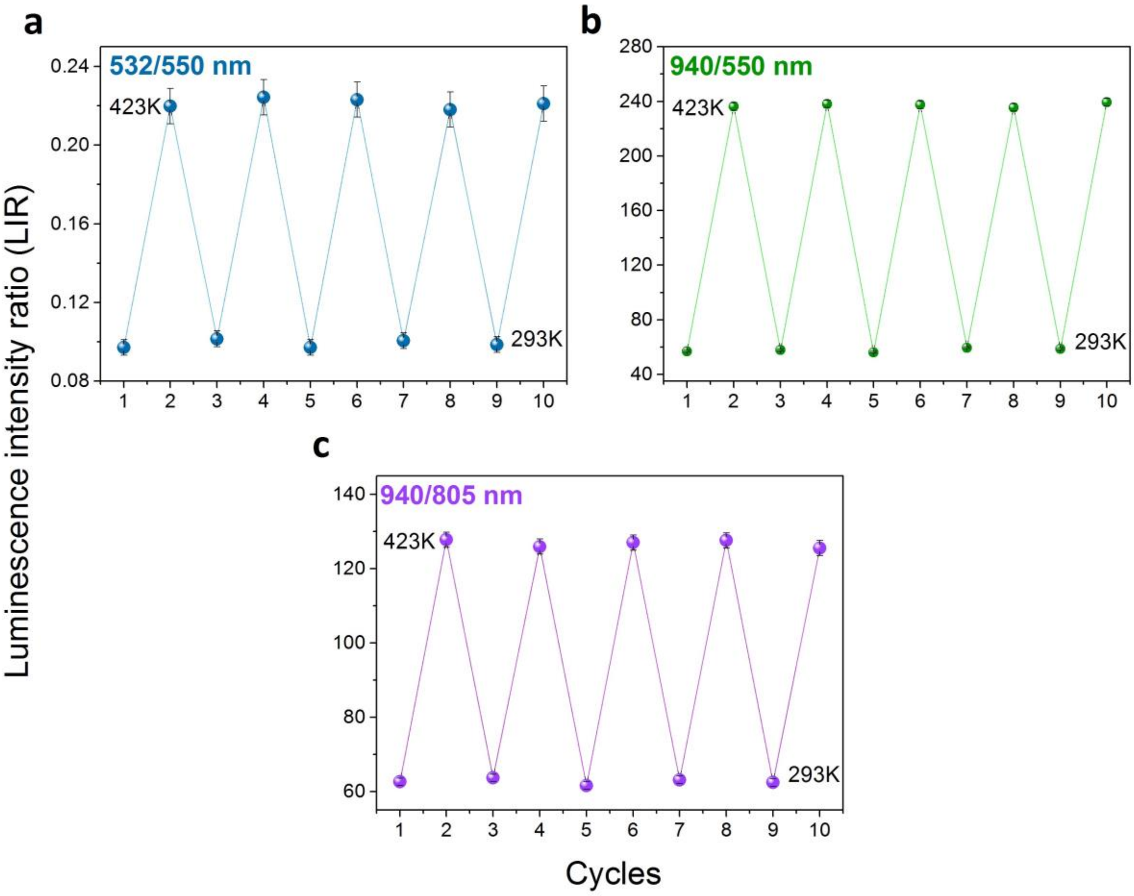

Figure S6. Thermal cycling of the YVO_4: Yb^{3+}, Er^{3+} sample between the low (293 K) and high (423 K) temperatures, for the determined thermometric parameters, i.e. a) 532/550 nm, b) 935/550 nm and c) 935/805 nm band intensity ratios; λ_{ex} = 975 nm (300 mW).