

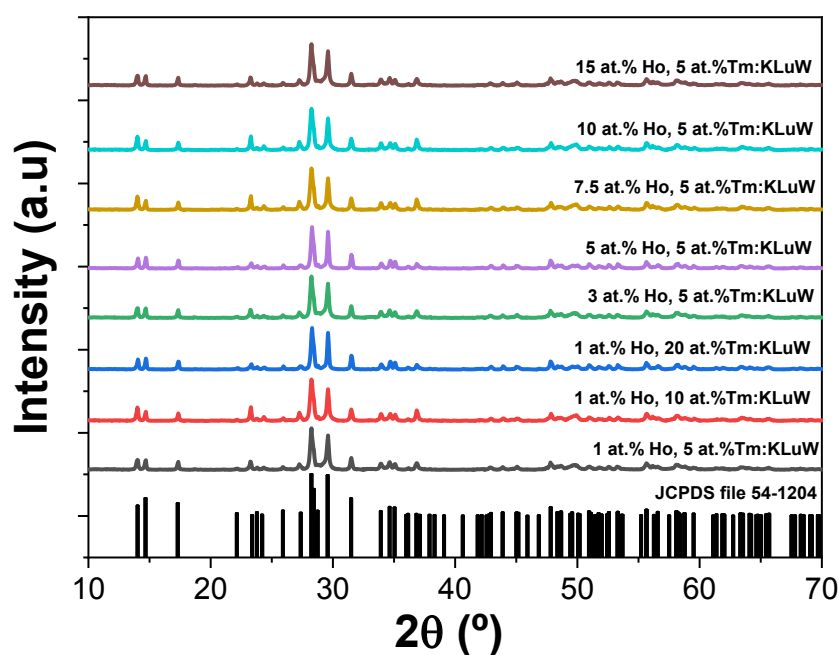
## SUPPORTING INFORMATION

### Short-wavelength infrared self-assessed photothermal agents based on Ho,Tm:KLu(WO<sub>4</sub>)<sub>2</sub> nanocrystals

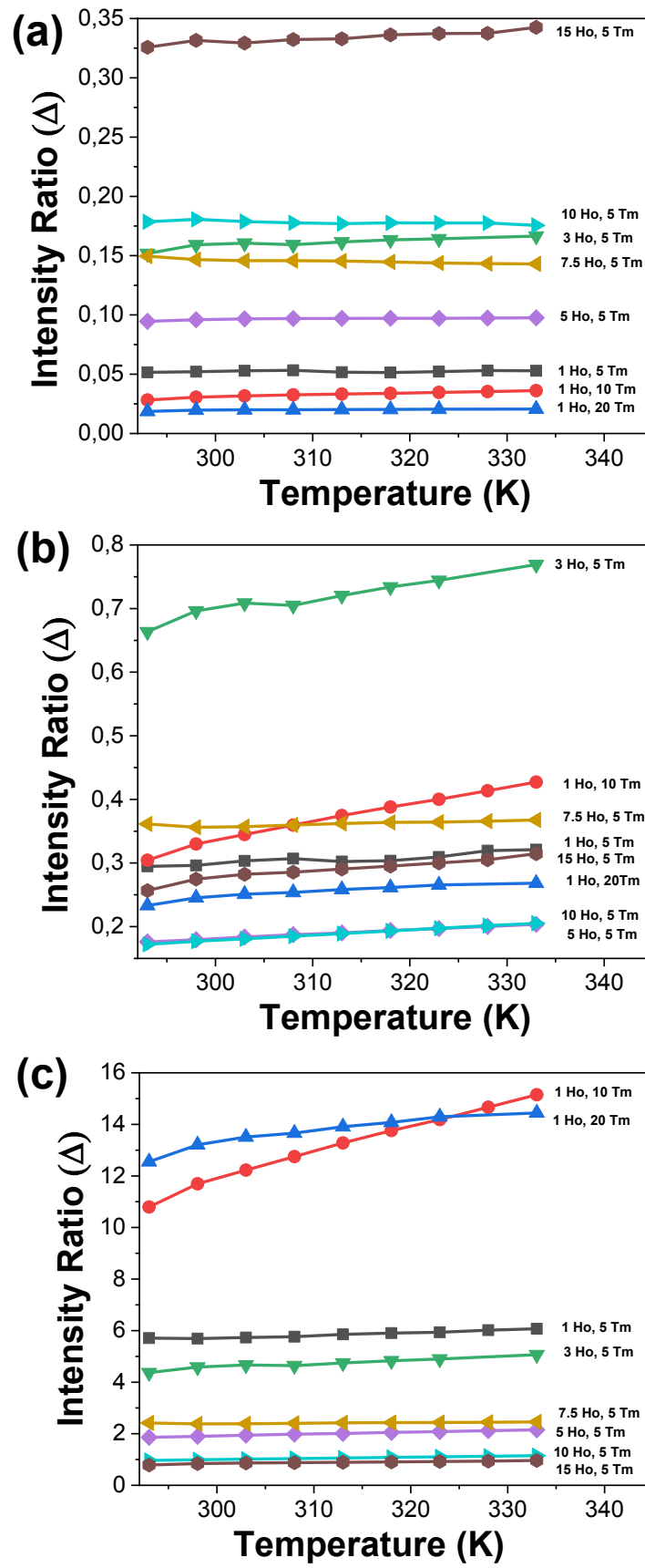
Albenc Nexha, Joan J. Carvajal\*, Maria Cinta Pujol, Francesc Díaz and Magdalena Aguiló

*Universitat Rovira i Virgili, Departament Química Física i Inorgànica, Física i Cristal·lografia de Materials i Nanomaterials (FiCMA-FiCNA) – EMaS, Campus Sescelades, E-43007, Tarragona, Spain*

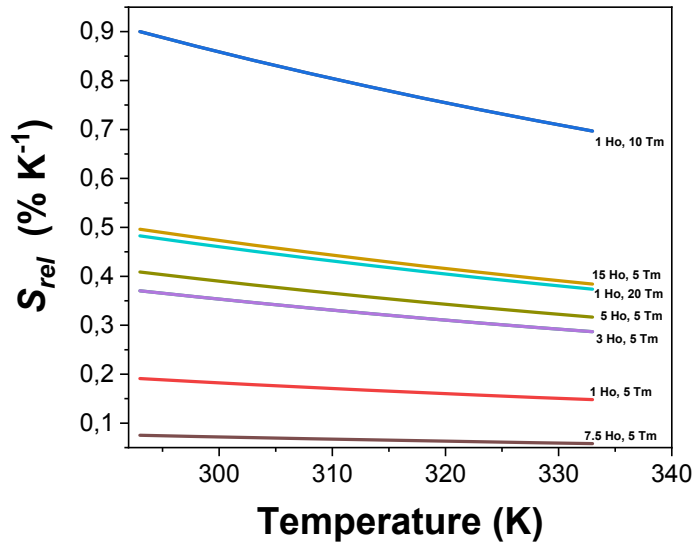
\*Corresponding author: [joanjosep.carvajal@urv.cat](mailto:joanjosep.carvajal@urv.cat)



**Fig. S1:** XRD patterns of the all Ho,Tm:KLuW nanocrystals synthesized by the modified sol-gel Pechini method containing different dopant concentrations. The reference pattern of KLu(WO<sub>4</sub>)<sub>2</sub> (JCPDS file 54-1204)<sup>1</sup> is included for comparison.



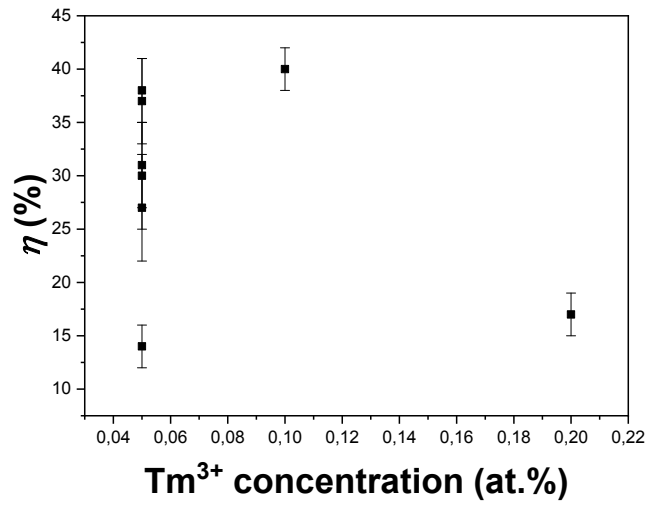
**Fig. S2:** The variation of the thermometric parameter  $\Delta$  with temperature: (a) 1.45  $\mu\text{m}$ /1.8  $\mu\text{m}$ , (b) 1.45  $\mu\text{m}$ /1.96  $\mu\text{m}$ , and (c) 1.8  $\mu\text{m}$ /1.96  $\mu\text{m}$ .



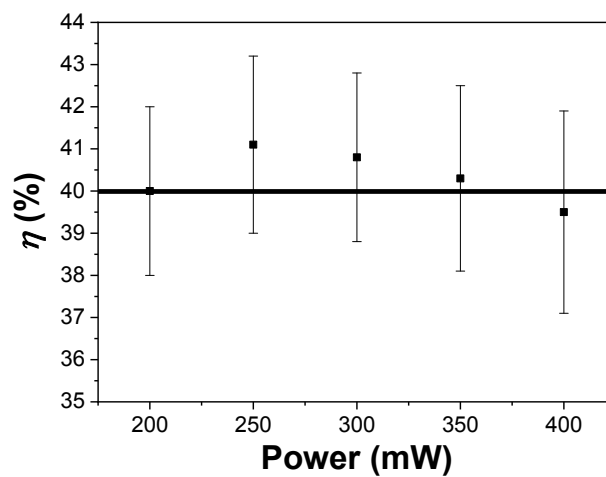
**Fig. S3:** The relative thermal sensitivity of the  $\text{KLu}_{1-x}\text{Ho}_x\text{Tm}_y(\text{WO}_4)_2$  nanocrystals operating in the SWIR regime for the emission intensity ratio 1.8  $\mu\text{m}$ /1.96  $\mu\text{m}$

**Table S1:** Photothermal conversion efficiency and relative thermal sensitivity of all the synthesized Ho,Tm:KLu(WO<sub>4</sub>)<sub>2</sub> nanocrystals

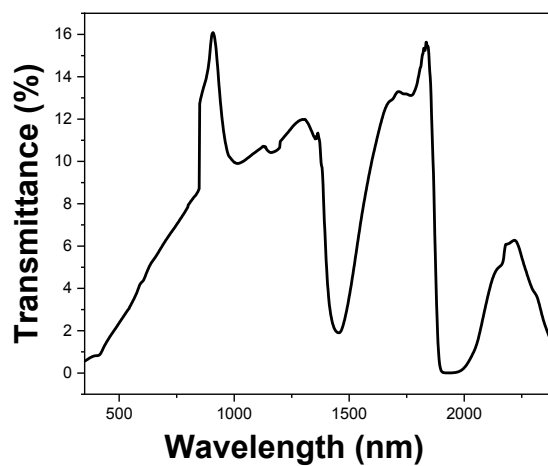
| Ho <sup>3+</sup> (at. %) | Tm <sup>3+</sup> (at. %) | $S_{rel}$ (% K <sup>-1</sup> ) | $\eta$ (%) |
|--------------------------|--------------------------|--------------------------------|------------|
| 0.01                     | 0.05                     | 0.19                           | 38 ± 3     |
| 0.01                     | 0.1                      | 0.90                           | 40 ± 2     |
| 0.01                     | 0.2                      | 0.37                           | 17 ± 2     |
| 0.03                     | 0.05                     | 0.37                           | 30 ± 5     |
| 0.05                     | 0.05                     | 0.40                           | 37 ± 4     |
| 0.075                    | 0.05                     | 0.075                          | 14 ± 2     |
| 0.1                      | 0.05                     | 0.49                           | 31 ± 4     |
| 0.15                     | 0.05                     | 0.48                           | 27 ± 5     |



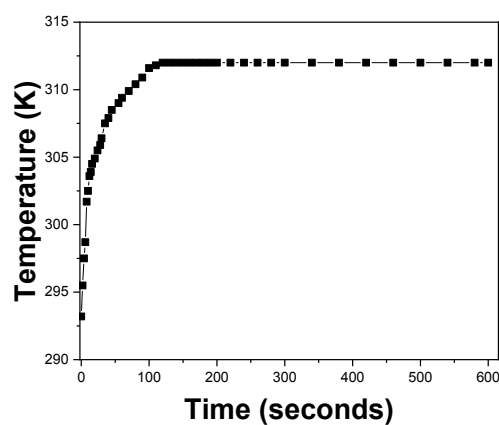
**Fig. S4:** Variation of the photothermal conversion efficiency with the concentration of Tm<sup>3+</sup>.



**Fig. S5:** Variation of the photothermal conversion efficiency of the  $\text{KLu}_{1-x}\text{yHo}_x\text{Tm}_y(\text{WO}_4)_2$  ( $x=0.01$  at.%,  $y=0.1$  at.%) nanocrystals with the laser pumping power.



**Fig. S6:** Transmittance of the chicken breast piece of meat used in the *ex-vivo* experiment.



**Fig. S7:** Evolution of the temperature with time when the  $\text{KLu}_{1-x}\text{yHo}_x\text{Tm}_y(\text{WO}_4)_2$  ( $x=0.01$  at.%,  $y=0.1$  at.%) nanocrystals are covered with a 2 mm thick chicken breast piece of meat, recorded with the reference thermocouple.

**References:**

1. M. C. Pujol, X. Mateos, A. Aznar, X. Solans, S. Suriñach, J. Massons, F. Díaz and M. Aguiló, *J. Appl. Cryst.*, 2006, **39**, 230-236.