

Electronic Supplementary Information

White light upconversion in (Ho,Tm,Yb):KLu(WO₄)₂ nanocrystals

E.W. Barrera^a M.C. Pujol^{b,*} J.J. Carvajal^a, X. Mateos^a, R.M. Solé^a, J. Massons^a, A. Speghini^b, M. Bettinelli^b, C. Cascales^c, M. Aguiló^a, F. Díaz^a.

^a Física i Cristal·lografia de Materials i Nanomaterials (FiCMA-FiCNA)-EMAS, Universitat Rovira i Virgili (URV), Campus Sescelades, c/ Marcel·lí Domingo, s/n, E-43007 Tarragona, Spain

^b Laboratorio di Chimica dello Stato Solido, Dipartimento di Biotecnologie, Università di Verona and INSTM, UdR Verona, Ca' Vignal, Strada Le Grazie 15, 37134 Verona, Italy

^c Instituto de Ciencia de Materiales de Madrid, CSIC, calle Sor Juana Inés de la Cruz, Cantoblanco, E-28049 Madrid, Spain

* corresponding author: mariacinta.pujol@urv.cat

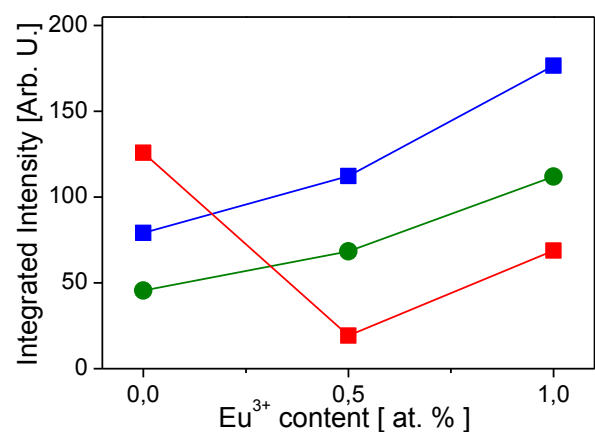


Figure S1. Dependence of the emission intensities with Eu³⁺ content. Excitation power corresponds to 354 W/cm².

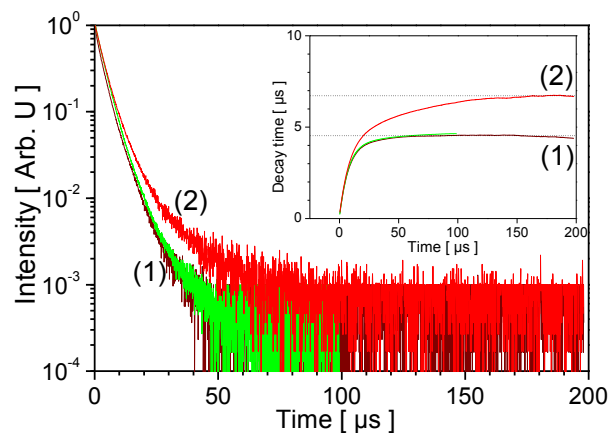


Figure S2. Photoluminescence decay of Ho³⁺ ⁵S₂ (1) and ⁵F₅ (2) multiplets after 460 nm excitation for 1 % Ho, 10 % Yb:KLuW nanocrystals (T0H1Y10 sample). The inset shows the convergence of decay time value.

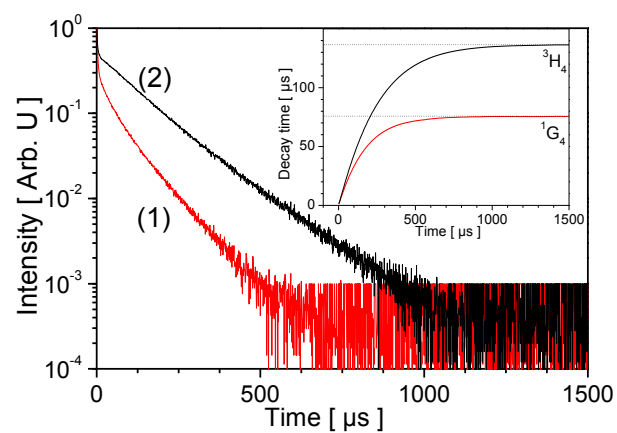


Figure S3. RT photoluminescence decay of 1G_4 (1) and 3H_4 (2) multiplets to the ground state after 460 nm excitation for 1 % Tm, 10 % Yb:KLuW nanocrystals (T1H0Y10 sample). The inset shows the convergence towards decay time value.

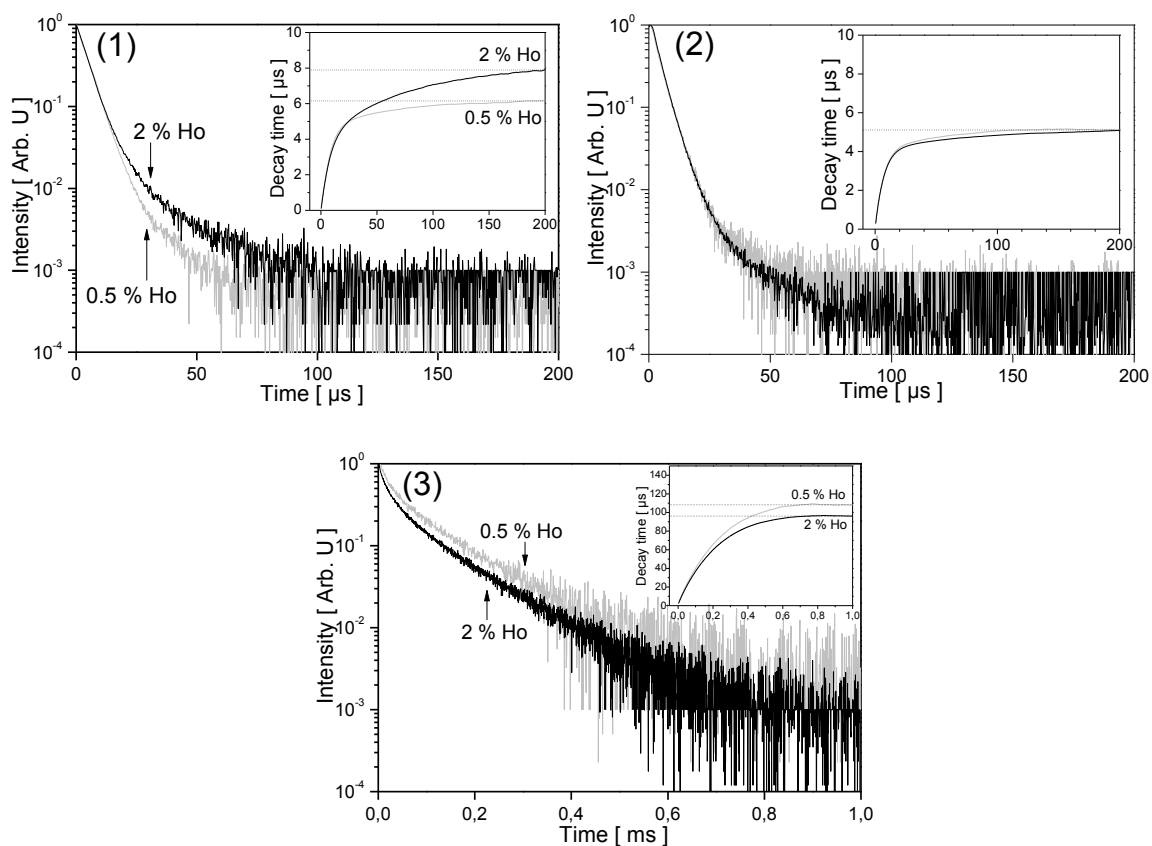


Figure S4. RT photoluminescence decay of $^5S_2, ^5F_4 \rightarrow ^5I_8$ (1), $^5F_5 \rightarrow ^5I_8$ (2) and $^3H_4 \rightarrow ^3H_6$ (3) transitions in Ho^{3+} doped 1 % Tm, 1 % Yb: KLuW nanocrystals (T0.5H1Y1 and T2H1Y1 samples) The inset shows in each case the convergence of the decay time value.

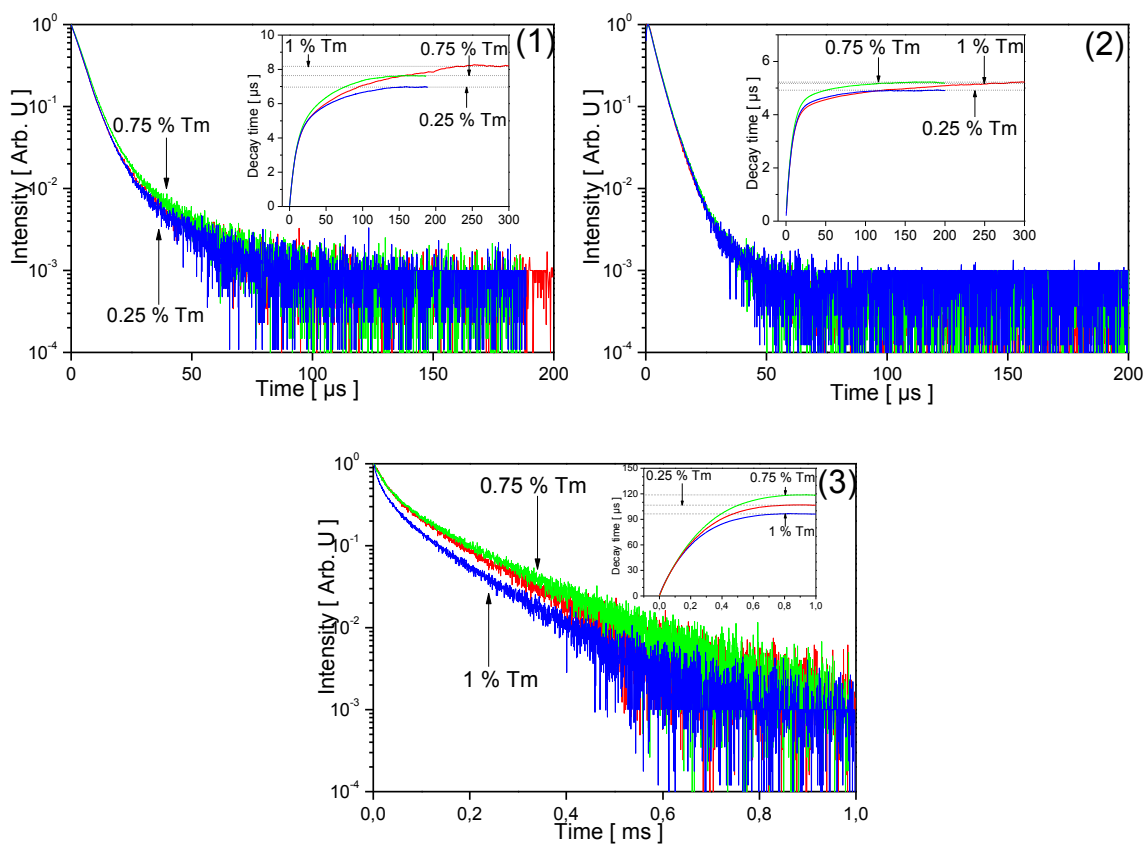


Figure S5. RT photoluminescence decay observed for the $^5S_2, ^5F_4 \rightarrow ^5I_8$ (1), $^5F_5 \rightarrow ^5I_8$ (2) and $^3H_4 \rightarrow ^3H_6$ (3) transitions after 460 nm excitation in Tm³⁺ doped 2 % Ho, 1 % Yb:KLuW nanocrystals (T0.25H2Y1, T0.75H2Y1 and T1H2Y1 samples). The insets show the convergence of the decay time value.

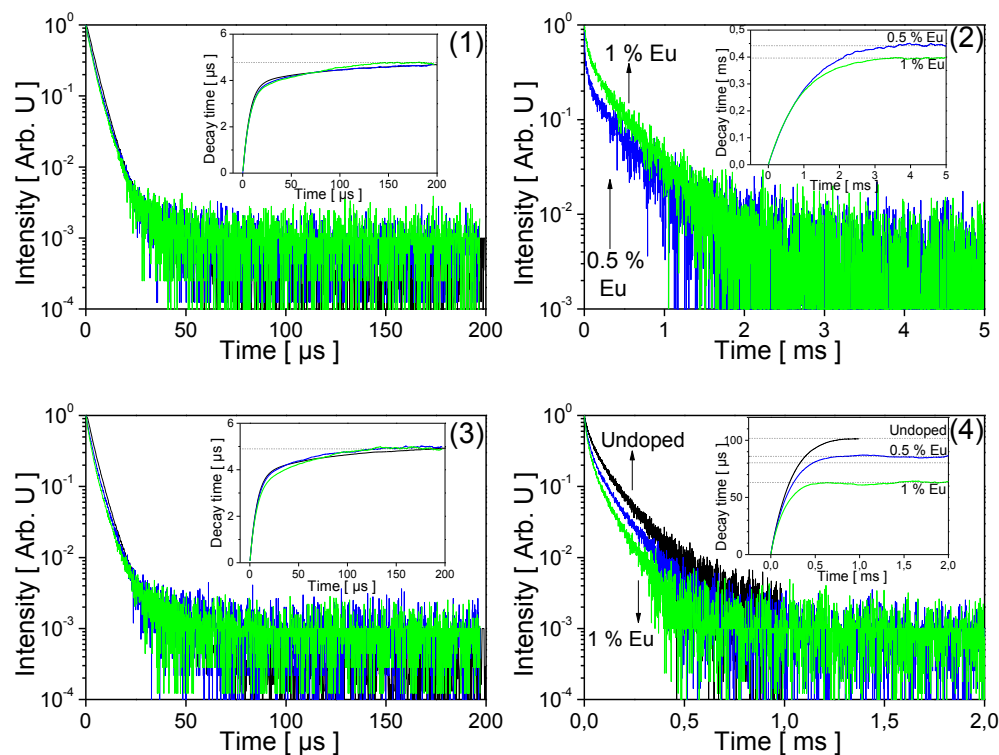


Figure S6. Room temperature photoluminescence decay of $\text{Ho}^{3+} \ ^5\text{S}_2, \ ^5\text{F}_4 \rightarrow \ ^5\text{I}_8$ (1), $\text{Eu}^{3+} \ ^5\text{D}_0 \rightarrow \ ^7\text{F}_2$ (2) $\text{Ho}^{3+} \ ^5\text{F}_5 \rightarrow \ ^5\text{I}_8$ (3) and $\text{Tm}^{3+} \ ^3\text{H}_4 \rightarrow \ ^3\text{H}_6$ (4) transitions in Eu^{3+} doped 1 % Tm, 2 % Ho, 1 % Yb:KLuW nanocrystals (T1H2Y1, T1H2E0.5Y1 and T1H2E1Y1 samples). The insets show the convergence of decay time value.