Electronic Supplementary Material (ESI) for Nanoscale Advances.

Supporting Information

NIR Luminescence lifetime nanothermometry based on phonon assisted Yb^{3+}-Nd^{3+} energy transfer

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Keywords: luminescence thermometry, lifetimes, phonon assisted energy transfer, lanthanides, relative sensitivity, orthophosphates, nanocrystals

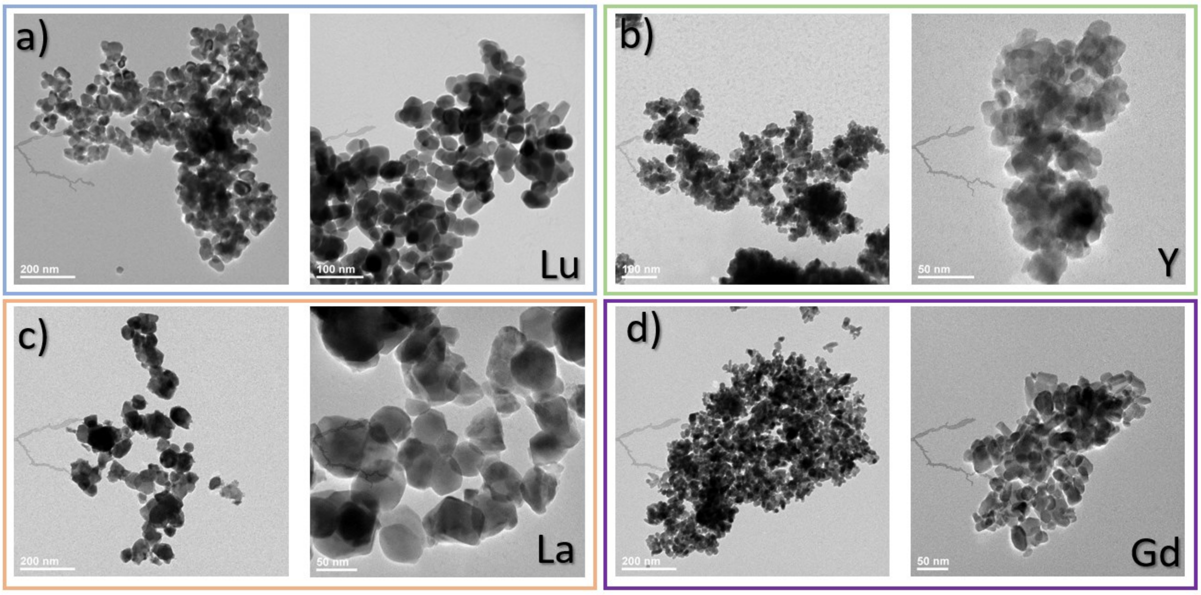

Figure S1. The representative TEM images of $Nd_{0.5}Lu_{0.4}Yb_{0.1}PO_4$ -a) $Nd_{0.5}Y_{0.4}Yb_{0.1}PO_4$ -b) $Nd_{0.5}La_{0.4}Yb_{0.1}PO_4$ -c) and $Nd_{0.5}Gd_{0.4}Yb_{0.1}PO_4$ -d).

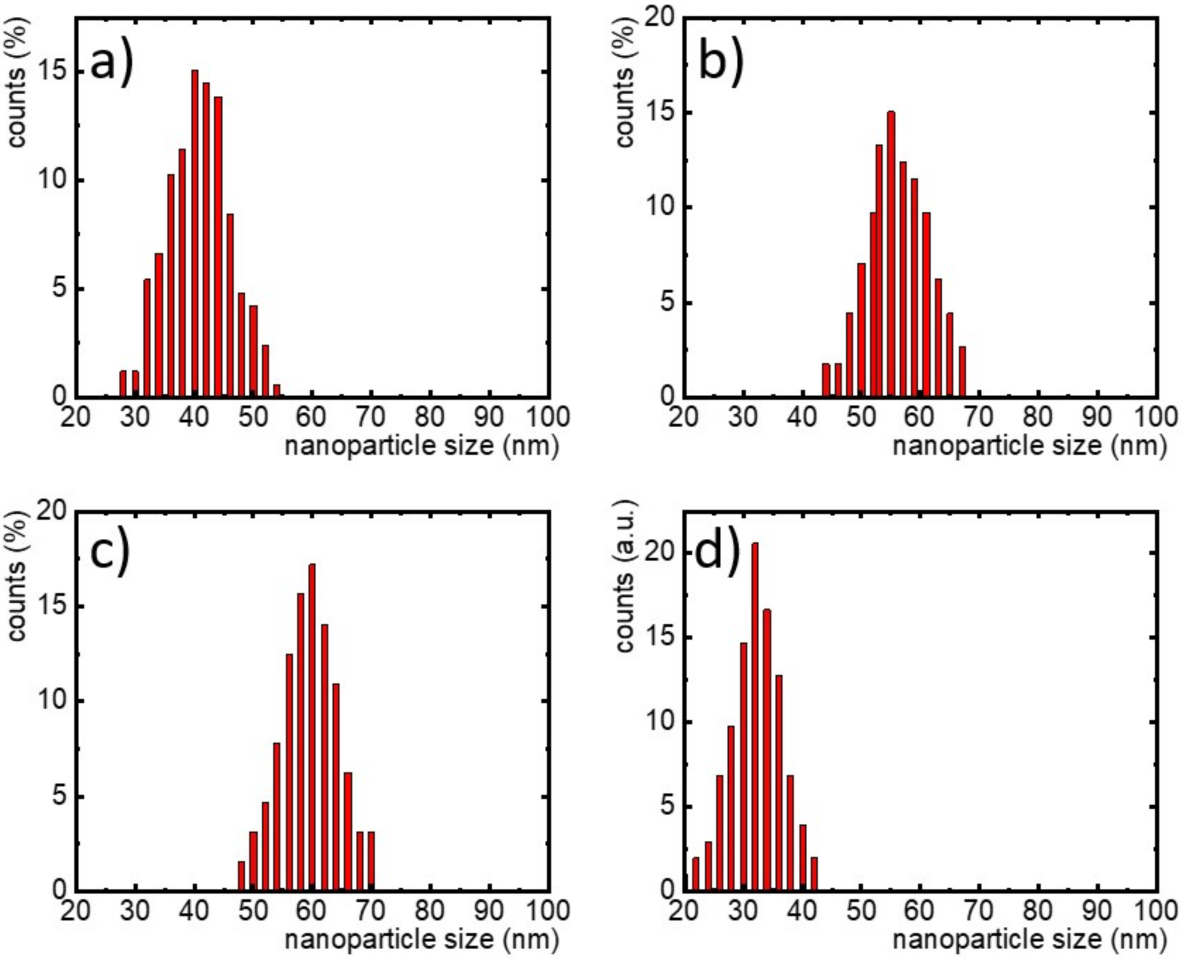

Figure S2. The histograms of the nanoparticles diameter of $Nd_{0.5}Y_{0.4}Yb_{0.1}PO_4$ -a), $Nd_{0.5}Lu_{0.4}Yb_{0.1}PO_4$ -b) $Nd_{0.5}La_{0.4}Yb_{0.1}PO_4$ -c) and $Nd_{0.5}Gd_{0.4}Yb_{0.1}PO_4$ -d).

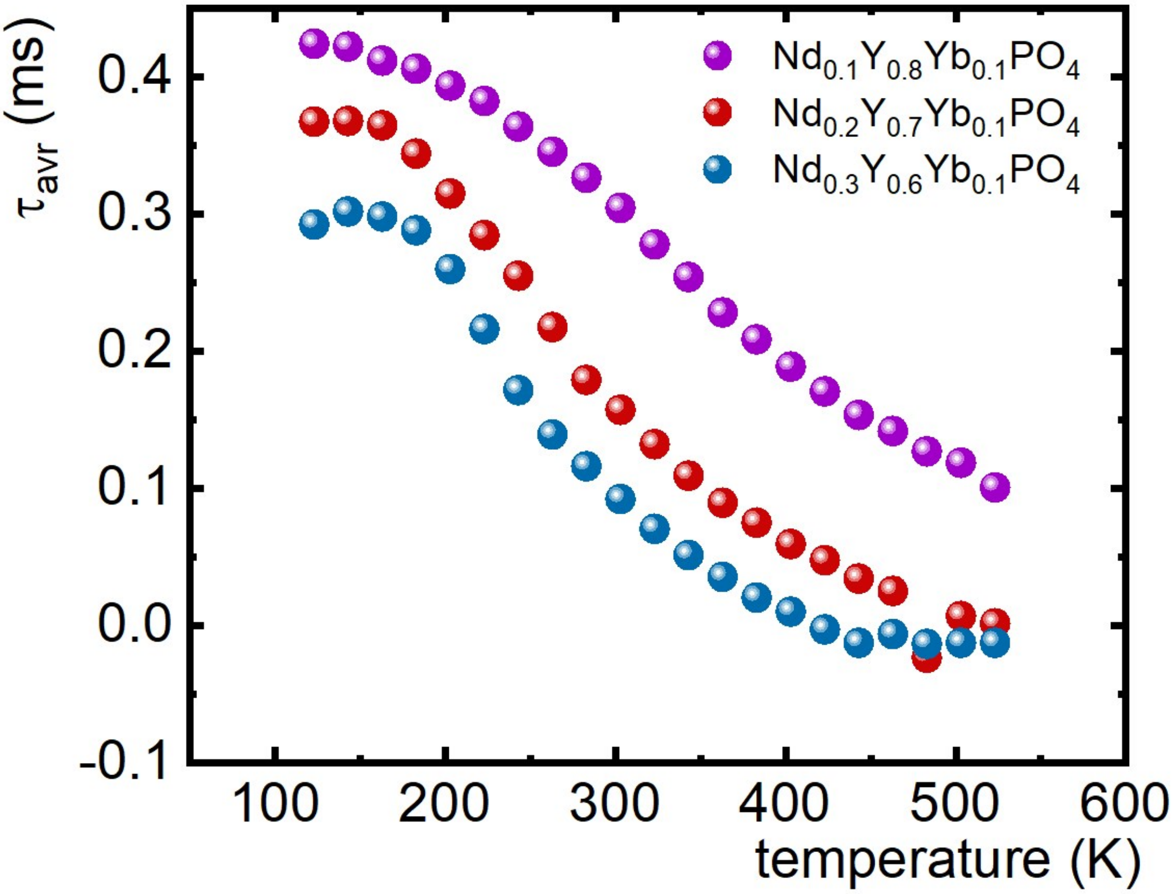

Figure S3. The τ_{avr} as a function of temperature for different concentration of Nd^{3+} ions

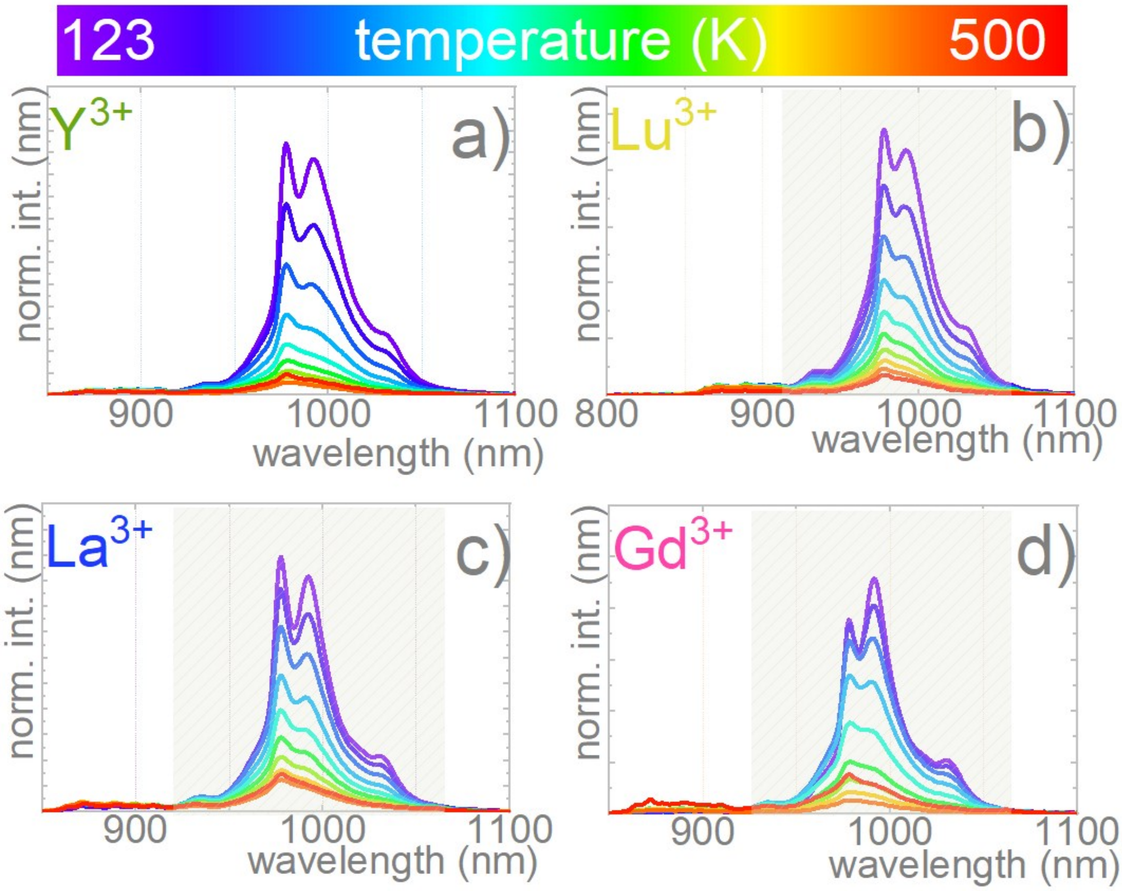

Figure S4. The emission spectra of $Nd_{0.5}Y_{0.4}Yb_{0.1}PO_4$ -a), $Nd_{0.5}Lu_{0.4}Yb_{0.1}PO_4$ -b), $Nd_{0.5}La_{0.4}Yb_{0.1}PO_4$ -c), $Nd_{0.5}Gd_{0.4}Yb_{0.1}PO_4$ -d) nanocrystals obtained upon λ_{exc}=808 nm at different temperatures.

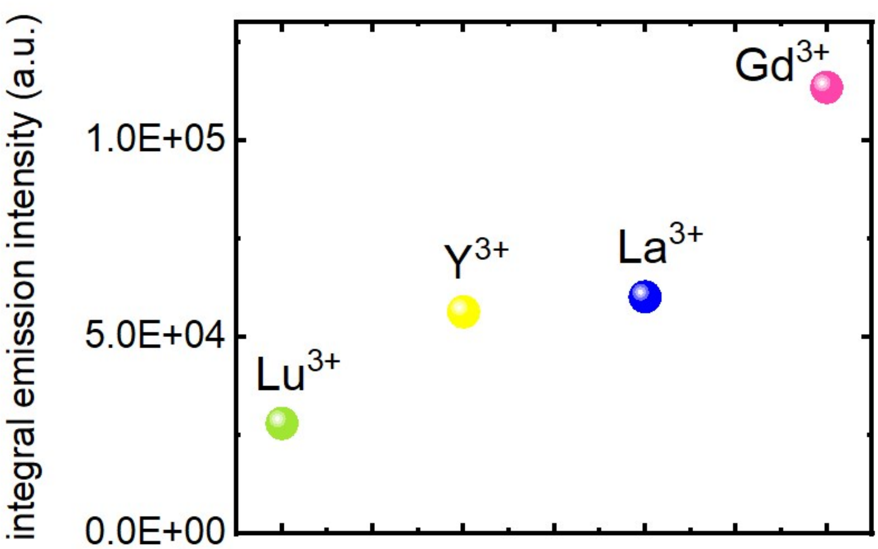

Figure S5. The comparison of the integral emission intensity of Yb^{3+} ions ($^2F_{5/2}\rightarrow{}^2F_{7/2}$ electronic transition) measured at room temperature upon λ_{exc}=808 nm

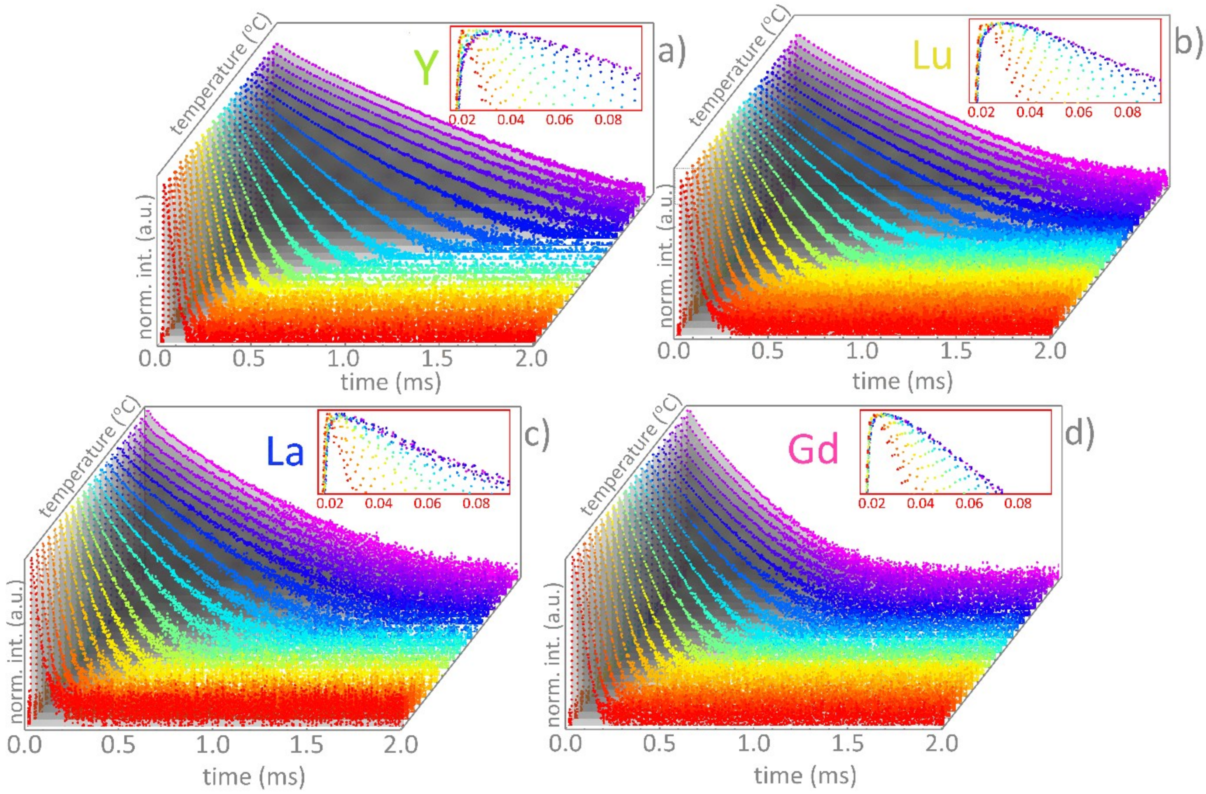

Figure S6. The luminescence decay profiles of $^{2}F_{5/2}$ state of Yb^{3+} ions measured at different temperatures of $Nd_{0.5}Y_{0.4}Yb_{0.1}PO_4$ -a), $Nd_{0.5}Lu_{0.4}Yb_{0.1}PO_4$ -b), $Nd_{0.5}La_{0.4}Yb_{0.1}PO_4$ -c), $Nd_{0.5}Gd_{0.4}Yb_{0.1}PO_4$ -d) nanocrystals.

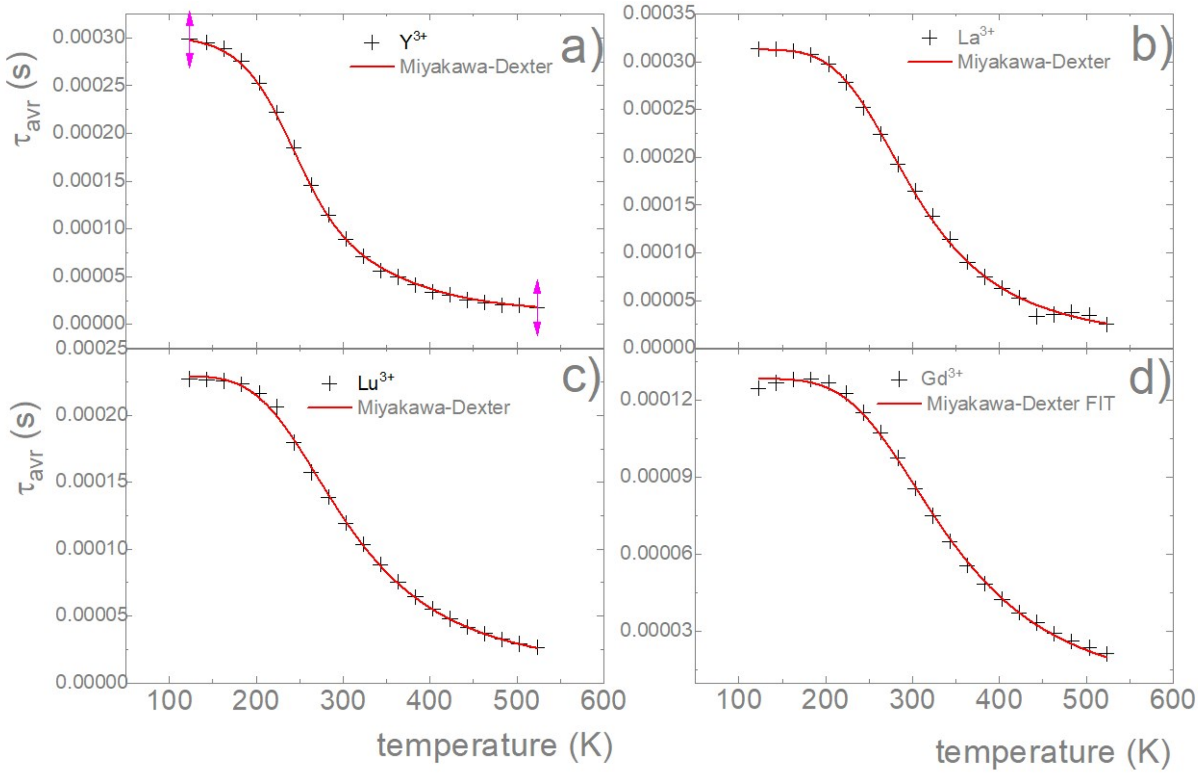

Figure S7. The τ_{avr} as a function of temperature with the fit using Miyakawa-Dexter for $Nd_{0.5}Y_{0.4}Yb_{0.1}PO_4$ -a), $Nd_{0.5}La_{0.4}Yb_{0.1}PO_4$ -b), $Nd_{0.5}Lu_{0.4}Yb_{0.1}PO_4$ -c), $Nd_{0.5}Gd_{0.4}Yb_{0.1}PO_4$ -d).

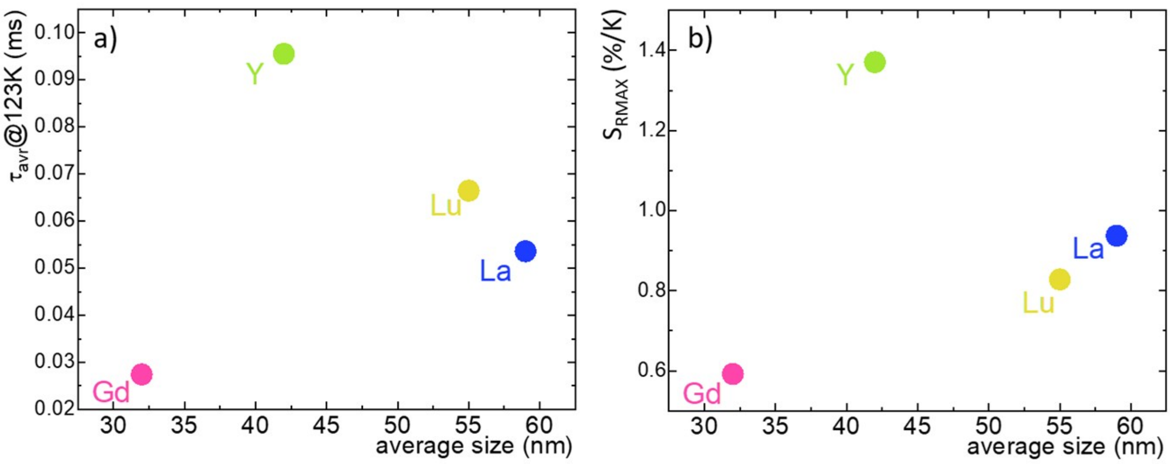

Figure S8. The τ_{avr} of the $^2F_{5/2}$ state measured at 123 K of the Yb^{3+} ions (a); and the S_{RMAX} (b) in the $REPO_4:Nd^{3+},Yb^{3+}$ nanocrystals shown as a function of the average particle size.

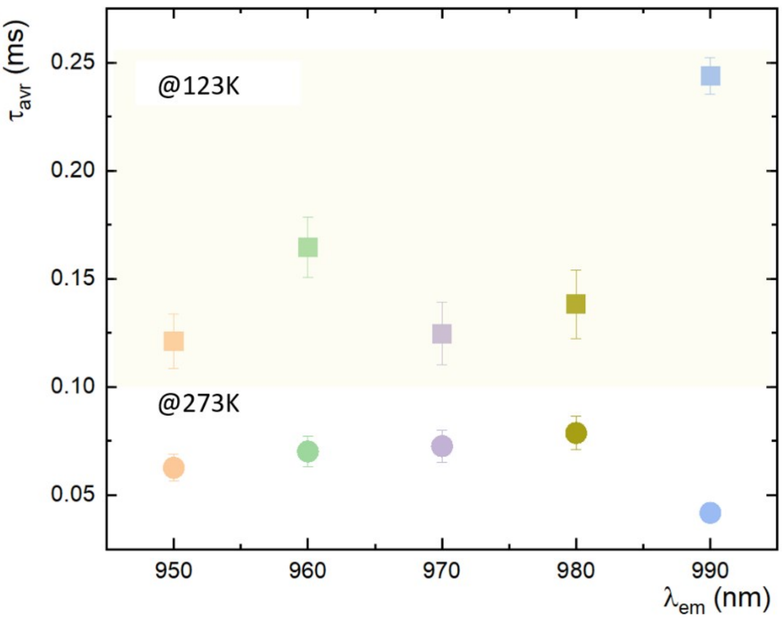

Figure S9. The τ_{avr} measured for $Nd_{0.5}Y_{0.4}Yb_{0.1}PO_4$ nanocrystals at 123 K and 273 K for different emission wavelength (λ_{em}).

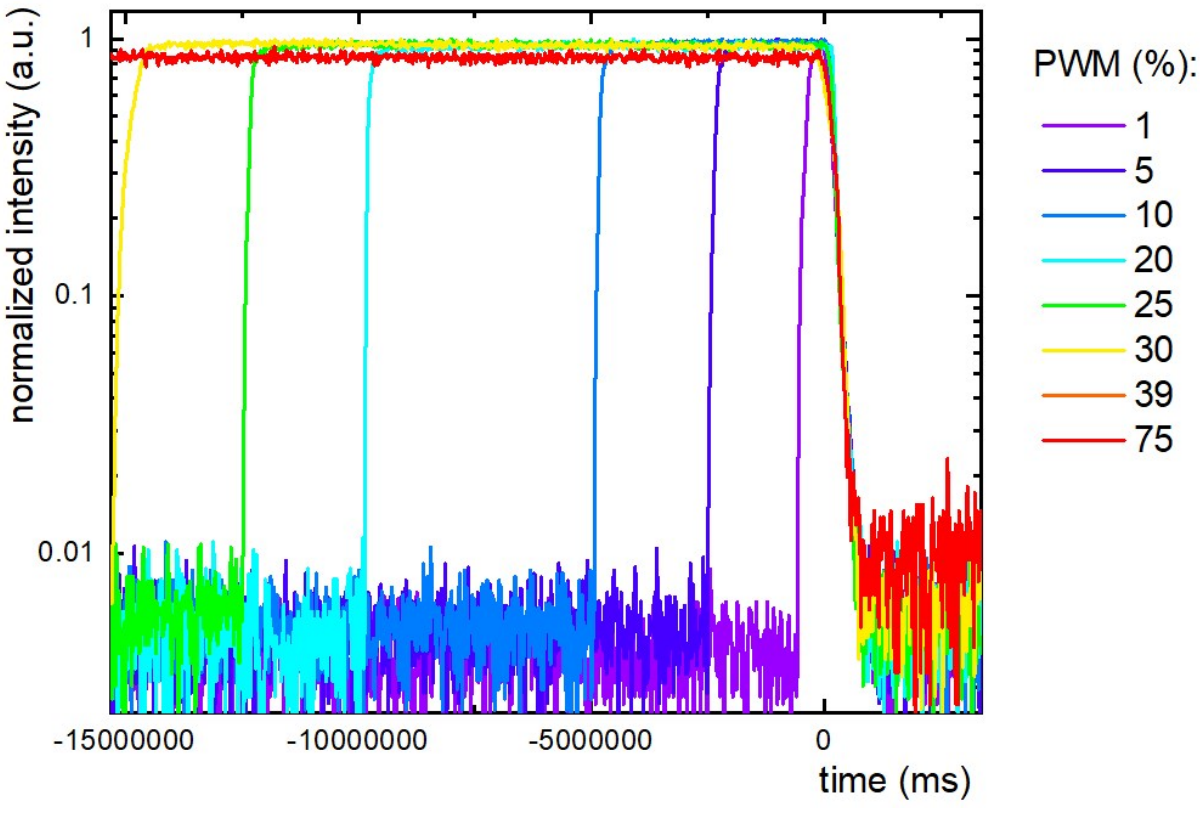

Figure S10. The comparison of the luminescence decay profile measured at 123 K for the $Nd_{0.5}Y_{0.4}Yb_{0.1}PO_4$ nanocrystals with different filling factor of pulse width modulation (PWM) λ_{exc}=808 nm, λ_{em}=980 nm.