
Supporting Information

Great enhanced size-tunable ultraviolet upconversion luminescence of monodisperse β -NaYF₄:Yb/Tm nanocrystals

Feng Shi, Jianshuo Wang, Daisheng Zhang, Guanshi Qin, and Weiping Qin*

State Key Laboratory on Integrated Optoelectronics, College of Electronic Science and Engineering, Jilin University, Changchun 130012, China

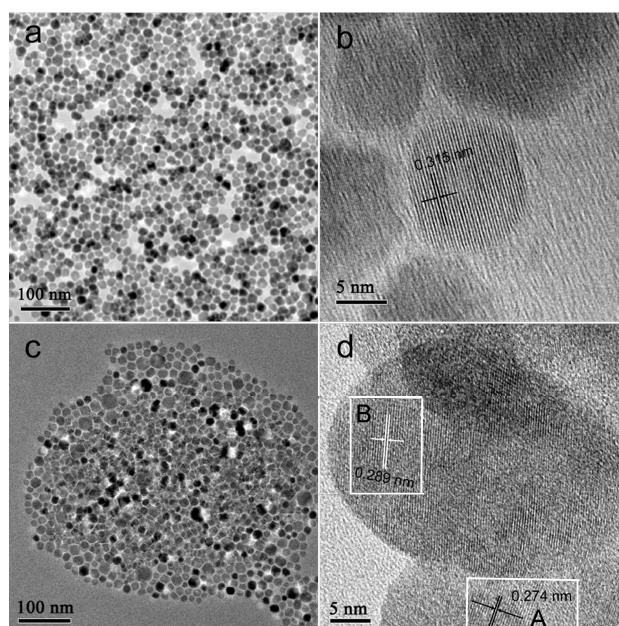


Fig. S1. TEM and HRTEM images of $\text{NaYF}_4\text{:}20\%\text{Yb}$, $0.5\%\text{Tm}$ nanocrystals prepared under different temperatures: (a-b) $280\text{ }^\circ\text{C}$; (c-d) $290\text{ }^\circ\text{C}$ (other synthesis conditions: 15 mL ODE / 6 mL OA ; 60 min)

Surface functional groups identification

The functional groups attached on the β -NaYF₄:20%Yb, 0.5%Tm NCs were identified with FT-IR studies as shown in Fig. S2. OA exhibits an absorption band around 3448 cm⁻¹, corresponding to the stretching vibration of hydroxyl group (-OH) in -COOH of absorbed oleic acid. The 2925 and 2854 cm⁻¹ absorption bands are assigned to the asymmetric and symmetric stretching vibrations of methylene (CH₂) in the long alkyl chain of OA molecules. The peak at 3010 cm⁻¹ arising from the =C-H stretching vibration can be seen in the spectrum and the peak at 1712 cm⁻¹ is attributed to the C=O stretching vibration frequency. In addition, the bands peaked at 1562 and 1465 cm⁻¹ can also be assigned to the asymmetric and symmetric stretching vibration of the carboxylic group (-COOH) of the bound oleic acid, respectively. Due to the presence of the OA overlayer, these NCs can be transparently dispersed into nonpolar solvents such as cyclohexane and aggregate by adding polar solvents such as ethanol, which enable their purification and application both in solid and fluid environments.

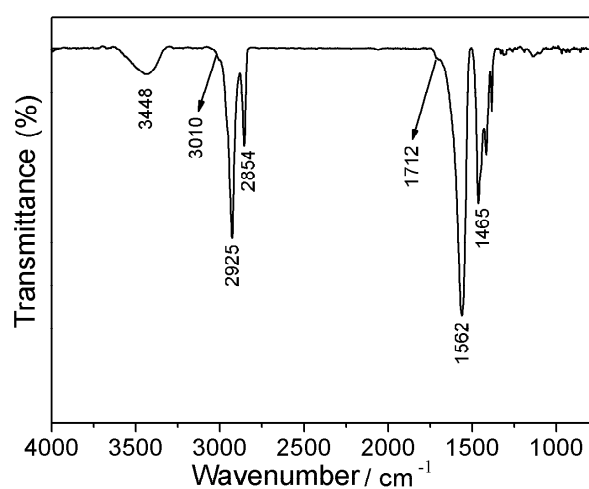


Fig. S2. FT-IR spectrum of the NaYF₄: 20%Yb, 0.5%Tm nanocrystals.

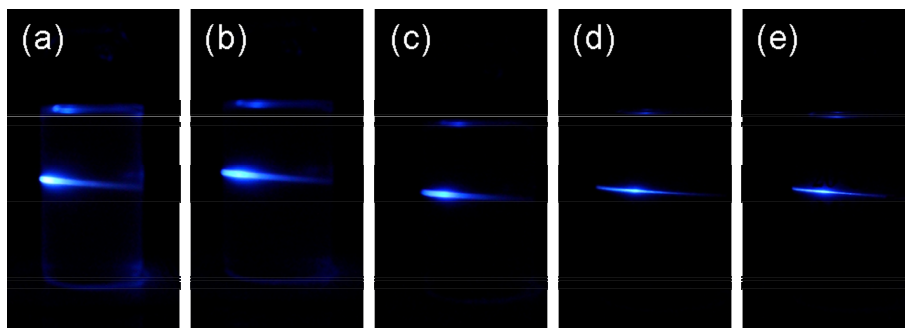


Fig. S3. Digital photos of the UC photoluminescence of β -NaYF₄:20%Yb³⁺, 0.5%Tm³⁺ NCs with different sizes dispersed in cyclohexane at room temperature: (a) 30 nm; (b) 50 nm; (c) 400 nm; (d) 180 nm; (e) 100 nm.

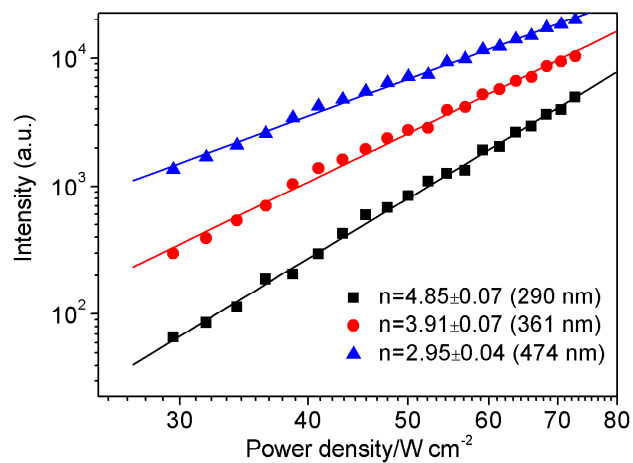


Fig. S4. Power dependency of the emission intensity of Tm^{3+} transitions that take place from different excited states ($^1\text{I}_6$, $^1\text{D}_2$, $^1\text{G}_4$) to the ground state $^3\text{H}_6$. Plots (log-log) of emission intensity versus excitation power in $\beta\text{-NaYF}_4\text{:20\%Yb, 0.5\%Tm}$ nanocrystals ($\sim 30\text{nm}$, pumped by a 980 nm laser).