Li+ ion doping: an approach for improving the crystallinity and upconversion emissions of NaYF4:Yb3+, Tm3+ nanoparticles


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Supporting Information

Li⁺ ions doping: An Approach for Improving the Crystallinity and Upconversion Emissions of NaYF₄: Yb³⁺, Tm³⁺ Nanoparticles

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Figure S1. Pump power dependence of the violet (452 nm) and blue (479 nm) emission of NaYF$_4$: Yb$^{3+}$, Tm$^{3+}$ nanocrystals: (a) 0 mol% Li$^+$, (b) 5 mol% Li$^+$, (c) 7 mol% Li$^+$, (d) 10 mol% Li$^+$, (e) 15 mol% Li$^+$.

As shown in Fig. S1, the $n$ values of all the samples of NaYF$_4$: Yb$^{3+}$, Tm$^{3+}$ nanocrystals introducing Li$^+$ ions were smaller than that of NaYF$_4$: Yb$^{3+}$, Tm$^{3+}$ nanocrystals.
Figure S2. Temporal evolutions of UC luminescence from $^1D_2$ levels of Tm$^{3+}$ ions in NaYF$_4$: Yb$^{3+}$, Tm$^{3+}$ co-doped with Li$^+$ ions (0, 5, 7, 10, 15 mol%) corresponding to (a–e) by monitoring the UC emissions centered at 452 nm under excitation of a 980 nm laser, black circles experimental data; coloured solid line fitting by:

$$I(t) = I_0 - A_1 \exp(-t / \tau_1) + A_2 \exp(-t / \tau_2)$$
**Figure S3.** Temporal evolutions of UC luminescence from $^{1}G_4$ levels of Tm$^{3+}$ ions in NaYF$_4$: Yb$^{3+}$, Tm$^{3+}$ co-doped with Li$^+$ ions (0, 5, 7, 10, 15 mol%) corresponding to (a–e) by monitoring the UC emissions centered at 479 nm under excitation of a 980 nm laser, black circles experimental data; coloured solid line: fitting by:

$$ I(t) = I_0 - A_1 \exp\left(-t / \tau_1\right) + A_2 \exp\left(-t / \tau_2\right) $$