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

Published in:
Nanoscale

DOI:
10.1039/c3nr01916k

Citation for published version (APA):

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Supporting Information

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

Chengzhou Zhao,ᵃᵇ Xianggui Kong,ᵃ⁺⁺ Xiaomin Liu,ᵃ Langping Tu,ᵃᵇ Fei Wu,ᵃᵇ Youlin Zhang,ᵃ Kai Liu,ᵃᵇ,c Qinghui Zengᵃ and Hong Zhang⁺⁺⁺

ᵃ State Key Laboratory of Luminescence and Applications, Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences, Changchun 130033, P. R. China.

ᵇ Graduate University of the Chinese Academy of Sciences, Beijing 100049, P. R. China.

ᶜ Van’t Hoff Institute for Molecular Sciences, University of Amsterdam, Science Park 904, 1098 XH Amsterdam, The Netherlands.

Electronic Supplementary Material (ESI) for Nanoscale
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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 $^1G_4$ 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:

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