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):

General rights
It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations
If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: https://uba.uva.nl/en/contact, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.
Supporting Information

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

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

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.
Figure S1. Pump power dependence of the violet (452 nm) and blue (479 nm) emission of NaYF₄: Yb³⁺, Tm³⁺ 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 NaYF₄: Yb³⁺, Tm³⁺ nanocrystals introducing Li⁺ ions were smaller than that of NaYF₄: Yb³⁺, Tm³⁺ 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:

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