Supporting Information

Li^+ ions doping: An Approach for Improving the Crystallinity and Upconversion Emissions of $NaYF_4$: Yb^{3+}, Tm^{3+} 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 Zeng[a] and Hong Zhang*[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.

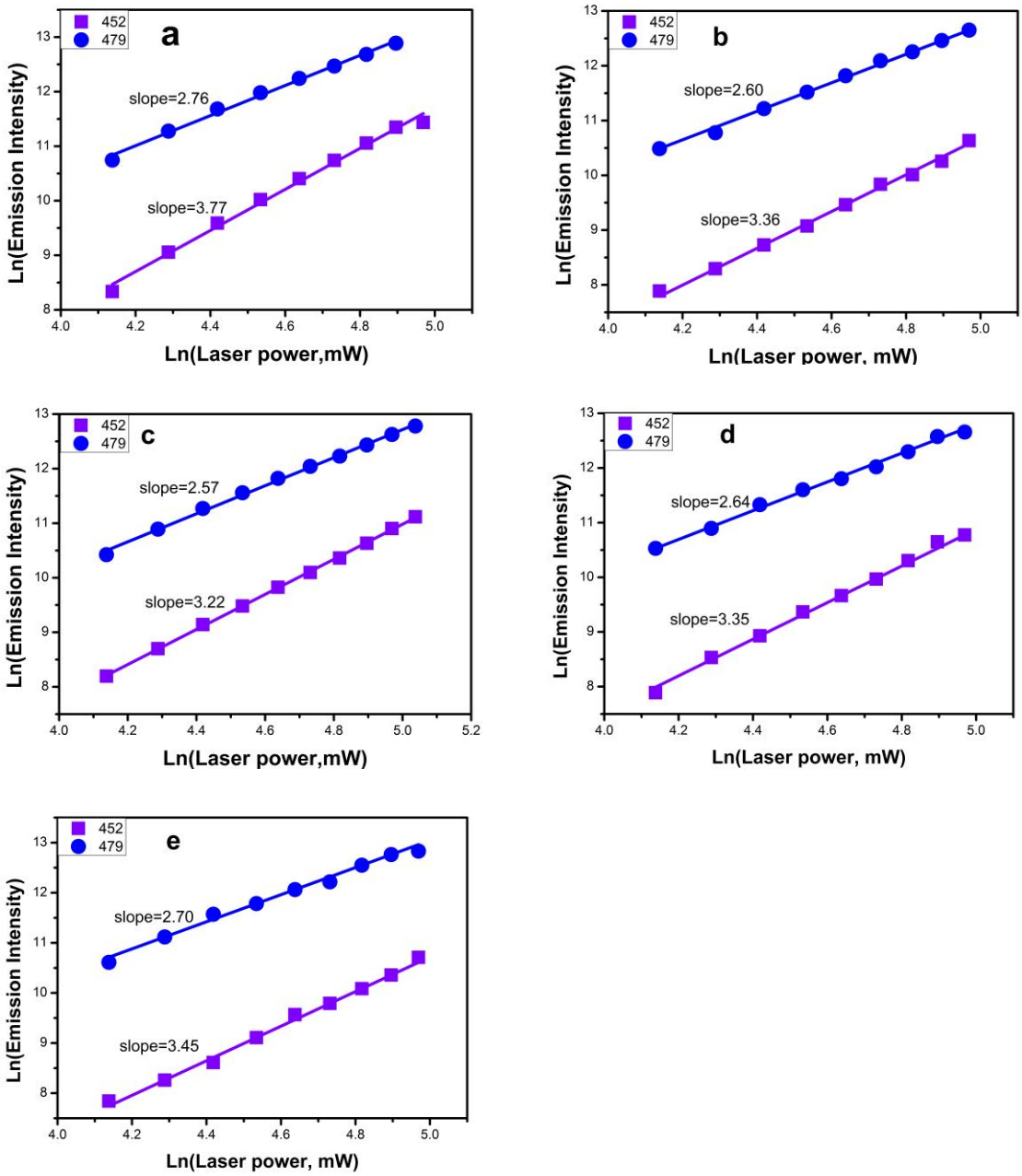

Figure S1. Pump power dependence of the violet(452 nm) and blue(479 nm) emission of $NaYF_4$: Yb^{3+}, Tm^{3+} nanocrystals: (a) 0 mol% Li^+, (b) 5 mol% Li^+, (c) 7 mol% Li^+, (d) 10 mol% Li^+, (e) 15 mol% Li^+.

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.

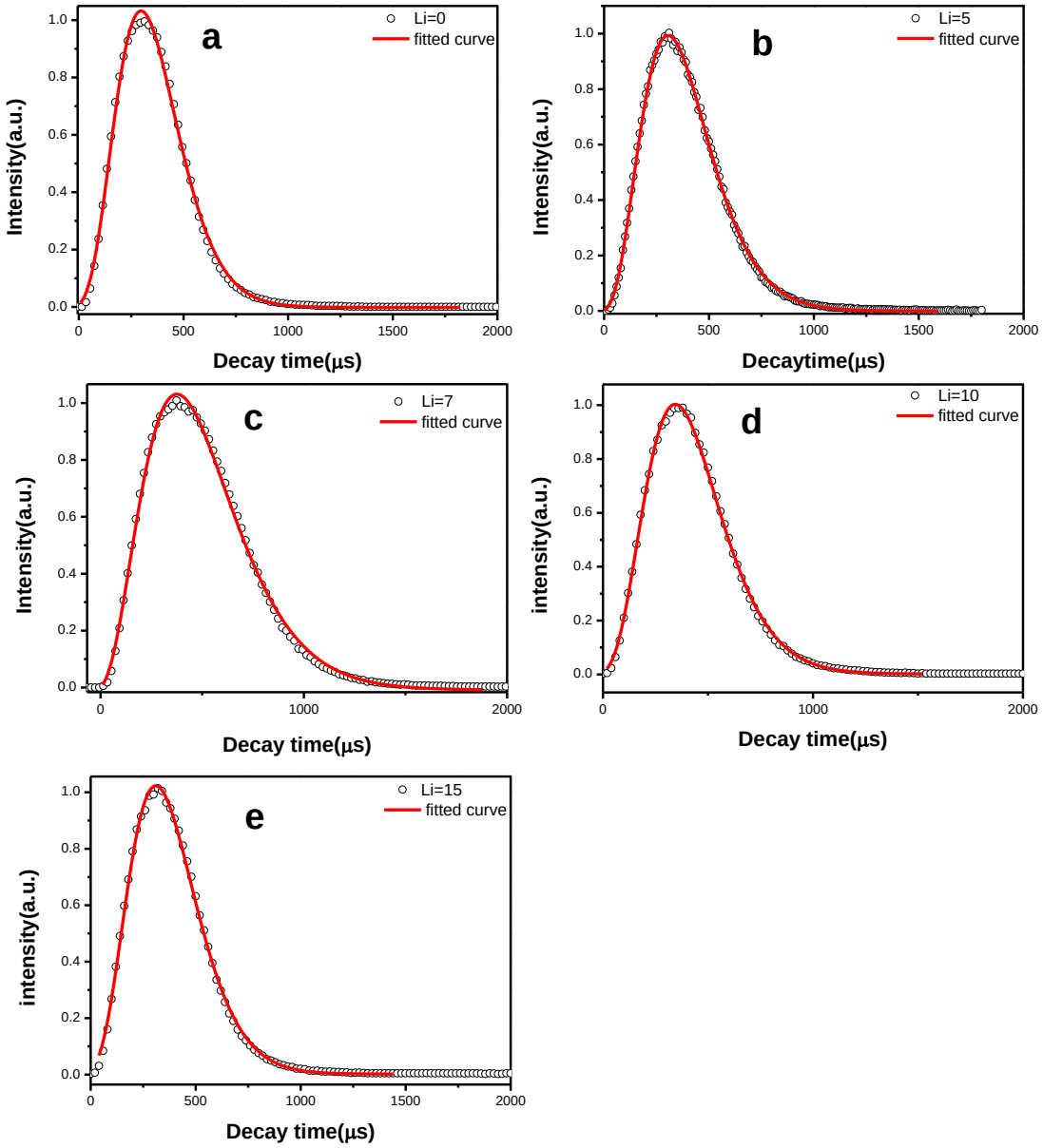

Figure S2. Temporal evolutions of UC luminescence from $^1D_2$ levels of Tm^{3+} ions in $NaYF_4$: Yb^{3+}, Tm^{3+} co-doped with Li^+ ions (0, 5, 7, 10, 15 mol%) corresponding to (a–e) by monitoring the UC emissions centered at 452 nm under excitation of a 980 nm laser, black circles experimental data; coloured solid line fitting by: $I(t) = I_0 - A_1 \exp(-t/\tau_1) + A_2 \exp(-t/\tau_2)$

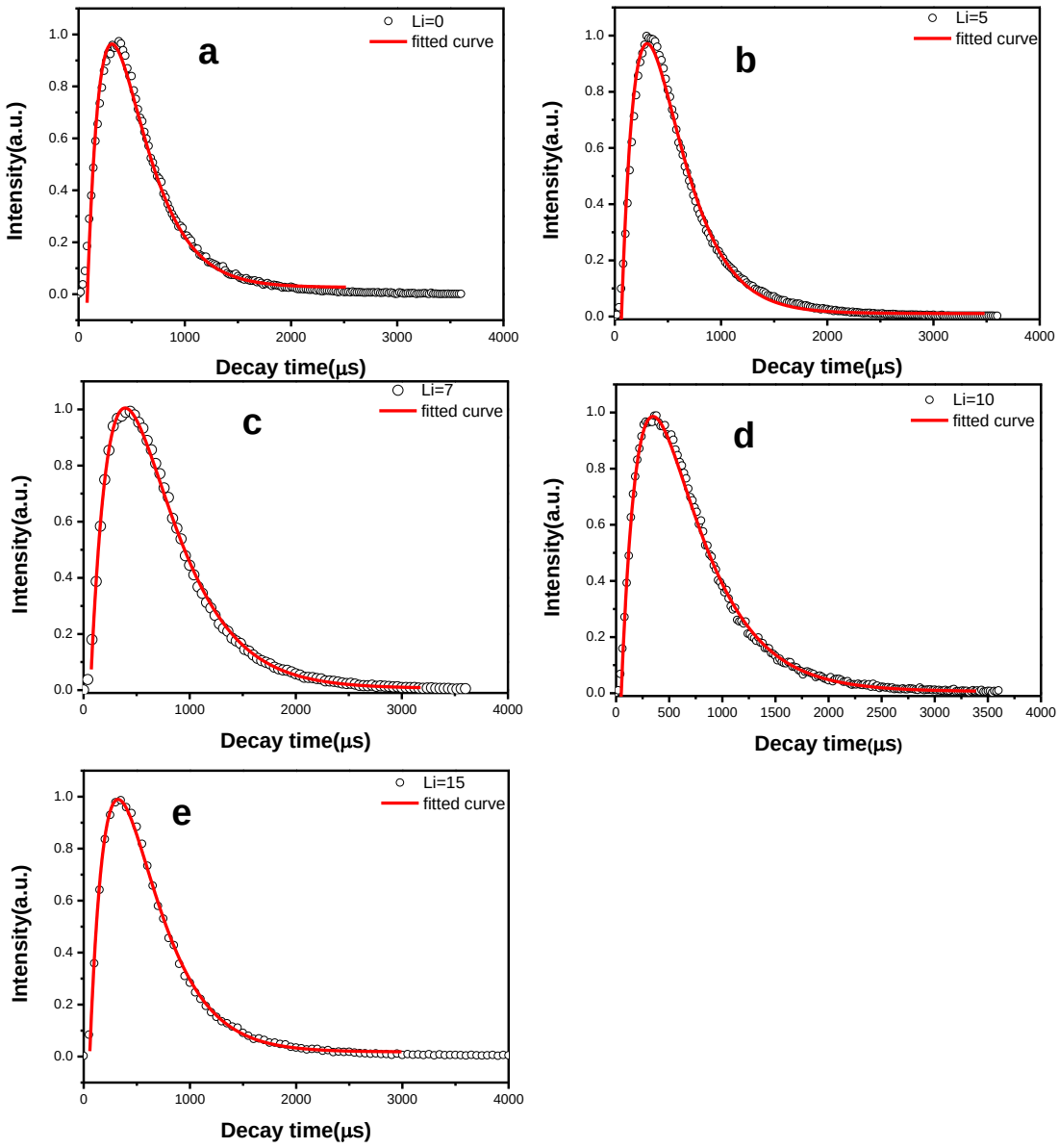

Figure S3. Temporal evolutions of UC luminescence from $^1G_4$ levels of Tm^{3+} ions in $NaYF_4$: Yb^{3+}, Tm^{3+} co-doped with Li^+ ions (0, 5, 7, 10, 15 mol%) corresponding to (a–e) by monitoring the UC emissions centered at 479nm under excitation of a 980 nm laser, black circles experimental data; coloured solid line: fitting by: $I(t) = I_0 - A_1 \exp(-t/\tau_1) + A_2 \exp(-t/\tau_2)$