Supporting Information for

Synthesis and strong near-infrared fluorescence of $LiLa_{1-x}Nd_x(PO_3)_4$ nanocrystals with high doping concentration

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Experimental Section

Chemicals. HNO_3 (GR, 65-68%), CH_4N_2O (AR) and ammonia solution (GR, 25-28%) were obtained from Aladdin Chemistry Co., Ltd. Urea while $LiNO_3$ (99%), Nd $(NO_3)_3 \cdot 6H_2O$ (99.9%), La $(NO_3)_3 \cdot 6H_2O$ (99.9%) and $NH_4H_2PO_4$ (98%) was provided by Alfa Aesar.

Preparation of LLNP nanocrystals. In this work, the LLNP nanocrystals were synthesized via combustion method. Taking $LiNd(PO_3)_4$ nanocrystals as an example, CH_4N_2O was added into 20mL aqueous solution containing 2mmol $LiNO_3$ and 2mmol $Nd(NO_3)_3$ under agitation. Then the solution of 8mmol $NH_4H_2PO_4$ in 10 mL deionized water was added into above solution dropwise after the pH was adjusted. After drying to honeycomb in blast oven at 80℃, the precursor was treated at 750℃ for 10min following combustion reaction. The collected product was washed and dried at 60℃ for 48h under vacuum.

Characterization. The X-ray diffraction (XRD) patterns of the samples were measured on a Bruker D8 Advance X-ray powder diffractometer with graphite monochromatized Cu Ka radiation (k_a=0.15405 nm). The Fourier transform infrared (FT-IR) spectra was obtained on a Shimadzu IRPrestige-21 FT-IR spectrophotometer in the wavenumber range of 400~4000cm^{-1} at a resolution of 2cm^{-1}, on a pressed pellet of the powdered sample dispersed in KBr. The morphologies were characterized by a JEOL JEM-3010 transmission electron microscope (TEM) under a 300 kV working voltage. The emission spectra and luminescence decay times of all the samples were measured by full-featured steady state/transient fluorescence spectrometer FLS920 from Edinburgh Instruments.

Table S1 Crystal data and structure refinement for NdP_5O_{14}, $LiNdP_4O_{12}$ and $LiNd(PO_3)_4$

Empirical formula	NdP_5O_{14}	$LiNdP_4O_{12}$	$LiNd(PO_3)_4$
Crystal system	Monoclinic	Monoclinic	Monoclinic
Space Group	P21/a	I2/a	C2/c
Cell parameters	a=13.03Å, b=9.001Å, c=8.768Å, β=90.48°	a=13.25Å, b=7.008Å, c=9.844Å, β=90.1°	a=16.487Å, b=7.043Å, c=9.754Å, β=126.46°
Volume($Å^3$)	1028.3	914.1	910.9
Z	4	4	4
Density(g/cm^{-3})	3.38	3.393	3.406
JCPDS	24-0782	29-0812	34-0003
$d_{min(Nd-Nd)}$ (Å)	5.192	5.62	5.644
c ($10^{21}cm^{-3}$)	3.88	4.37	4.39
τ (μs)	110	120	120
σ ($10^{-19}cm^2$)	2.5	3.2	3.2
ref	1, 2	3, 4, 5	6, 7

Table S2 FT-IR spectral data (cm^{-1}) and band assignments for $LiNd(PO_3)_4$

Wavenumber	Assignment
1310, 1240	ν_{as} (PO_2)
1149, 1083, 1067	ν_s (PO_2)
1012, 932	ν_{as} (POP)
812, 754, 735, 685	ν_s (POP)
596, 575, 560, 522	δ (PO_2)
474, 457, 436	δ (POP)

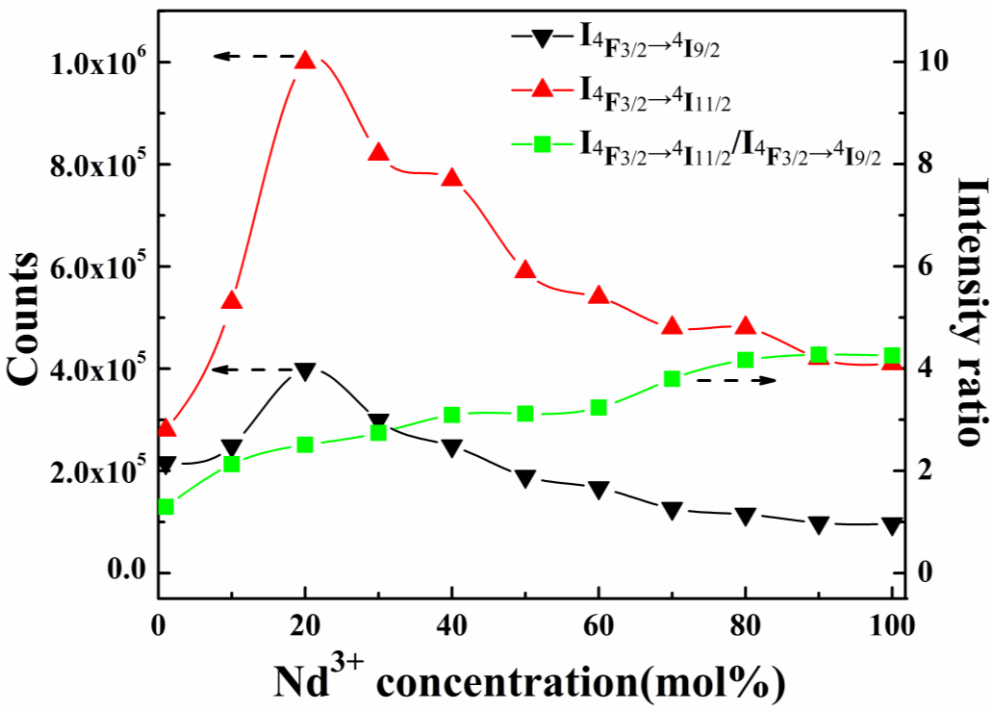

Fig.S1 Emission intensities ($^4F_{3/2}\rightarrow{}^4I_{11/2}$ and $^4F_{3/2}\rightarrow{}^4I_{9/2}$) of $LiLa_{1-x}Nd_x(PO_3)_4$ nanocrystals and their ratio dependence on the Nd^{3+} doping concentration

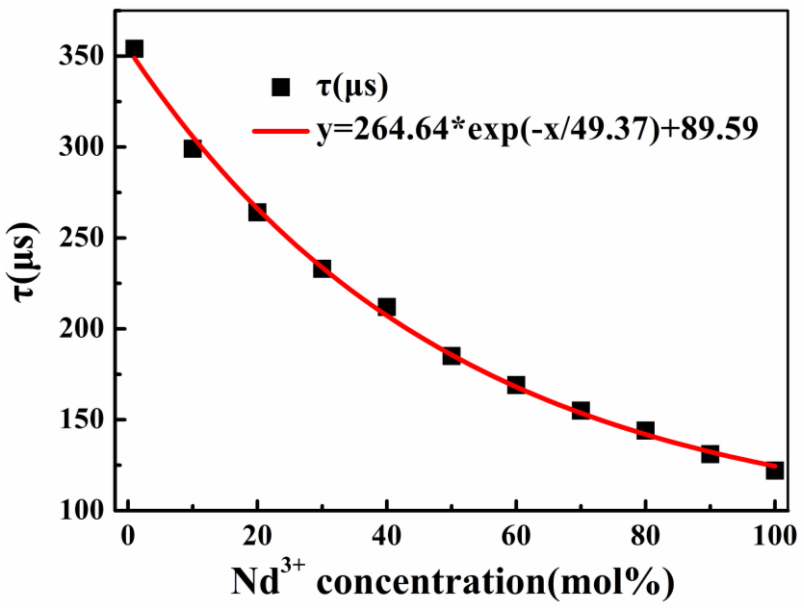

Fig.S2 The curve of fluorescence lifetimes (τ) dependence on Nd^{3+} concentration in $LiLa_{1-x}Nd_x(PO_3)_4$ nanocrystals

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