Supporting Information

Interacting layered hydroxide nanosheets with KF leading to Y/Eu hydroxyfluoride, oxyfluoride, and complex fluoride nanocrystals and investigation of photoluminescence

Jing Li, a,b,c Xuejiao Wang, *d Qi Zhu, a,b Byung-Nam Kim, c Xudong Sun, a,b,e Ji-Guang Li, *, a,b,c

a Key Laboratory for Anisotropy and Texture of Materials (Ministry of Education), Northeastern University, Shenyang, Liaoning 110819, China

b Institute of Ceramics and Powder Metallurgy, School of Materials Science and Engineering, Northeastern University, Shenyang, Liaoning 110819, China

c Research Center for Functional Materials, National Institute for Materials Science, 1-1 Namiki, Tsukuba, Ibaraki 305-0044, Japan

d College of New energy, Bohai University, Jinzhou, Liaoning 121000, China

e Liaoning Engineering Laboratory of Special Optical Functional Crystals, College of Environment and Chemical Engineering, Dalian University, Dalian, Liaoning 116622, China

*Corresponding author
Dr. Xuejiao Wang
Bohai University
E-mail: wangxuejiao@bhu.edu.cn

Dr. Ji-Guang Li
National Institute for Materials Science
E-mail: LI.Jiguang@nims.go.jp
**Fig. S1** The crystal structure of RE$_2$(OH)$_5$NO$_3$·nH$_2$O and hexagonal RE(OH)$_{3-x}$Fx (realized with the Vesta software).

**Fig. S2** AFM image (left panel) and height profiles (right panel) of the LREH-NO$_3^-$ nanosheets. The height profiles were obtained along the red lines marked for the nanosheets in the AFM image, respectively.
Fig. S3 The crystal structure of RE(OH)$_{3-x}$F$_x$, hexagonal RE(OH)$_3$, and hexagonal $\beta$-NaREF$_4$ (realized with the Vesta software).

Fig. S4 The crystal structure of $\alpha$-NaREF$_4$ and CaF$_2$ (realized with the Vesta software).
Fig. S5 Rietveld fitting of the powder XRD patterns for the products obtained by calcining the RE(OH)$_{3-x}$F$_x$ of $x=1.15$ (a, $R=20:3$) and $x=1.23$ (b, $R=30:3$) in air at 450 °C for 2 h. The derived phase constituents are included in the figures.

Fig. S6 Fluorescence decay kinetics (scattered data) and the results of exponential fitting (solid lines) for the oxyfluoride phosphors calcined from RE(OH)$_{1.49}$F$_{1.51}$ ($R=70:3$) in air the various temperatures indicated in the figure. The excitation and emission wavelengths used for measurements, the calcination temperature, and the derived lifetime ($\tau$) values are included in the figure.