Supplementary Information

Synthesis of Monodispersed $YbF_3:Er^{3+}$ Nanoplates with Rhombus Shape

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S1. Chemicals and Characterization

Ytterbium oxide（≥99.99%），erbium oxide，（≥99.99%），trifluoroacetic acid（TFA；≥99%），oleic acid（OA；90%）and 1-octadecene（ODE；90%）are used directly without further purification. Those chemicals are purchased from Sigma-aldrich or J&K Chemical Reagent Company.

The size and morphologies of the resulting nanocrystals were determined by a JEOL-2100F transmission electronic microscope (TEM) operating at 200kV. All the measurements were performed on the original aliquots without any size sorting.

S2. Nanocrystal synthesis

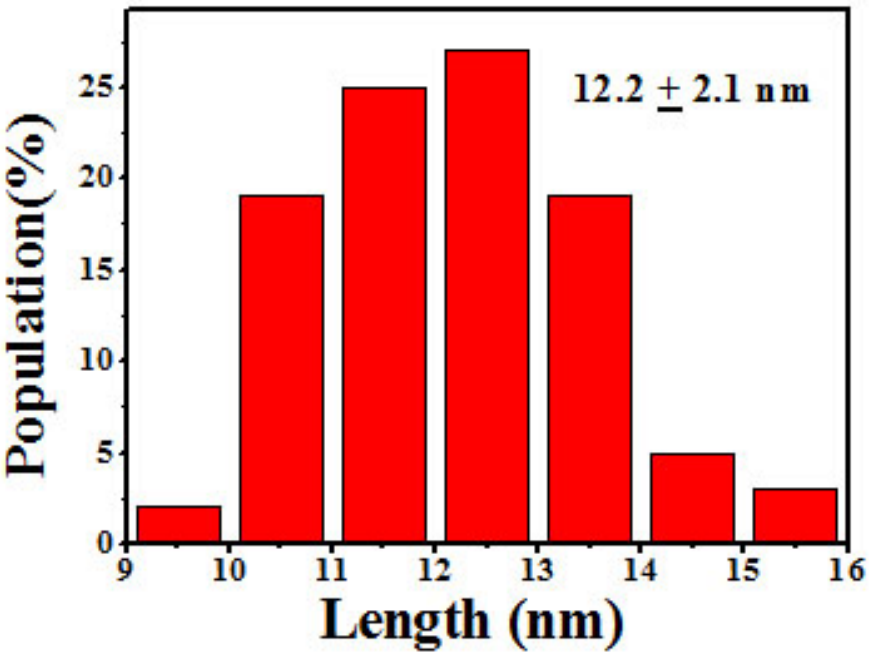
1) Synthesis of precursor.

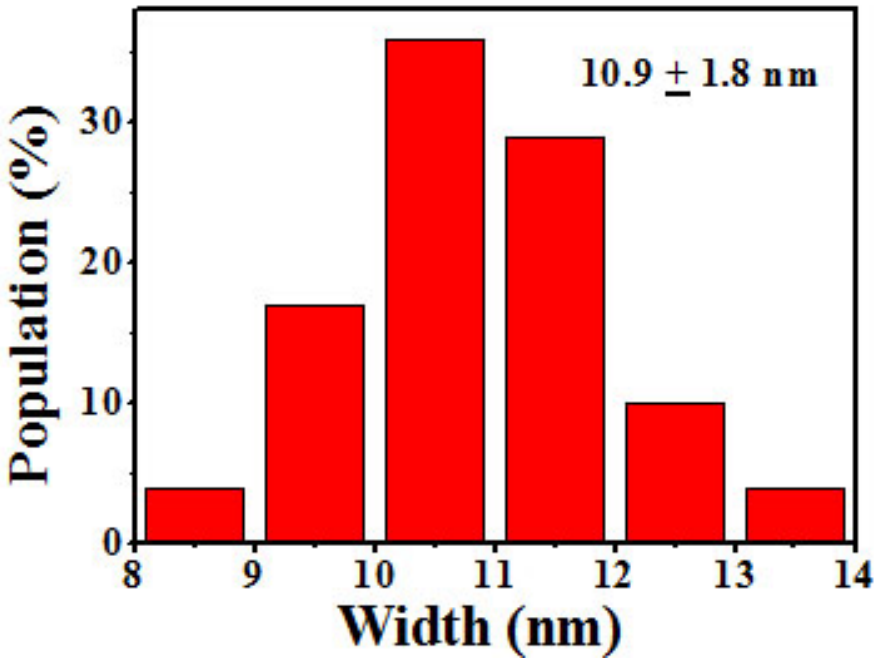
The trifluoroacetate precursors were synthesized from ytterbium oxide，erbium oxide and TFA. The corresponding proportion of the three chemicals were added into a four-necked flask（100mL）containing 10mL H_2O with continuous stirring. When the temperature reached 80℃，2.5mL TFA was injected quickly and then the solution was kept refluxing so as to form an optically transparent solution. The solution was dried in an oven at 80℃ for 24h to obtain trifluoroacetate precursors.

2） Synthesis of YbF_3：Er^{3+} nanocrystals.

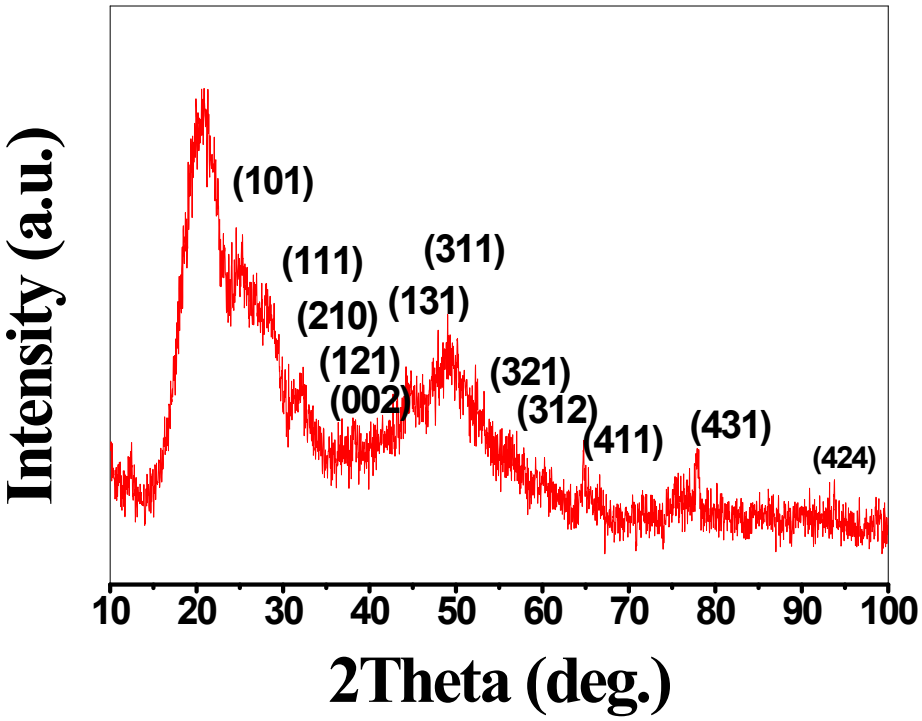
To obtain YbF：Er^{3+} nanocrystals，3.2mLOA and 20mLODE were added in the four-necked flask（100mL）containing trifluoroacetate precursors which have already dried. Then the solution was heated to 80~100℃ until the precursors dissolved completely. Then the solution was kept for about 15 minutes to remove water and oxygen with vigorous magnetic stirring under vacuum at 100℃. After that, the solution was bubbled under an inert Ar atmosphere for 30 minutes. The solution was then heated to 280℃, kept for 3h under Ar and kept refluxing. On cooling to room temperature, the nanocrystals were precipitated by adding an excess amount of ethanol into the reacted solution. The final products were collected by the means of centrifugation，washed with ethanol and trichoromethane for three times，and then dispersed in trichoromethane.

S3. Length and width Histogram of YbF_3:10%Er^{3+} nanoplates

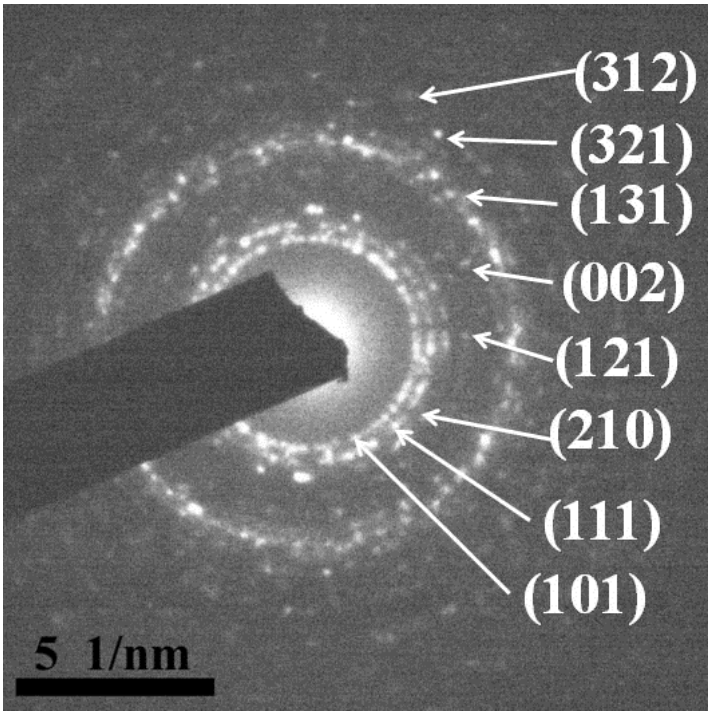




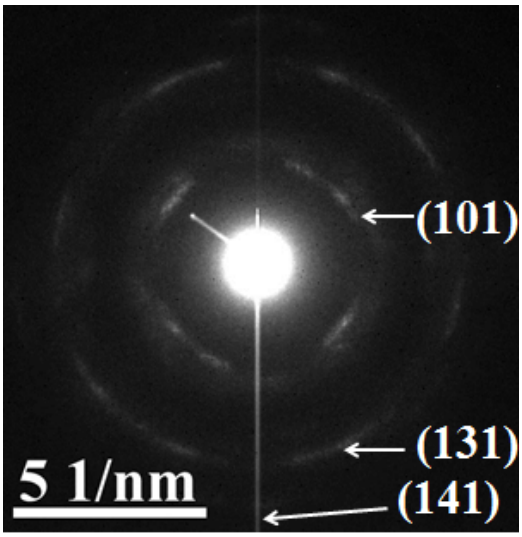
S4. XRD pattern of YbF_3:10%Er^{3+} nanoplates



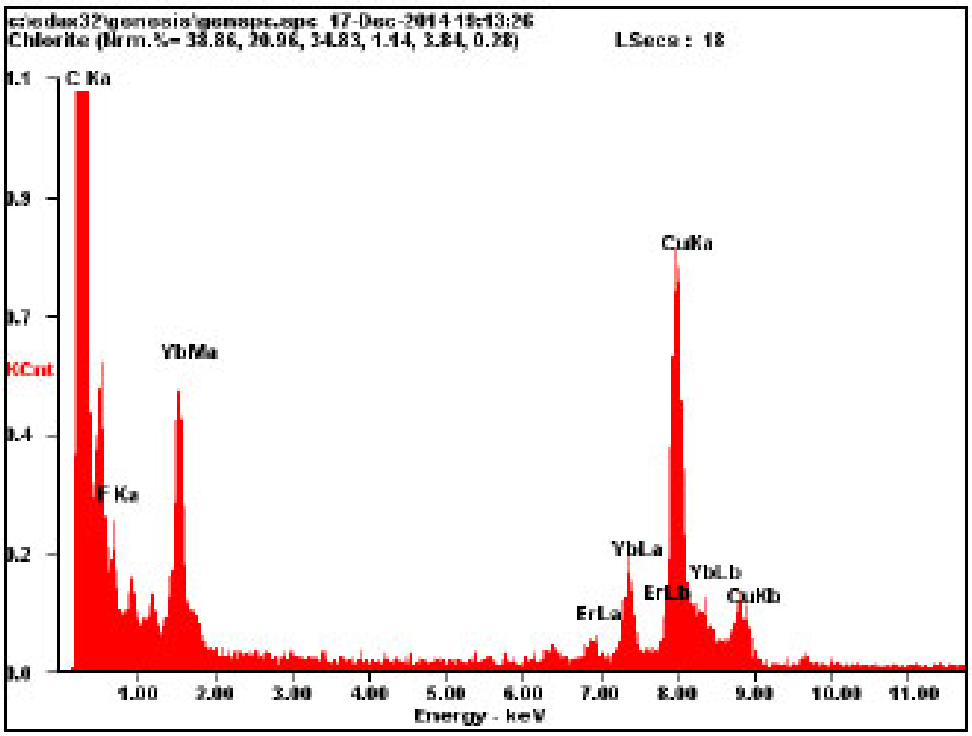
S5. Diffraction pattern of YbF_3:10%Er^{3+}



S6. Diffraction pattern of YbF_3:50%Er^{3+}

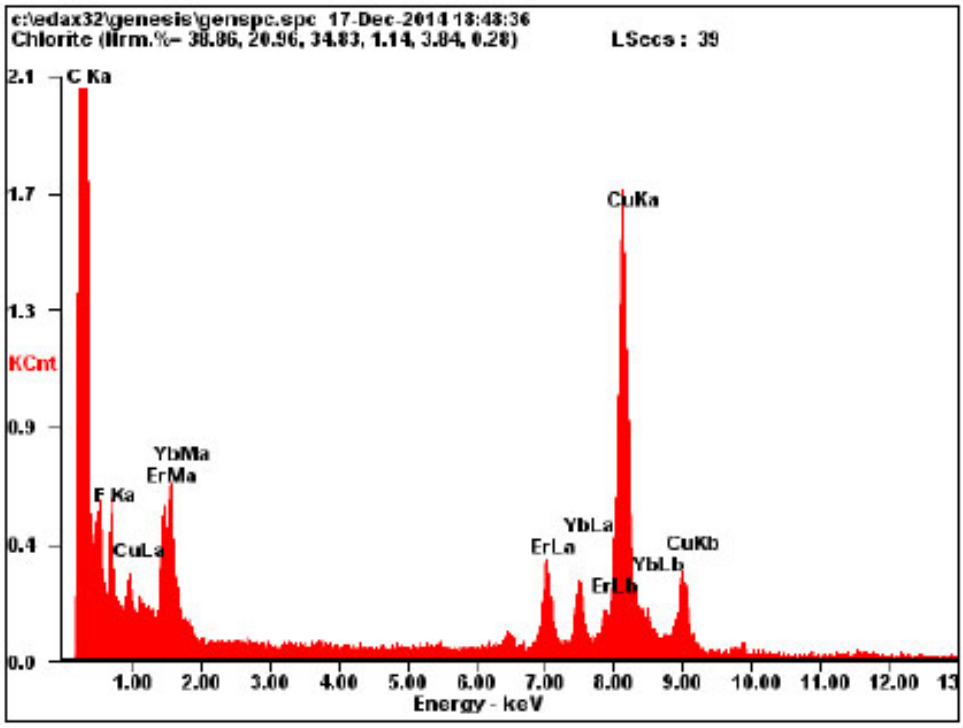


S7. EDX pattern and elemental quantification of YbF_3:10%Er^{3+} nanoplates



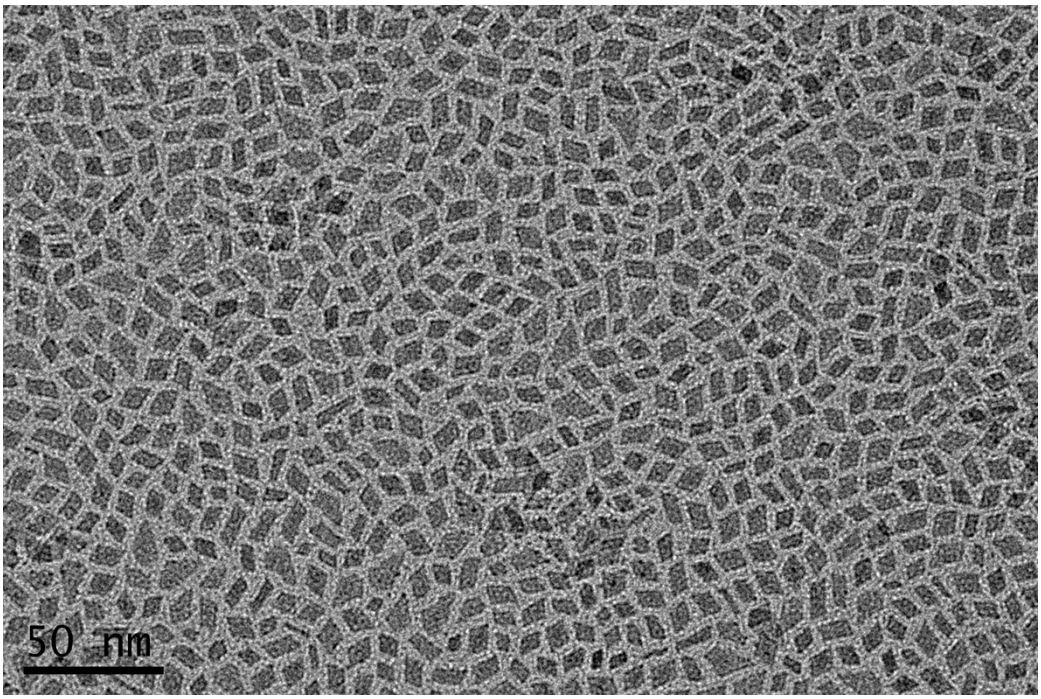
Element	Wt %	At %	K-Ratio	Z	A	F
ErL	24.68	25.32	0.2316	1.0001	0.9382	1.0000
YbL	75.32	74.68	0.7685	1.0000	1.0204	1.0000
Total	100.00	100.00				

S8. EDX pattern and elemental quantification of YbF_3:50%Er^{3+} nanoplates



Element	*Wt %*	*At %*	K-Ratio	Z	A	F
ErL	58.00	58.83	0.5595	1.0001	0.9645	1.0000
YbL	42.00	41.17	0.4406	0.9999	1.0492	1.0000
Total	100.00	100.00				

S9. TEM image of ErF_3: 10%Pr^{3+} nanoplates



S10. Energy level diagrams of $Er^{3+}$and Yb^{3+} ions