Simultaneous realization of structure manipulation and emission enhancement in NaLuF$_4$ upconversion crystals

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**Fig. S1** UC luminescence spectra of NaLuF$_4$:20%Yb$^{3+}$, 15%Er$^{3+}$, 1%Tm$^{3+}$ nano/micro-crystals with different NaF contents at 180 °C for 12 h under 980 nm laser excitation.

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**Supporting Information**

**Fig. S2** UC luminescence spectra of Gd\(^{3+}\)-absent NaLuF\(_4\):20\%Yb\(^{3+}\), 15\%Er\(^{3+}\), 1\%Tm\(^{3+}\) nano/micro-crystals synthesized by adding 8 mmol NaF at 180 °C for different reaction times under 980 nm laser excitation.
Fig. S3 UC luminescence spectra of Gd$^{3+}$-absent NaLuF$_4$:20%Yb$^{3+}$, 15%Er$^{3+}$, 1%Tm$^{3+}$ nano/micro-crystals synthesized by adding 8 mmol NaF at different reaction temperatures for 12 h under 980 nm laser excitation.