Electronic Supplementary Material (ESI) for CrystEngComm.


# A Structural Topotactic Transformation Synthetic Route for β-$NaYF_4$ Upconversion Nanocrystals from $YF_3$ at Room Temperature

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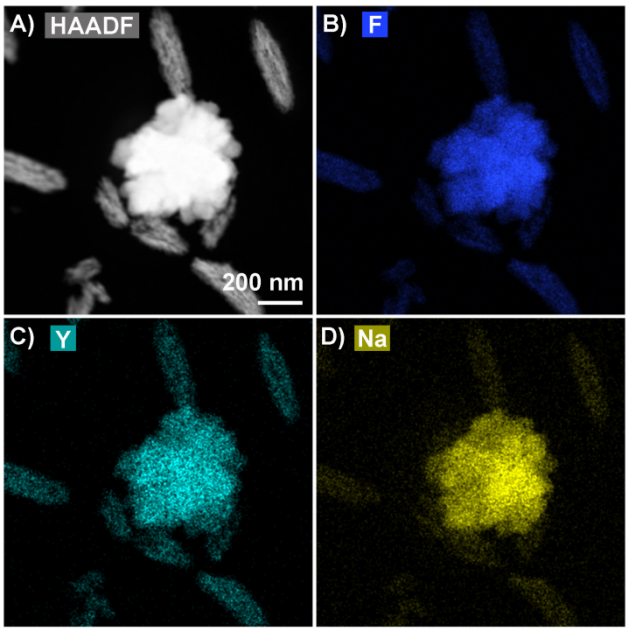


**Figure S1** Element mapping of (B) F, (C) Y, and (D) Na elements image of the product at 6 h.

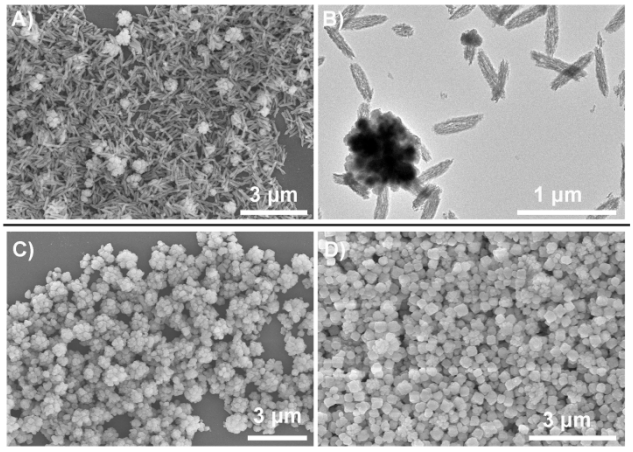


**Figure S2** SEM images of the products obtained at (A) 18 h, (C) 24 h, (D) 32 h, and (B) corresponding TEM image of the product obtained at 18 h.

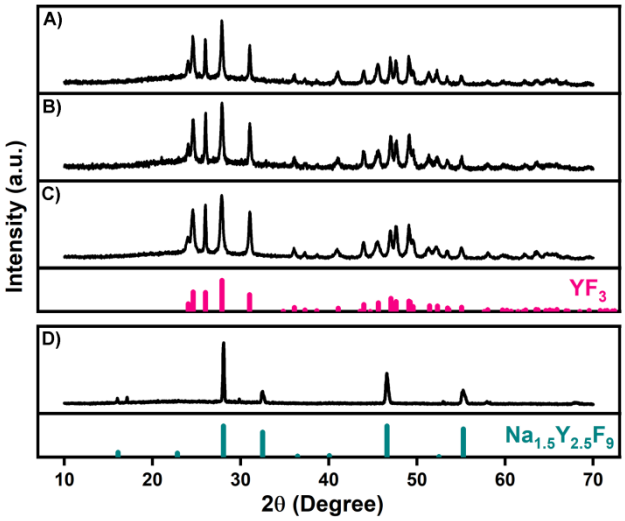


**Figure S3** XRD patterns of final products synthesized under different conditions: (A) 160 °C for 48 h with $YF_3$: NaF=1: 2 (mole ratio), (B) 160 °C for 48 h with $YF_3$: NaF=1: 3, (C) 200 °C for 48 h with $YF_3$: NaF=1: 3, and (D) 160 °C for 48 h with $YF_3$: NaF=1: 6.

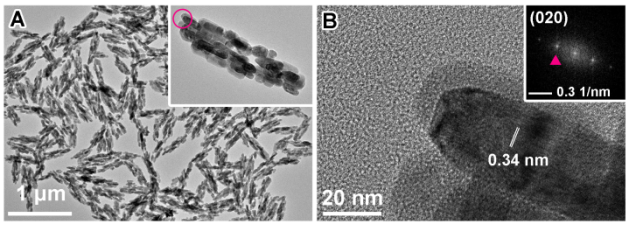


**Figure S4** TEM (A) and HRTEM (B) images of the products synthesized at 160 °C for 48 h with $YF_3$: NaF=1: 2 or 1: 3. It can be seen that the chain-like nanostructure is composed of oriented nanorods. The distinct lattice fringes with d spacing of 0.34 nm can be indexed to $YF_3$ (020) lattice plane, which is agree with that of the $YF_3$ nanospindle precursor.

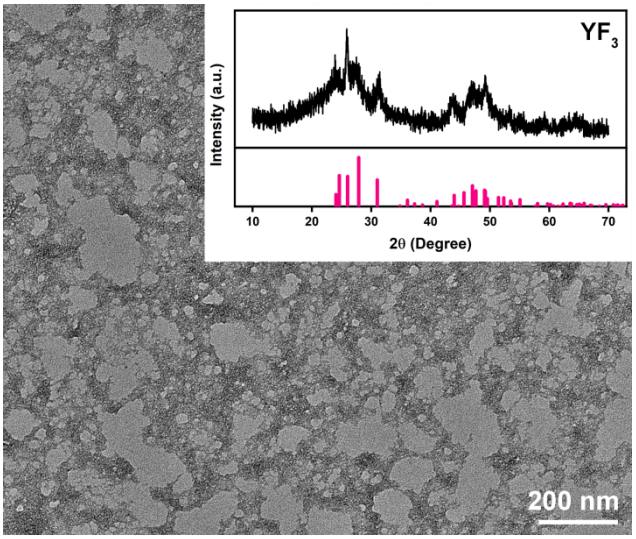


**Figure S5** TEM image and corresponding XRD pattern of the $YF_3$ precursor obtained with reaction time for 15 min.

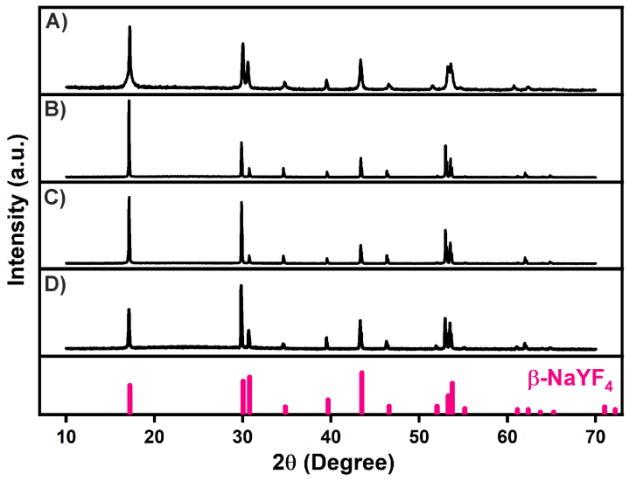


**Figure S6** XRD patterns of the β-$NaYF_4$ products synthesized using ultra small $YF_3$ nanoparticles under different conditions: (A) room temperature with $YF_3$: NaF=1: 6 (mole ratio), (B) 160 °C for 12 h with $YF_3$: NaF=1: 2 (mole ratio), (C) 160 °C for 12 h with $YF_3$: NaF=1: 4, and (D) 160 °C for 12 h with $YF_3$: NaF=1: 6.