Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

SUPPORTING INFORMATION

Sc^{3+} – Induced Morphology, Phase Structure, and Upconversion Luminescence Modulation of YF_3:Yb/Er Nanocrystals †

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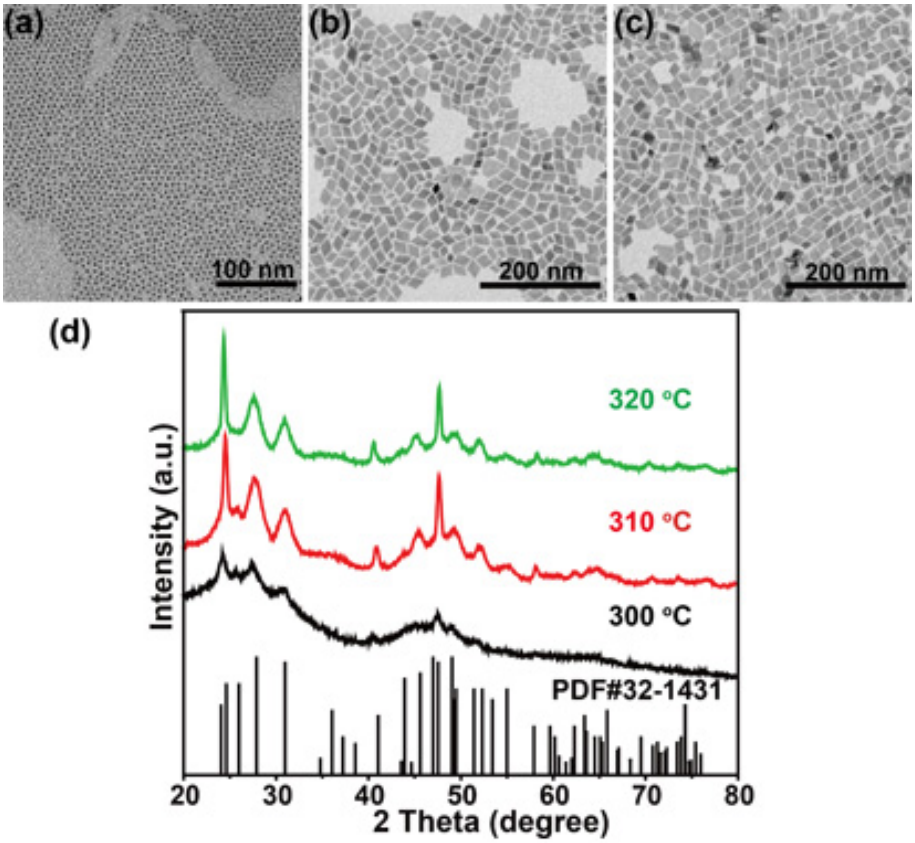

Fig. S1 TEM images of YF_3:Yb/Er (18/2 mol %) nanocrystals obtained at different reaction temperature of (a) 300 °C, (b) 310 °C, (c) 320 °C). (d) X-ray diffraction patterns of the above samples. The diffraction pattern at the bottom is the literature reference for orthorhombic YF_3 crystal (JCPDS: 32-1431).

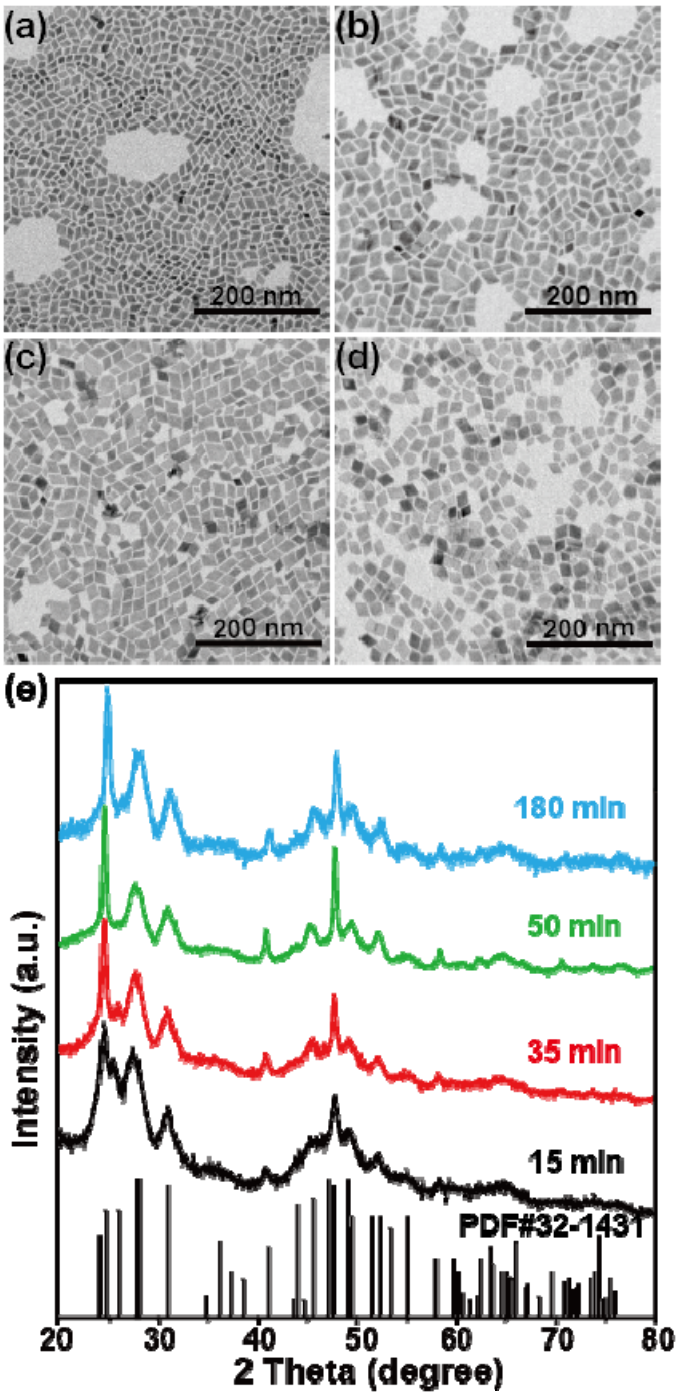

Fig. S2 TEM images of YF_3:Yb/Er (18/2 mol%) nanocrystals obtained at different reaction time 0f (a) 15, (b) 35, (c) 50, and (d) 180 min. (d) X-ray diffraction patterns of the above samples. The diffraction pattern at the bottom is the literature reference for orthorhombic YF_3 crystal (JCPDS: 32-1431).

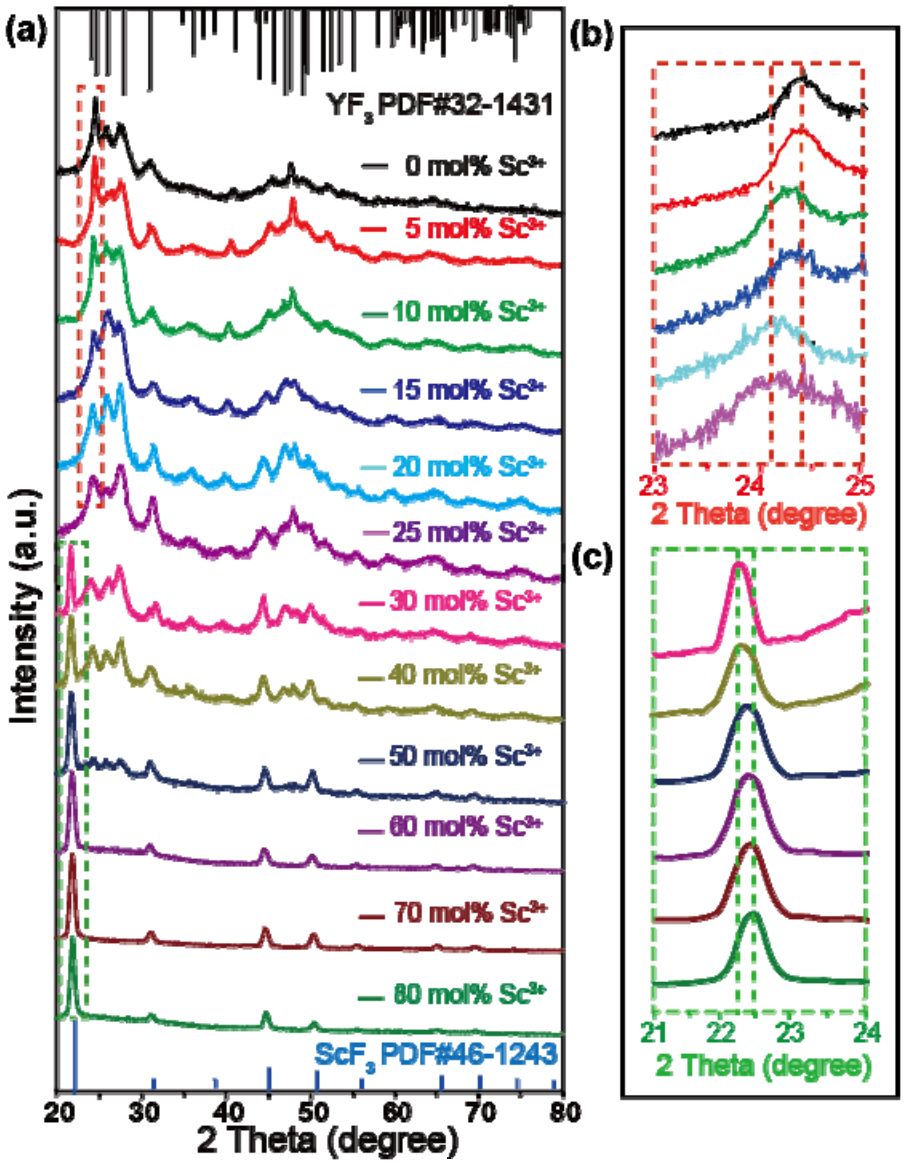

Fig. S3 (a) XRD patterns of YF_3:Yb/Er/Sc (18/2/x mol %) nanocrystals doped with varied amounts of Sc^{3+} (0-80 mol%). The diffraction patterns at the top is the literature reference of cubic ScF_3 crystal (JCPDS: 46-1243), and those at the bottom is the literature reference for orthorhombic YF_3 crystal (JCPDS: 32-1431). Enlarged XRD peaks corresponding to (b) orthorhombic YF_3 crystal (101) facet and (c) cubic ScF_3 crystal (100) facet doped with varying amounts of Sc^{3+}.

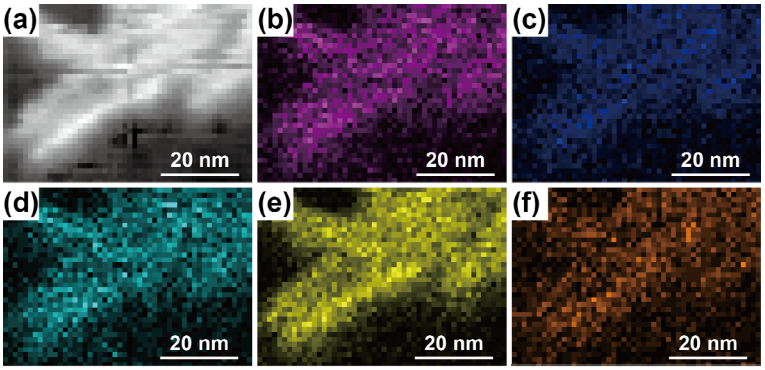

Fig. S4. (a) Energy dispersive X-ray spectroscopy (EDX) elemental mapping results of YF_3:Yb/Er/Sc (18/2/20 mol%) nanocrystals and the corresponding elemental distribution of (b) Y, (c) F, (d) Sc, (e) Yb, (f) Er.

Table S1. ICP analysis results of YF_3:Yb/Er/Sc (18/2/x mol%) nanocrystals at 5, 10, 20 and 70 mol% Sc^{3+} doping.

Nominal Sc^{3+} mol%	Analyzed Sc^{3+} mol%	Analyzed Y mol%
5	3.06	76.94
10	5.02	74.98
20	9.712	70.29
70	74.70	5.30

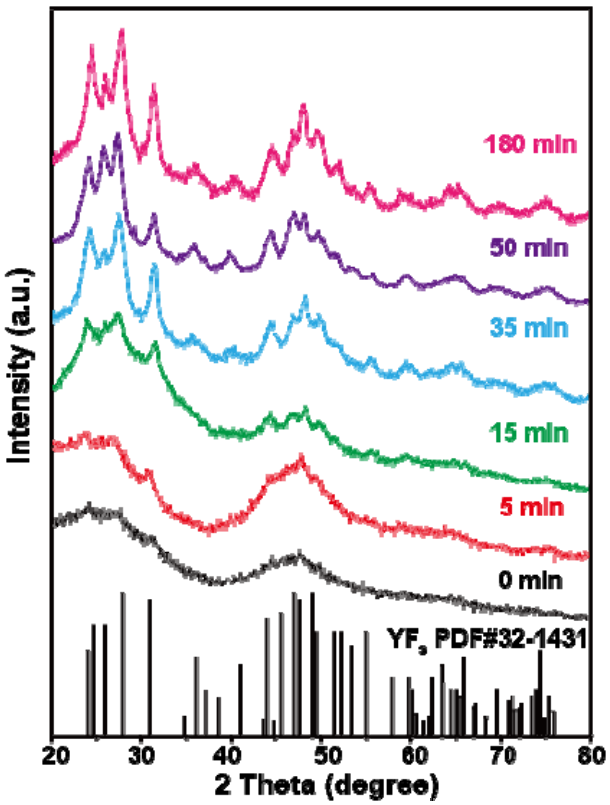

Fig. S5 (a) XRD patterns of YF_3:Yb/Er/Sc (18/2/20 mol %) nanocrystals with the reaction time of (a) 0, (b) 5, (c) 15, (d) 35, (e) 50, and (f) 180 min, respectively. At the bottom is the literature reference for orthorhombic YF_3 crystal (JCPDS: 32-1431).

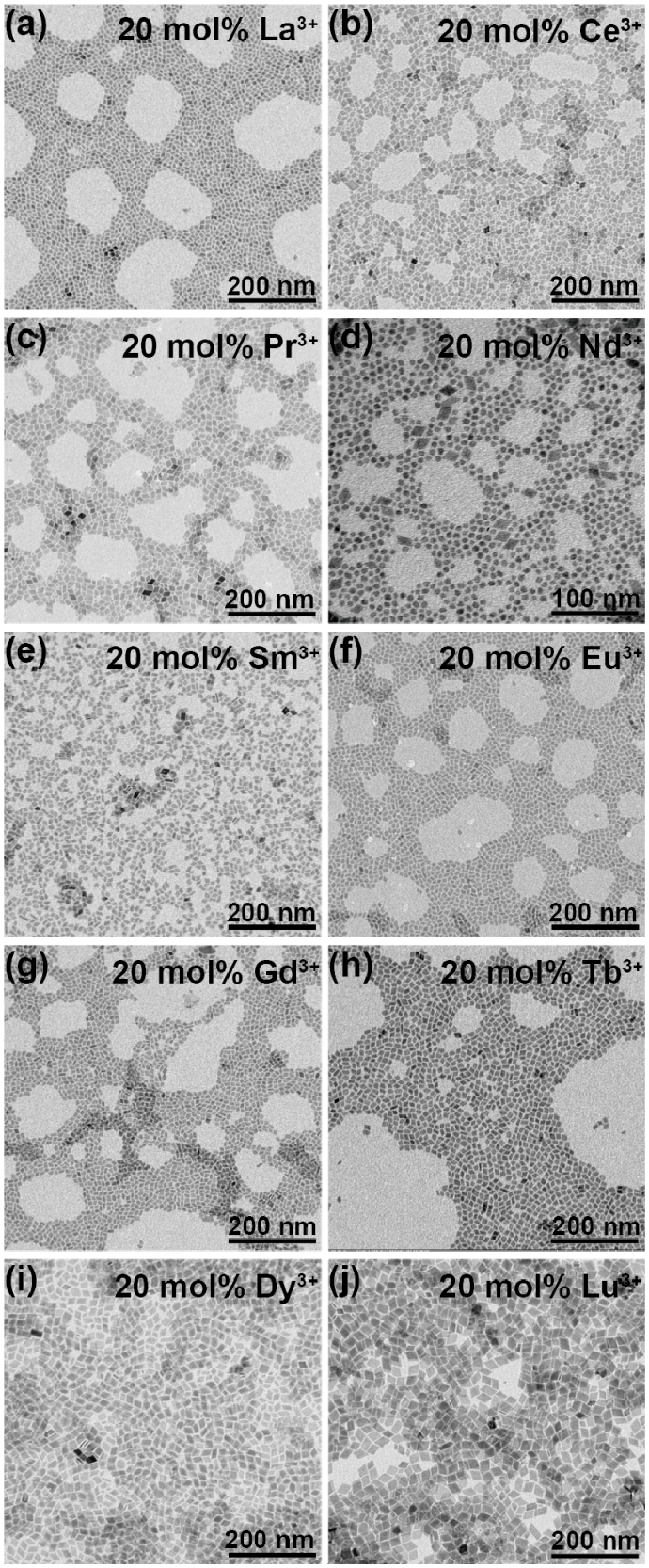

Fig. S6 TEM images of YF_3:Yb/Er (18/2 mol%) nanocrystals doped with 20 mol% contents of (a) La^{3+}, (b) Ce^{3+}, (c) Pr^{3+}, (d) Nd^{3+}, (e) Sm^{3+}, (f) Eu^{3+}, (g) Gd^{3+}, (h) Tb^{3+}, (i) Dy^{3+}, and (j) Lu^{3+}).

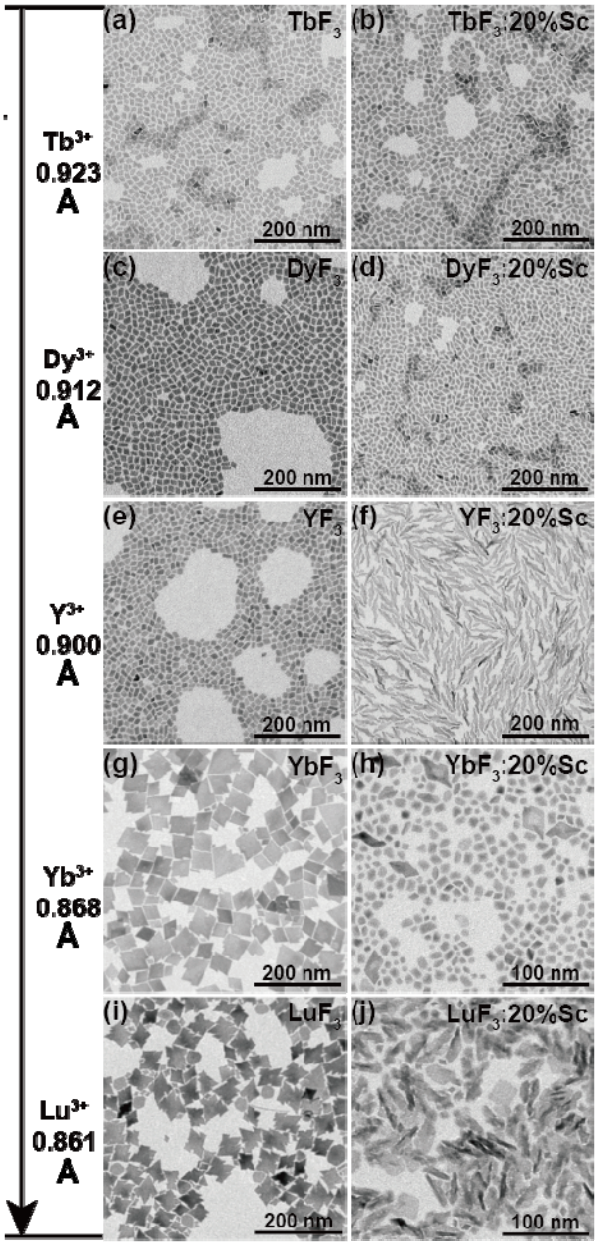

Fig. S7 TEM images of (a) and (b) TbF_3:Yb/Er (18/2 mol%) nanocrystals without and with 20 mol% Sc^{3+} ions, (c) and (d) DyF_3:Yb/Er (18/2 mol%) nanocrystals without and with 20 mol% Sc^{3+} ions, (e) and (f) YF_3:Yb/Er (18/2 mol%) nanocrystals without and with 20 mol% Sc^{3+} ions, (g) and (h) YbF_3:Yb/Er (18/2 mol%) nanocrystals without and with 20 mol% Sc^{3+} ions, and (i) and (j) LuF_3:Yb/Er (18/2 mol%) nanocrystals without and with 20 mol% Sc^{3+} ions.

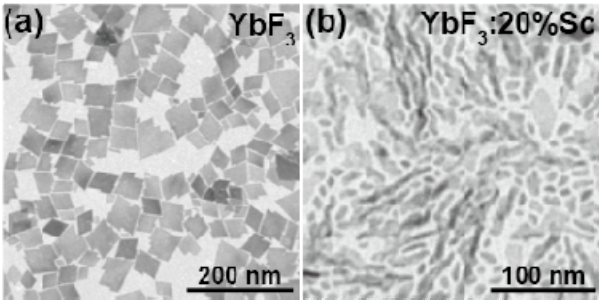

Fig. S8 (a) TEM images of YbF_3:Yb/Er (18/2 mol%) nanocrystals at the reaction time of 50 min. (b) TEM images of YbF_3:Yb/Er/Sc (18/2/20 mol%) nanocrystals at the reaction time of 180 min.

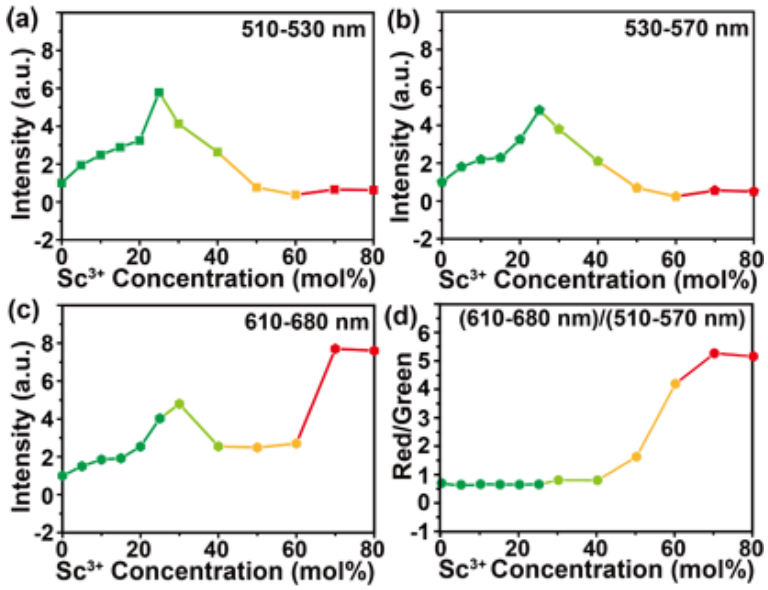

Fig. S9 Variation of the upconversion emission intensities at (a) 510-530 nm, (b) 530-570 nm, and (c) 610-680 nm as a function of the doping concentration of Sc^{3+} (0-80 mol%). (d) Red (610-680 nm) to green emission (510-570 nm) intensity ratio variation as a function of the doping concentration of Sc^{3+} (0-80 mol%).