Electronic Supplementary Material (ESI) for RSC Advances.

Core-shell Structured $NaMnF_3$:Yb,Er Nanoparticles for bioimaging application

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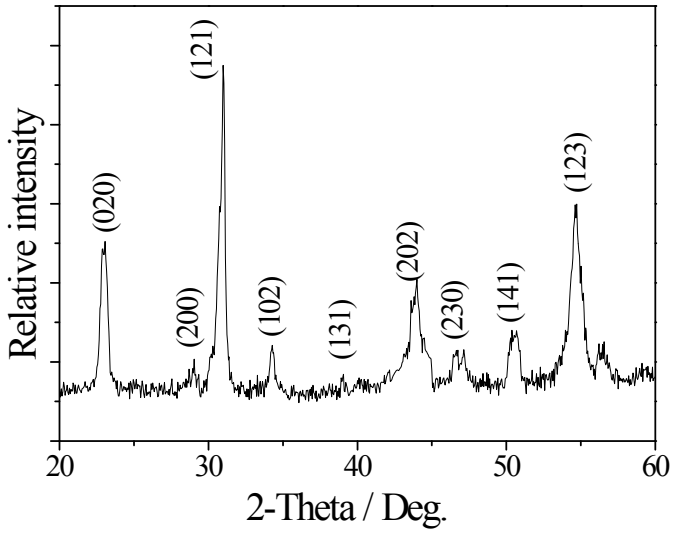
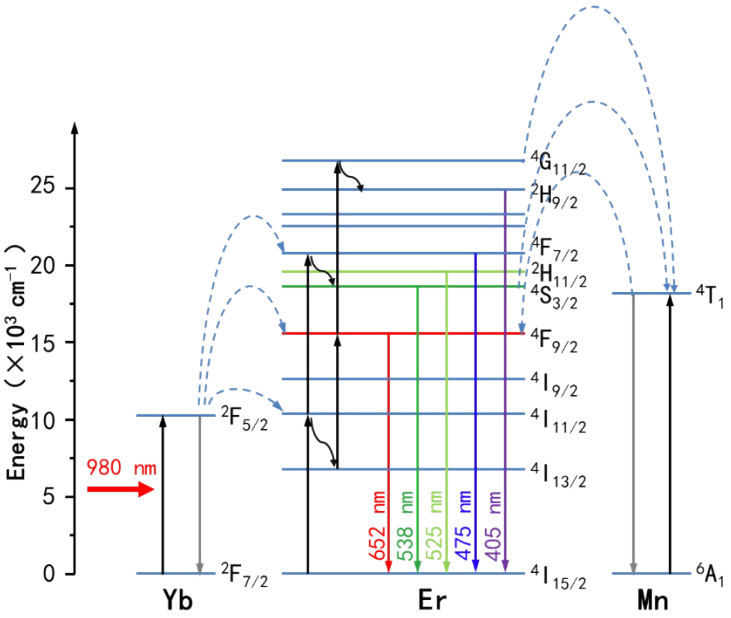
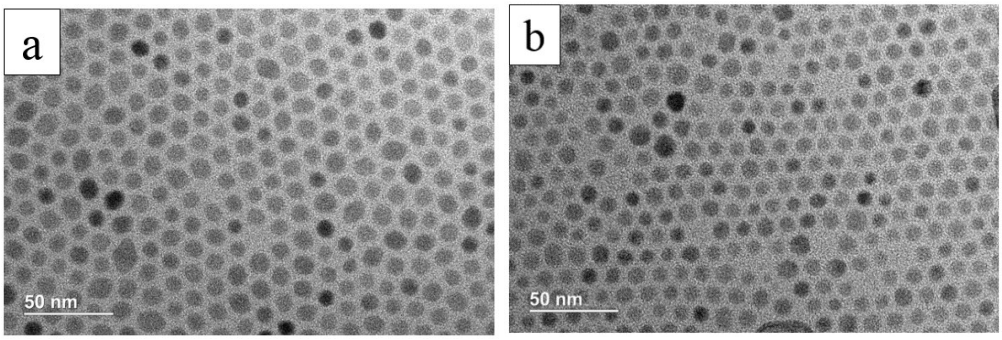


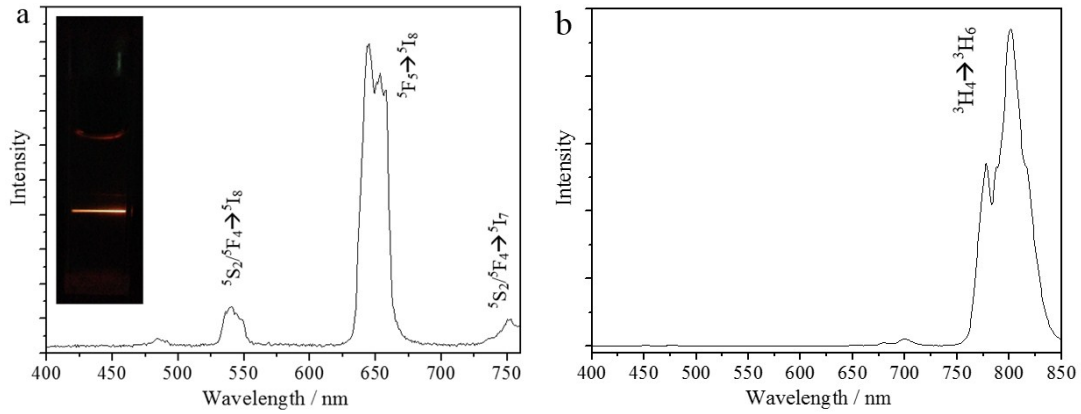
S1 XRD pattern of $NaMnF_3$:Yb^{3+}20%,Er^{3+}2% nanoparticles. The measured patterns indicated the prepared nanoparticles had crystallographic phases to the standard $NaMnF_3$ host lattice of JCPDS 18-1224



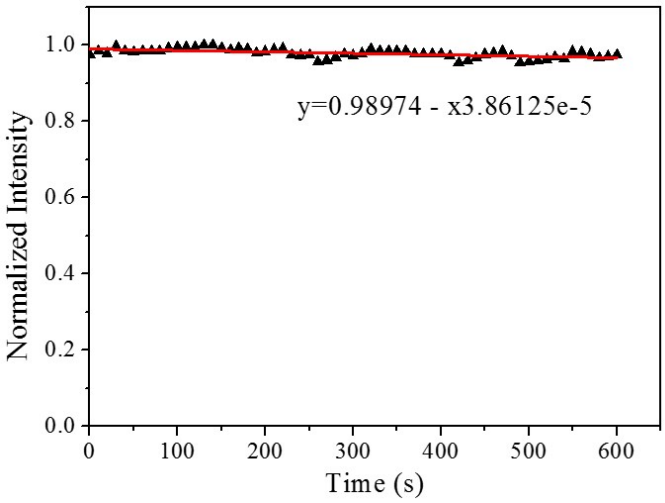
S2 Energy level diagrams of the Er^{3+}, Yb^{3+} ions and Mn^{2+} as well as the involved UC mechanisms



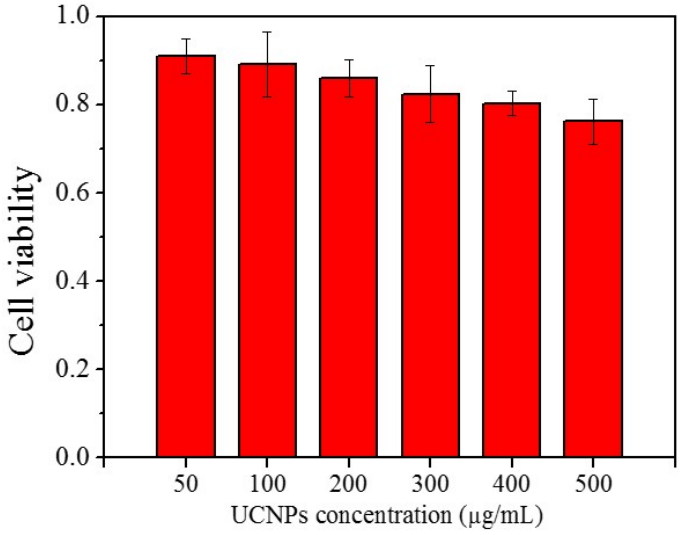
S3 Typical TEM images of (a) $NaMnF_3$:Yb^{3+}20%,Ho^{3+}2% and (b)$NaMnF_3$:Yb^{3+}20%,Tm^{3+}1% nanoparticle



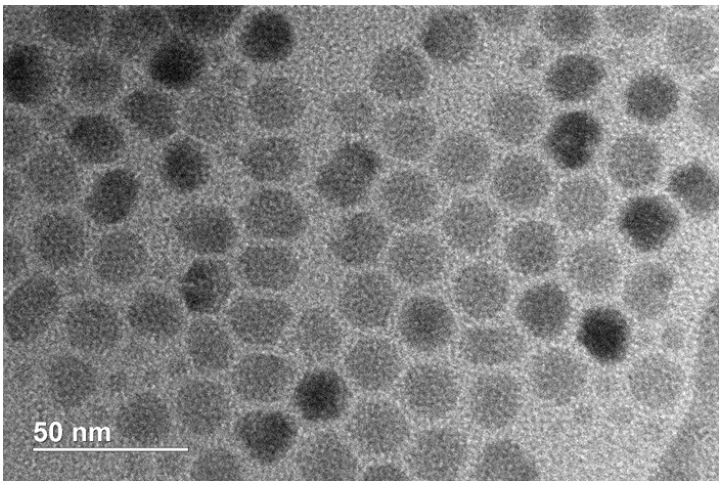
S4 photoluminescence spectra of (a) $NaMnF_3$:Yb^{3+}20%,Ho^{3+}2% and (b)$NaMnF_3$:Yb^{3+}20%,Tm^{3+}1% nanoparticle. The inset in Fig.S3. a shows the size distribution of $NaMnF_3$: 20% Yb^{3+}, 2% Er^{3+} nanoparticles



S5 photoluminescence intensity of PAAM-UCNPs irradiated different time



S6 Viability of HeLa cells incubated with PAAM-UCNPs at different concentrations



S7 Typical TEM images of $NaMnF_3$:Yb^{3+}20%,Er^{3+}2%@ $NaMnF_3$:Yb^{3+}20%,Nd^{3+}20% nanoparticles