

Supporting Information

Photon upconversion of Nd³⁺-Yb³⁺-Tb³⁺ doped core-shell-shell-shell nanoparticles

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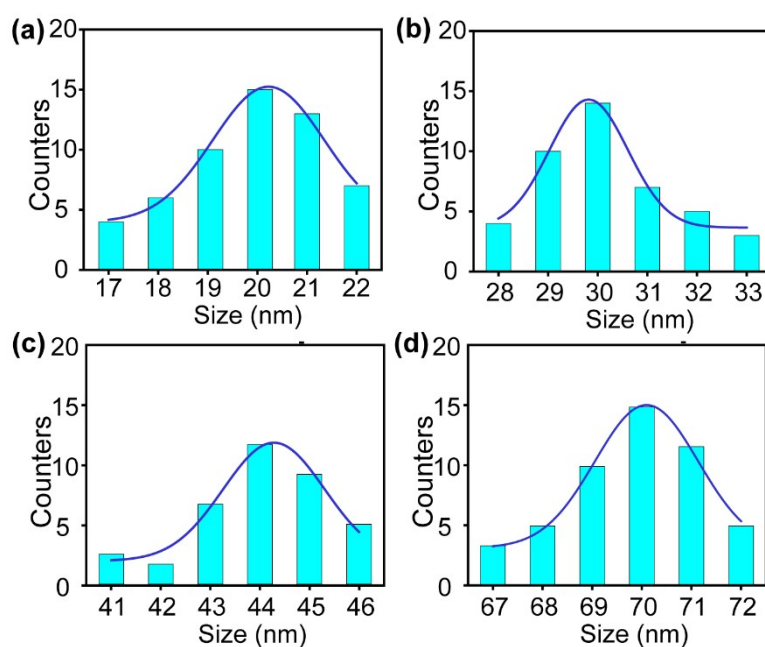


Fig. S1 Size distribution of core, CS, CSS, and CSSS nanoparticles.

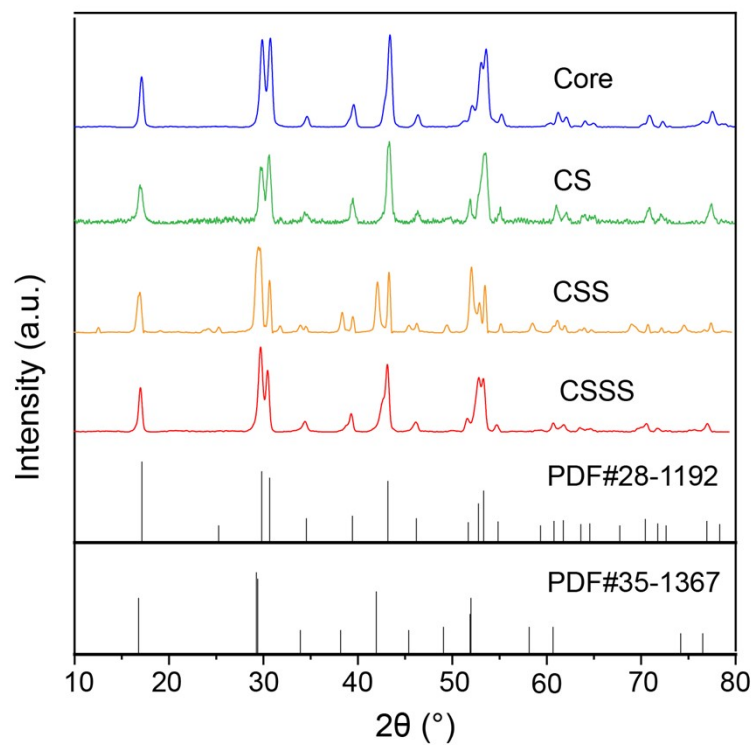


Fig. S2 X-ray diffraction (XRD) patterns of core, core-shell (CS), core-shell-shell (CSS), and core-shell-shell-shell (CSSS) nanoparticles.

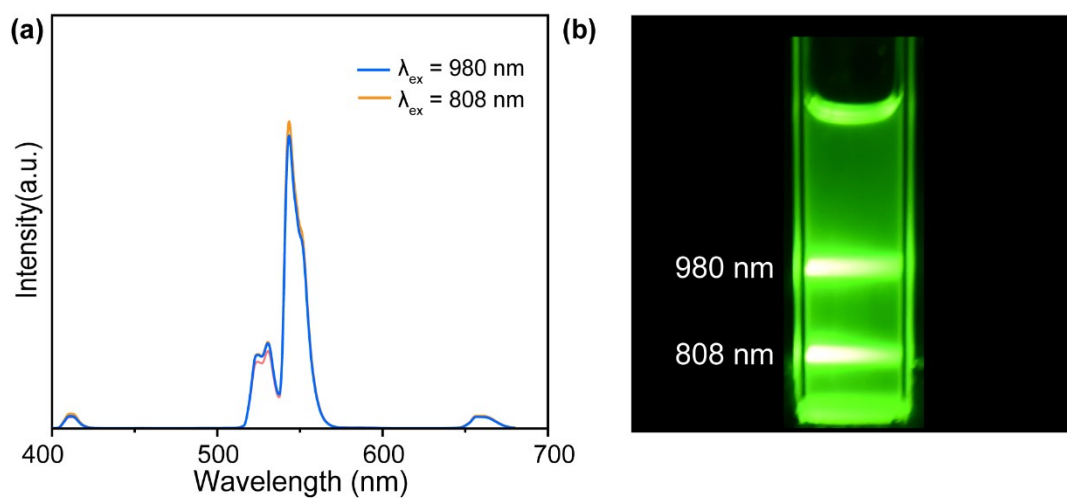


Fig. S3 luminescence spectrum of CSSS nanoparticles excited under 980 nm and 808 nm. (b) Photograph of CSSS nanoparticles excited under 980 nm and 808 nm.

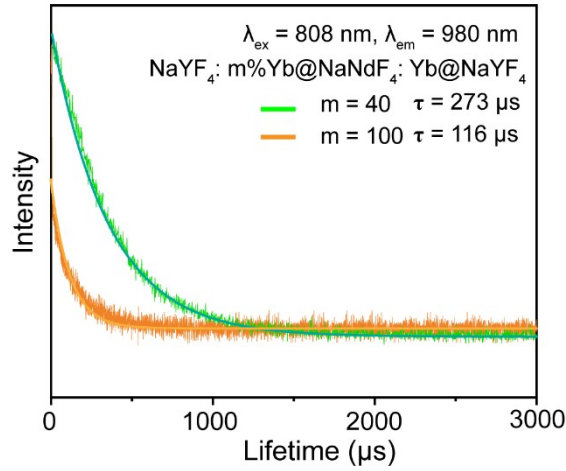


Fig. S4 Upconversion decay curves of $\text{NaYF}_4: m\% \text{Yb@NaNdF}_4: \text{Yb@NaYF}_4$ NPs

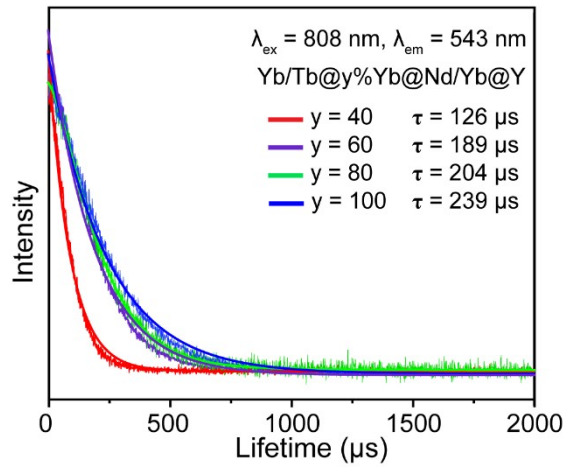


Fig. S5 Upconversion decay curves of CSSS NPs

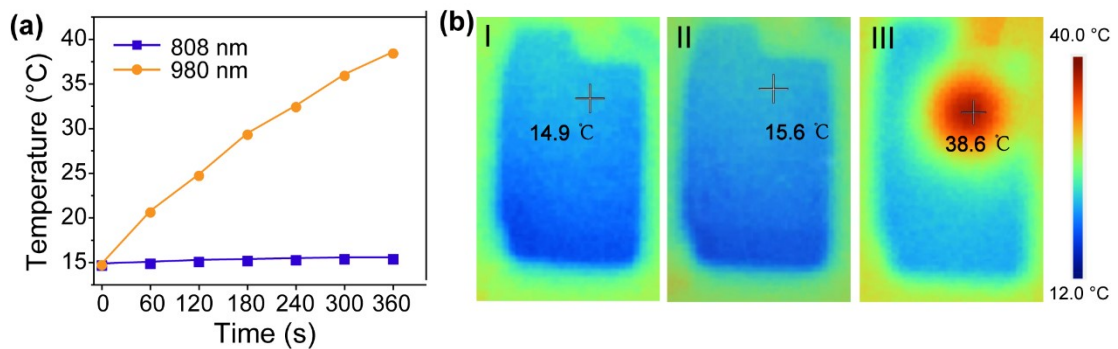


Fig. S6 (a) Time-resolved temperature curves of hydrogel heated by 808 nm and 980 nm laser irradiation. (b) Temperature-distribution image of hydrogel recorded after 360 s laser (I: natural state; II: 808 nm; III: 980 nm).