Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics.

Supporting Information

Simultaneous spectra and dynamics processes tuning of a single upconversion microtube through Yb^{3+} doping concentration and excitation power

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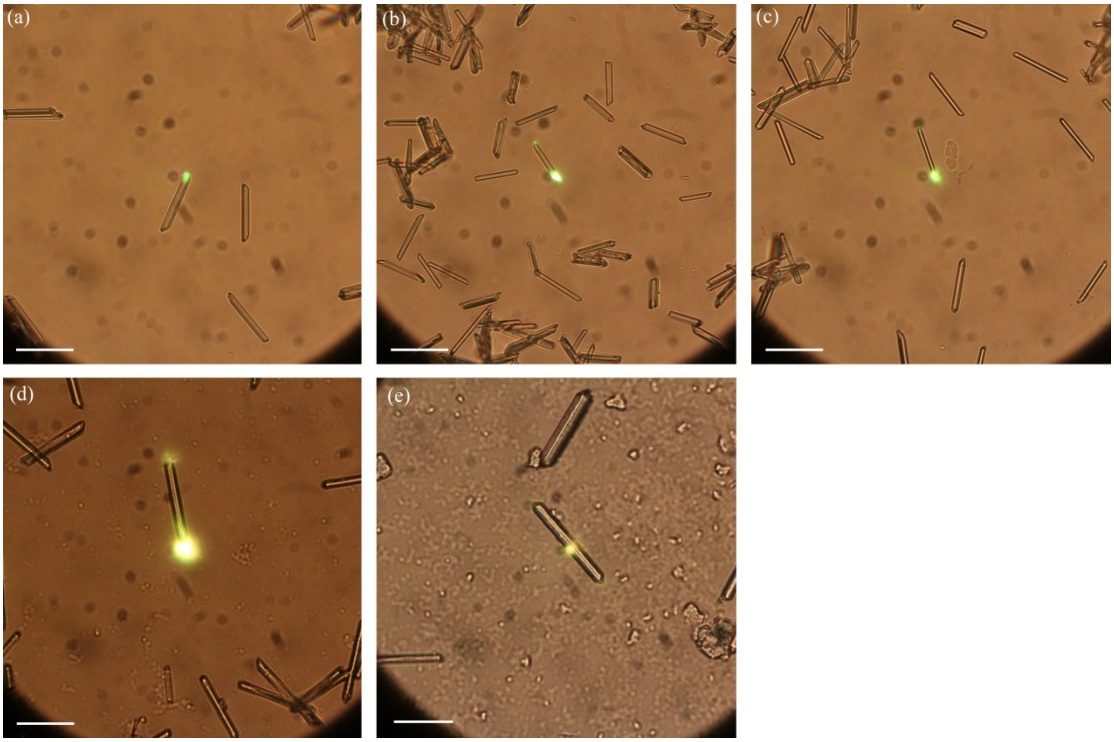

Fig. S1 Bright field optical microscope image of single $NaYF_4$: Yb/Er (x/2 mol%, x=5, 10, 20, 40 and 98) microtubes with local excitation at the central or the end part of tube. Scale bar, 50 μm.

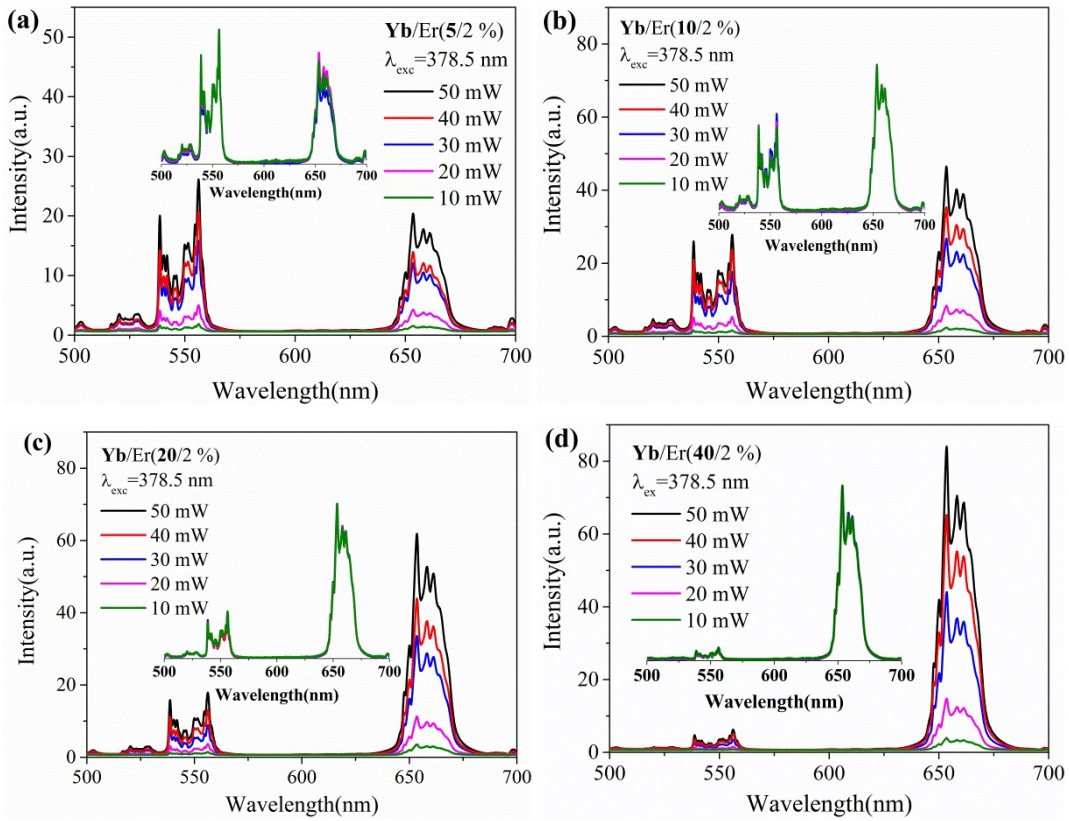

Fig. S2 Downconversion emission spectra under 378.5 nm laser excitation with different laser power densifies of $NaYF_4$: Yb/Er (x/2 mol%, x=5, 10, 20 and 40) microtubes. Insets are the normalized emission spectra excited with different laser power densifies. The Ti sapphire femtosecond laser (Mira-900, Spectra-Physics, 76 MHz, pulse width<200 fs) equiped with a second harmonic generation (SHG) was employed as downconversion excitation source (378.5 nm laser).

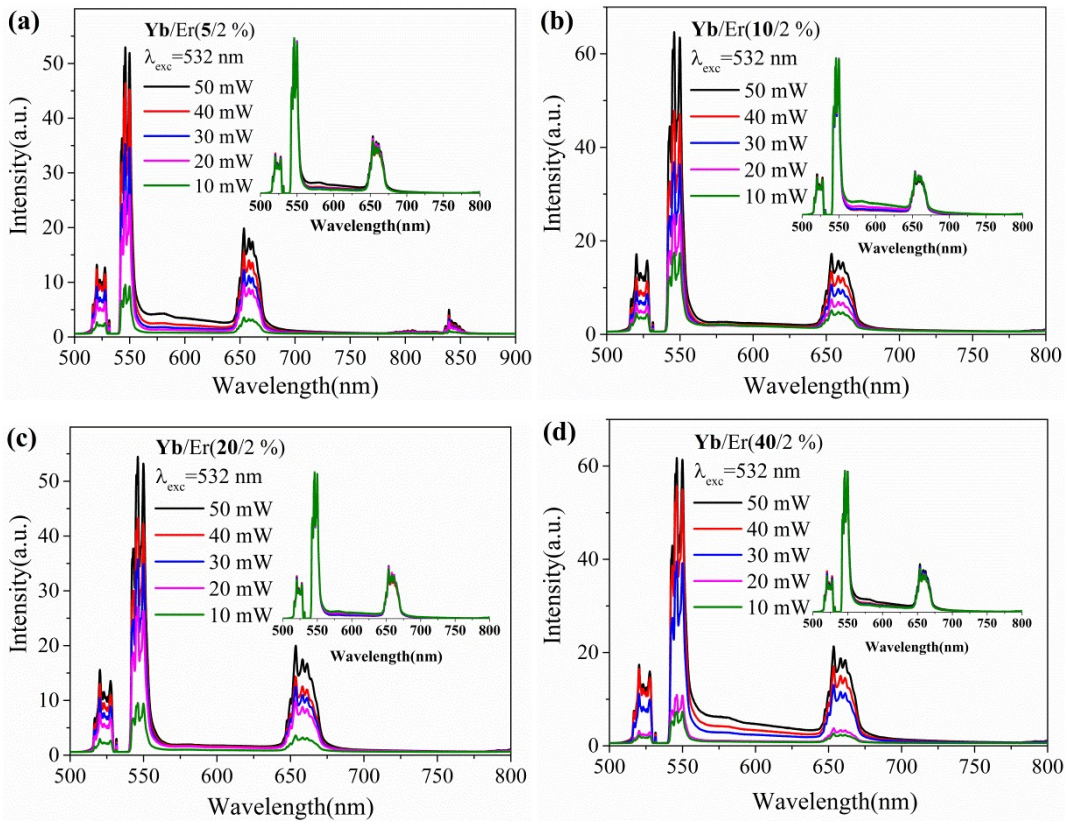

Fig. S3 Downconversion emission spectra under 532 nm laser excitation with different laser power densifies of $NaYF_4$: Yb/Er (x/2 mol%, x=5, 10, 20 and 40) microtubes. Insets are the normalized emission spectra excited with different laser power densifies.

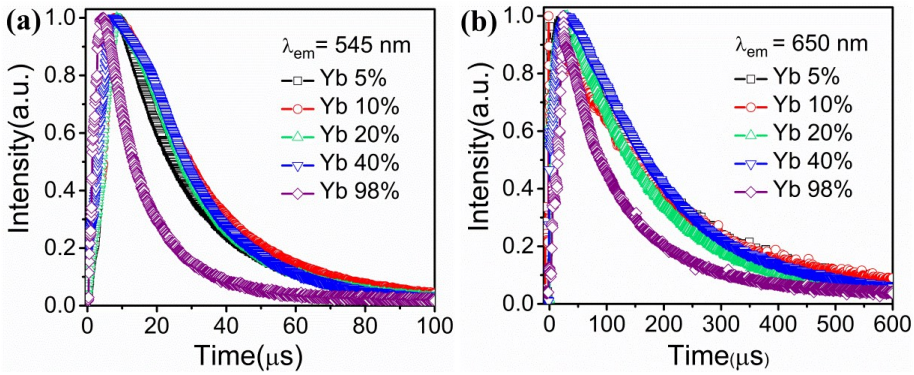

Fig. S4 Normalized lifetime decay curves for the green luminescence (a) and red luminescence (b) with 532 nm laser excitation in $NaYF_4$: Yb/Er (x/2 mol%, x =5, 10, 20, 40 and 98) microtubes.

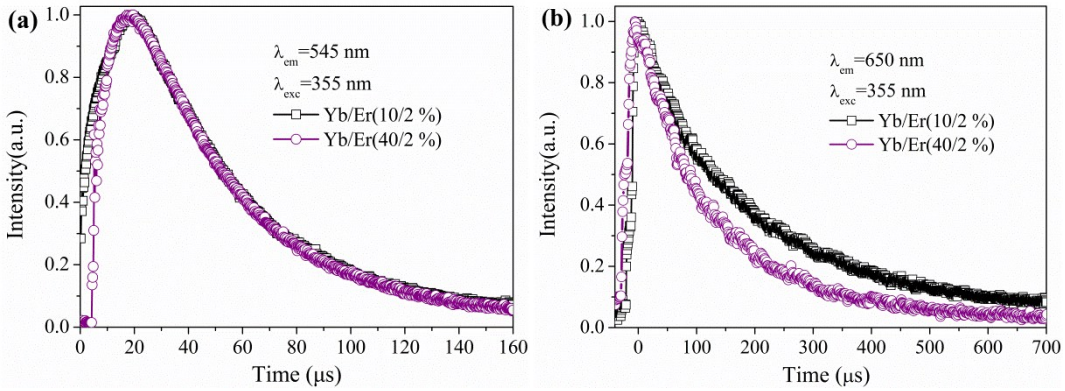

Fig. S5 Normalized lifetime decay curves for the green luminescence (a) and red luminescence (b) with 355 nm laser excitation in $NaYF_4$: Yb/Er (x/2 mol%, x = 10 and 40) microtubes.