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

Supporting Information

Facile Synthesis and Screen Printing Dual-mode Luminescent Material of $NaYF_4$: Er, Yb (Tm) /Carbon Dots for Anti-Counterfeiting Applications

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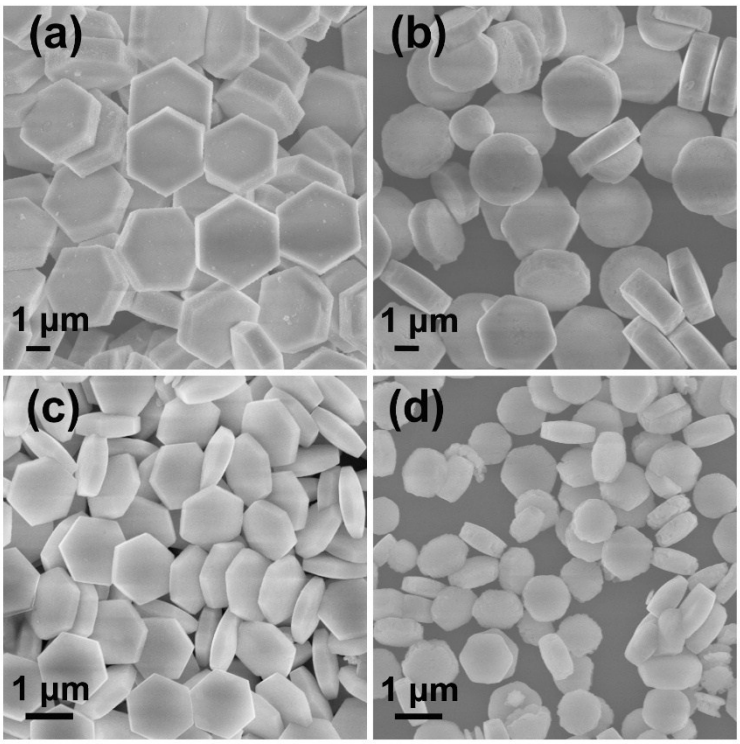

Figure S1 SEM images of $NaYF_4$: Yb^{3+} 50%, Er^{3+} 2% UCMPs (a), $NaYF_4$: Tm^{3+} 2%, Er^{3+} 10% UCMPs (c), and corresponding images of UCMPs/CDs (b, d), respectively.

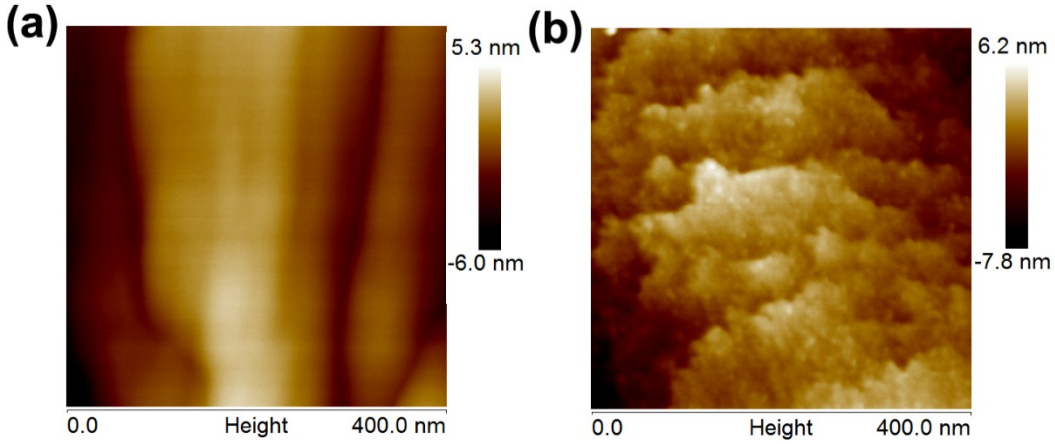

Figure S2 AFM images of $NaYF_4$: Yb^{3+} 18%, Er^{3+} 2% UCMPs (a), $NaYF_4$: Yb^{3+} 18%, Er^{3+} 2% UCMPs/CDs (b).

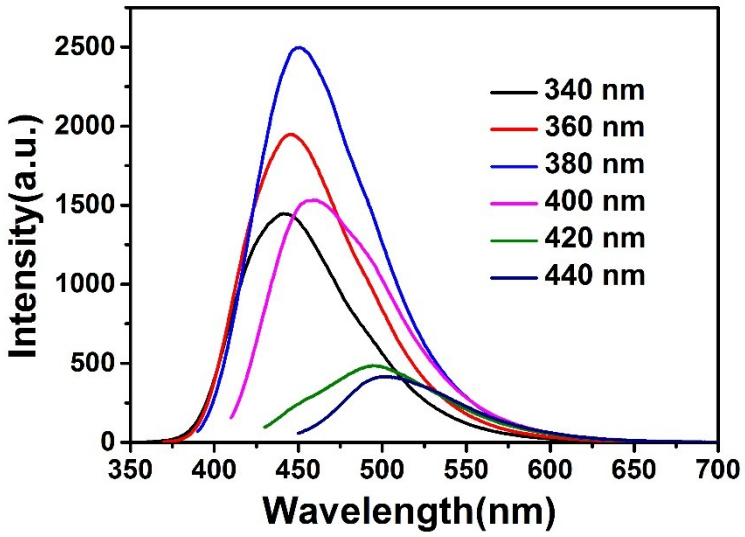

Figure S3 The fluorescent spectra of CDs solution.

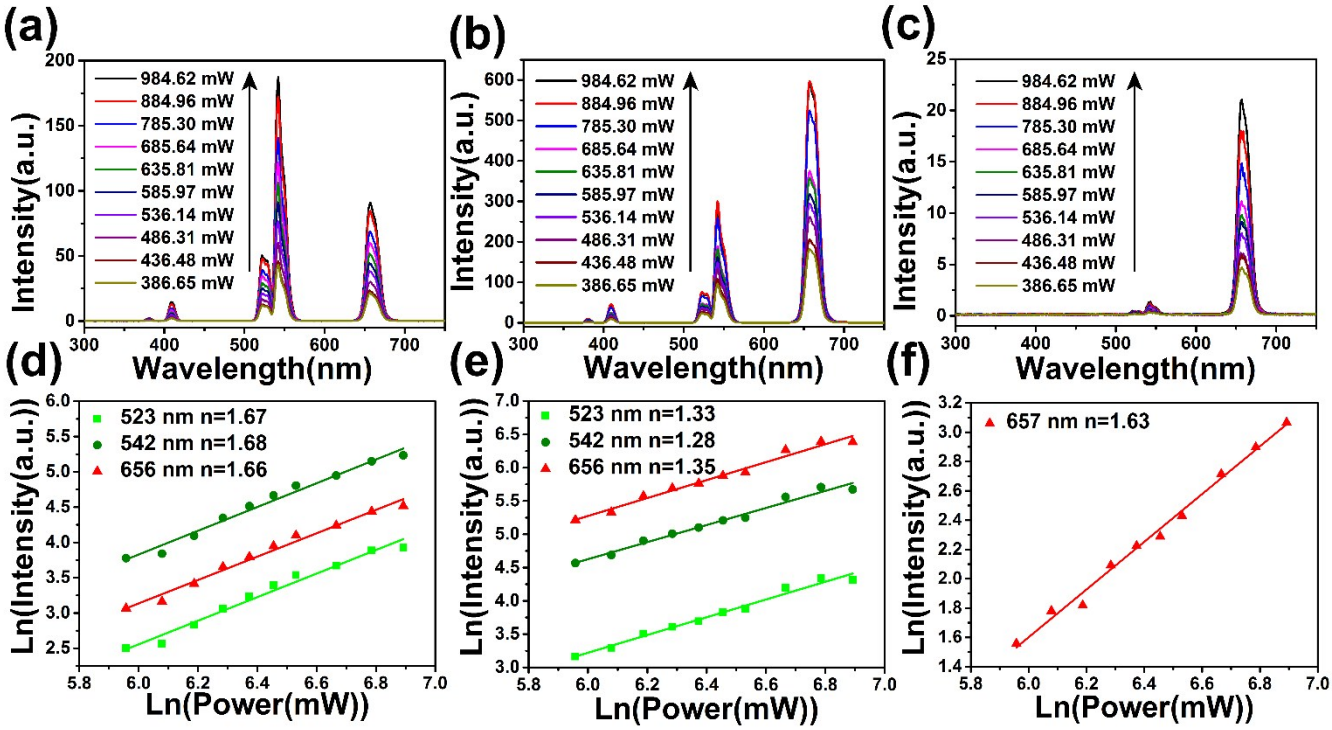

Figure S4 The UC luminescent intensity of naked UCMPs in $NaYF_4$:Yb^{3+} 18%, Er^{3+} 2% (a), $NaYF_4$:Yb^{3+} 50%, Er^{3+} 2% (b), and $NaYF_4$:Tm^{3+} 2%, Er^{3+} 10% (c); the corresponding laser power dependence of the emission of naked UCMPs under the 980nm laser excitation (d-f).

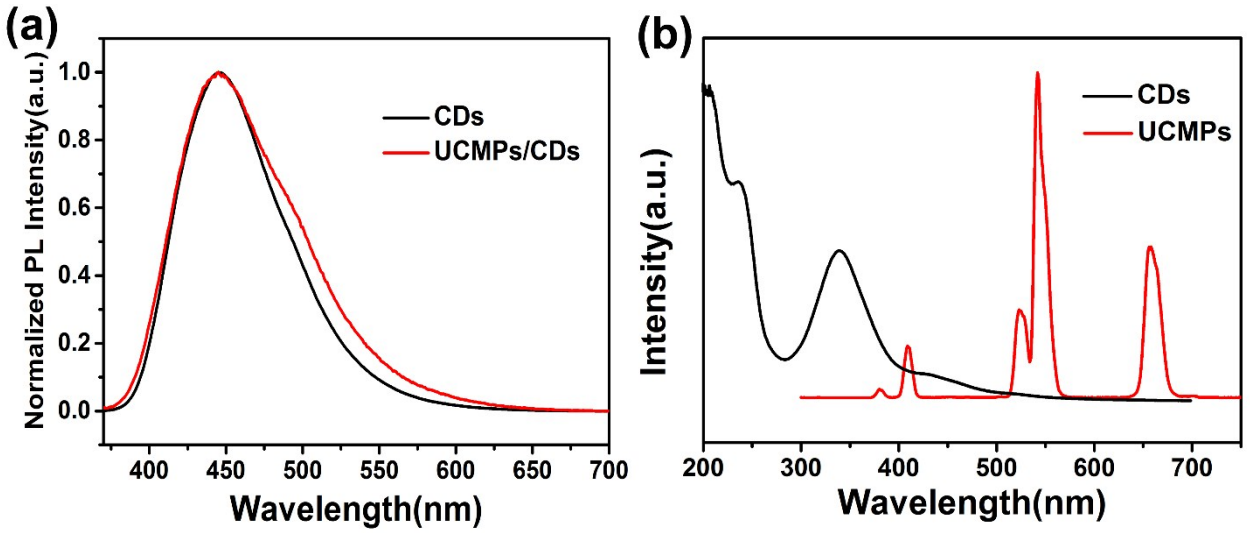

Figure S5 The DC fluorescence spectra of CDs and UCMPs/CDs (a), and the absorption spectra (black line) of CDs and UC PL spectra (red line) of UCMPs (b).

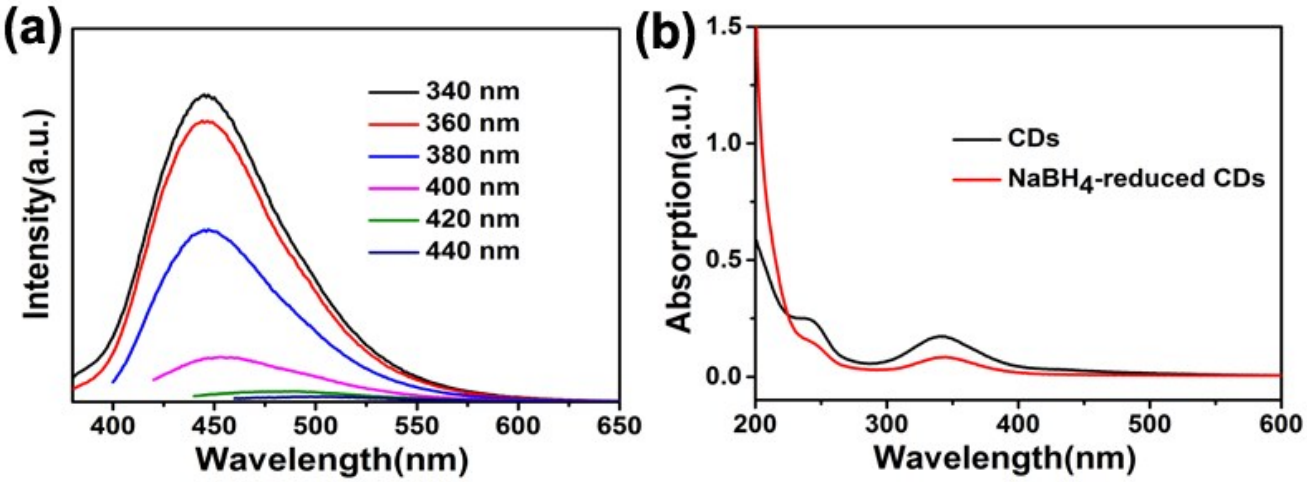

Figure S6 The fluorescent spectra of $NaBH_4$-reduced CDs solution (a); and UV–visible absorption spectra (b).

For the reduction of the CDs, the process: sodium borohydride ($NaBH_4$, 0.05 g) is mixed with an aqueous solution of CDs (0.01 mg/ml, 15 ml), and then stirred for 18 hours at room temperature. The redundant sodium borohydride is removed by dialysis treatment.

Figure S7 The photographs of screen printing plates.