Electronic Supplementary Information For

Plasmon enhanced efficient dye-sensitized solar cells using core-shell-structured β-$NaYF_4$:Yb,Er@SiO_2@Au nanocomposites

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Experimental

Measurement of upconversion quantum yield

The quantum yield of upconversion luminescence emission of the UCNPs was calculated with the following equation:[1]

$$\mathrm{QY} = \frac{Photos\ emitted}{Photos\ absobed} = \frac{L_{sample}}{E_{reference} - E_{sample}}$$

Where QY is the quantum yield, L_{sample} is the emission intensity; $E_{reference}$ and E_{sample} are the intensities of the excitation light in the presence of the undoped and doped upconversion samples, respectively. Quantum yield measurement was performed using a fluorescence spectroscopy (Edinburgh LFS920) modified by using Ocean Optics UV-VIS-NIR CCD (QE65000) as a detector for collecting the 980 nm light and the UC emissions. An integrating sphere was also used to measure the efficiency data. The response of the detection systems in photon flux was determined using a calibrated VIS-NIR lamp (Ocean Optics LS-1-CAL). In addition, pure $NaYF_4$ without doped Yb^{3+} and Er^{3+} ions were used as reference for measurement of 980 nm absorption.

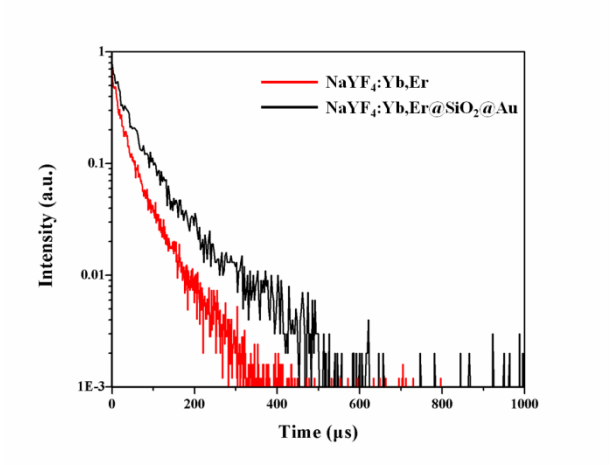

Figure S1 Decay curves of Er^{3+} emission at 543 nm by excitation at 980 nm in $NaYF_4$:Yb,Er and $NaYF_4$:Yb,Er@SiO_2@Au samples.

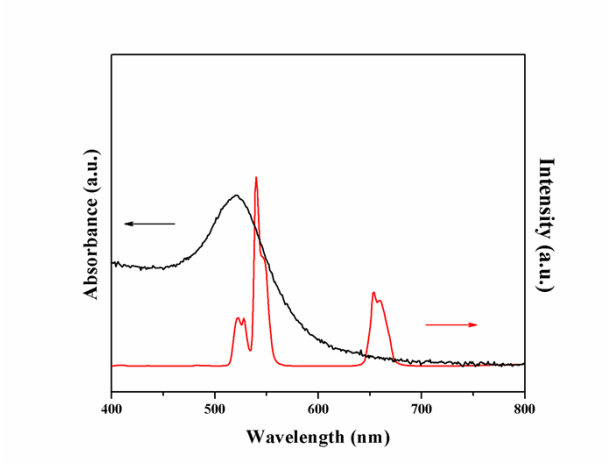

Figure S2 UV-vis absorption spectrum of Au NPs (black curve) and upconversion fluorescence spectrum of $NaYF_4$:Yb,Er NPs (red curve).

Reference

1 J. C. Boyer, F. C. J. M. van Veggel, *Nanoscale*, 2010, **2**, 1417.