Electronic Supplementary Information (ESI)

Synthesis of gold nanorod/neodymium oxide yolk/shell composite with plasmon enhanced near-infrared luminescence

Yafang Zhang,*[a,b] Jiahong Wang,*[b,c,d] Fan Nan[b,e] and Qu-Quan Wang *[b]

[a]School of Physics and Technology, University of Jinan, Jinan, 250022, P. R. China.
E-mail: yfzhang_opt@126.com
[b]School of Physics and Technology, Wuhan University, Wuhan, 430072, P. R. China.
E-mail: qqwang@whu.edu.cn
[c]Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, Shenzhen 518055, P. R. China
E-mail: jh.wang1@siat.ac.cn
[d]Department of Physics, City University of Hong Kong, Kowloon, Hong Kong, P. R. China
[e]Department of Chemical and Biomolecular Engineering, Clarkson University, Potsdam, NY 13699, United States.

1. Experimental Section

Preparation of AuNR@Nd_2O_3 yolk/shell nanocomposites: The AuNRs were firstly synthesized using a seed-mediated growth method.[1] The freshly prepared AuNRs solution was centrifuged at 10,000 rpm for 10 min and resuspended in defined volume of ultrapure water. Fig. ESI-1a shows the TEM images of AuNRs. The surfactant was exchanged from CTAB to oleate according to the method described previously[1]. For the synthesis of AuNR@Nd_2O_3 core/shell composite, 5 mL of oleate-coated AuNRs aqueous solution was added to 14 mL of ultrapure water, followed by injection of $Nd(NO_3)_3$ (0.01 M, 0.5 mL) and HMT (0.2 M, 0.5 mL) aqueous solution. The resulting mixture was gently stirred till a well-dispersed solution was achieved. After incubated in an oven at 85℃ for 3 h, the solution was centrifuged at 8,000 rpm for 8 min and resuspended in 5 mL of ultrapure water. The above steps were repeated for three times, the final AuNR@Nd_2O_3 yolk/shell nanocomposites were obtained as shown in Fig. ESI-1b.

Preparation of Nd_2O_3 hollow nanoparticles: The Nd_2O_3 hollow nanoparticles were prepared by using a electrolyte etching method.[2,3] In detail, 1,2-DMPII and I_2 were first dissolved in the mixing solution of acetonitrile/ butyl cyanide [85/15, v:v]. Then, 1 mL of 1.2 M 1,2-DMPII solution, 1 mL of 0.1 M I_2 aqueous solution and 40 μL of LiI aqueous solution are mixed together. An appropriate amount of the electrolyte solution was injected into 5 mL of the AuNR@Nd_2O_3 yolk/shell composite aqueous solution. The mixture was sonicated for different time to achieve composite contain various length AuNR. After 4 h etching, the AuNRs totally disappeared and the hollow Nd_2O_3 HNPs were obtained as Fig. ESI-1c shows.

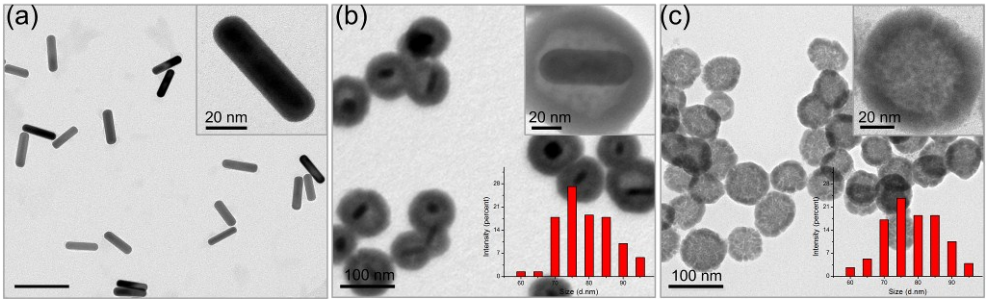

Fig. ESI-1 Low magnification and single particle TEM images of original AuNRs (a), AuNR@Nd_2O_3 yolk/shell nanocomposites (b) and Nd_2O_3 hollow nanoparticles (c). The insets in (b) and (c) are size distribution of AuNR@Nd_2O_3 yolk/shell and Nd_2O_3 hollow nanoparticles.

2. Characterization

Extinction spectra were recorded on TU-1810UV-Vis-NIR spectrophotometer (Purkinje General Instrument Co. Ltd Beijing, China). Transmission electron microscopy (TEM) images were obtained on a JEOL 2100F transmission electron microscope at an accelerating voltage of 200 kV. The excitation source for the fluorescence spectra was a Ti:Sapphire laser (Mira 900, Coherent) at 730 nm. An 830 nm cut filter was used to filter the exciting noise and a tunable neutral density filter was used to adjust the excitation intensity, respectively. The near-infrared luminescence spectra were recorded by a spectrometer (Spectrapro 2500i, Acton) with liquid nitrogen cooled CCD (SPEC-10:100B, Princeton)

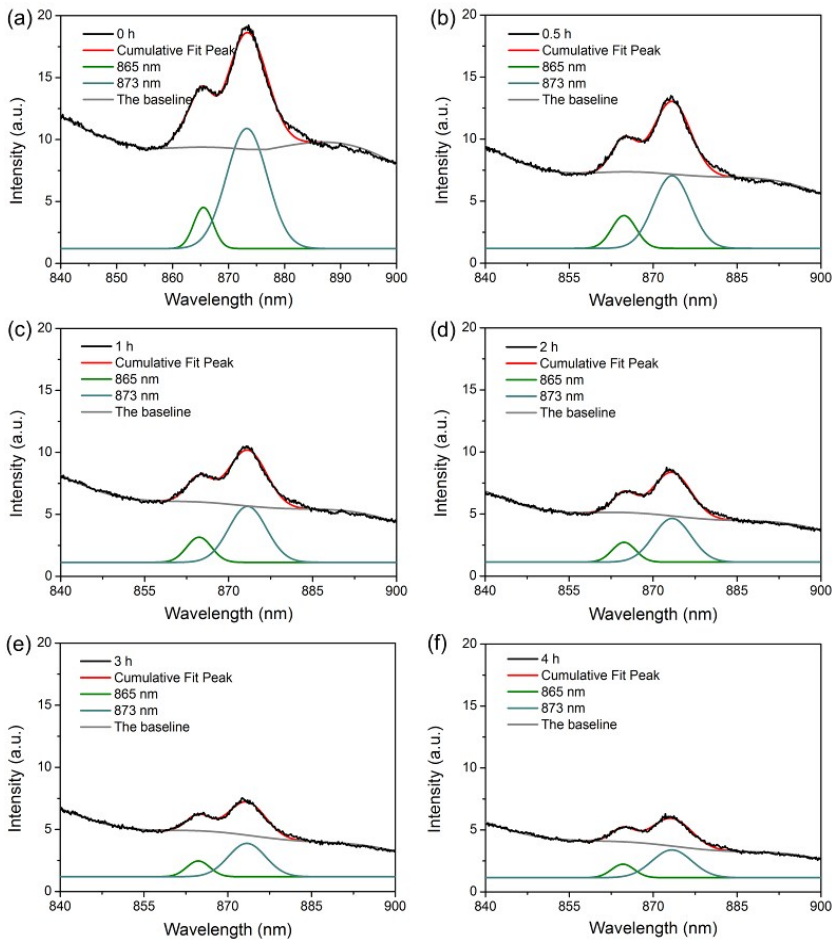

Fig. ESI-2 Emission spectra of composites after etching for 0 h (a), 0.5 h (b), 1.0 h (c), 2.0 h (d), 3.0 h (e) and 4.0 h (f). The spectra are fitted into Gaussian lines. The green and the blue lines present the emission bands at 865 nm and 873 nm of Nd^{3+}. The gray lines present the baseline.

References

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