Electronic Supplementary Information

Facile Synthesis of Ultrasmall GdF_3 Nanowires via Oriented Attachment Growth and Their Luminescence Properties

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Experimental Section

1. Preparation of GdF_3 ultrathin nanowires and Eu^{3+} doping GdF_3 ultrathin nanowires:

Otcylamine was purchased from ACROS. $Gd(NO_3)_3$, Octanol and oleic acid were purchased from Tianjin Chemical Reagent Company. All the chemicals were analytical reagents and used without further purification. $Gd(acac)_3$ was prepared by the method according to the ref.[1] In a typical synthesis of the GdF_3 nanowires, $Gd(acac)_3$ (1 mmol,) and HF (3 mml) were added in the mixture of octylamine (4.0 ml) and octanol (12.0 ml) with stirring to for about 10 min forming a transparent solution. Then, the solution was transformed in to a Teflon-lined autoclave. The autoclave was sealed and maintained 200 °C for 4 hours in an oven. After cooling to room temperature, white precipitate was collected by centrifugation and washing with ethanol repeatedly to obtain ultrasmall GdF_3 nanowires. The obtained precipitate could be dissolved in non-polar solvent easily such as chloroform and cyclohexane. The GdF_3 ultrasmall nanowires with Eu^{3+} doping was prepared by the same method only with 20 mol% $Eu(acac)_3$ substituting $Gd(acac)_3$ in precursor solution.

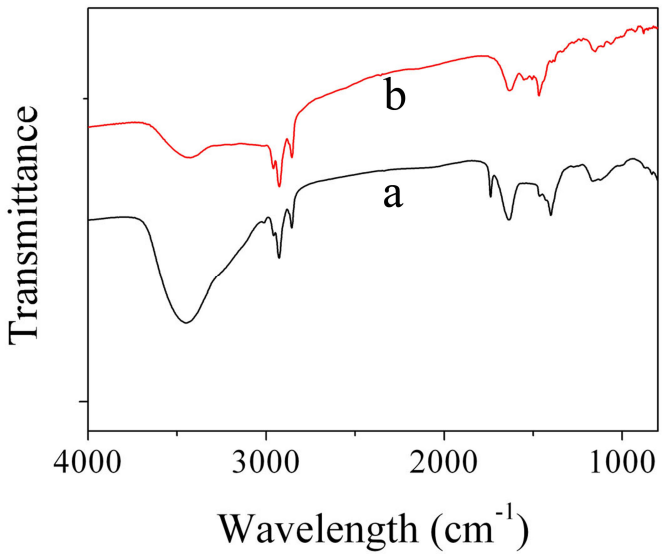
2. Characterization:

The X-ray diffraction (XRD) patterns of the samples were collected using a diffractometer (Rigaku D/Max 2200PC) with CuKα radiation (λ=1.5418Å) and graphite monochromator from 20 to 70° at a scanning rate 2.0 °/min. Unit cell dimensions were determined in the JADE 5 program for X-ray diffraction pattern processing, identification, and quantification. The size and morphology of the products were characterized by transmission electron microscopy (TEM, JEM100-CXII) with the potential of performing selected-area electron diffraction (SAED) equipped with energy dispersive X-ray (EDX, Oxford) spectrum. High-resolution TEM (HR-TEM, JEOL-2010) was applied to study the intrinsic crystallography of the obtained samples. The chemical composition of the as-prepared nanowires and nanodots doped with Eu^{3+}

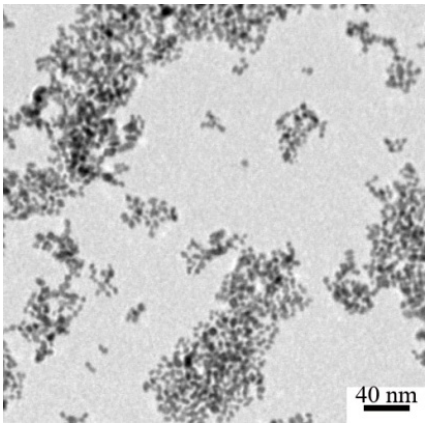
were analyzed by EDX (Oxford). The fluorescence properties of all the samples were investigated under Hitachi F4500 fluorescence spectrometer and Edinburgh lifetime and steady state spectrometer (FLS920) equipped with 450 W Xe lamps. The samples for fluorescence testing were prepared by solid powder of samples.

2. **Fig. S1.** FT-IR spectrum of the as-prepared GdF_3 samples with oleic acid (a) and octylamine (b), respectively.

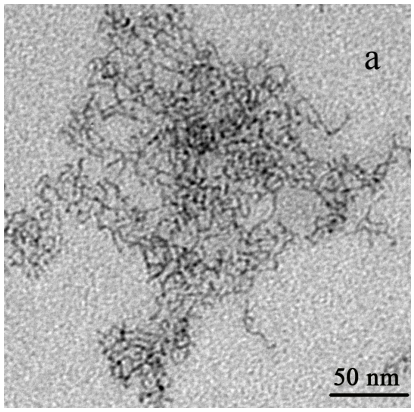
The FTIR spectrum shows that for the octylamine capping sample(curve b), the broad band around 3429 cm^{-1} was assigned to stretching vibrations of N-H bonds and adsorbed water molecular, the absorptions at about 2900 cm^{-1} was corresponded to stretching vibrations of C-H bonds, and the bands between 1627 cm^{-1} was assigned to bending vibrations of N-H bonds. For the oleic acid capping sample (curve a), the C=O stretching vibration peak at 1739 cm^{-1} was clearly observed in the FTIR spectrum. Comparing to that of free oleic acid at 1708 cm^{-1}, the C=O peak shifts to higher wavenumber indicates its coordination interaction with the GdF_3 nanocrystals.[1] The multiple peaks in the range of 1000-1700 cm^{-1} could be assigned to the C-H, COO- and H_2O modes or their mixtures.

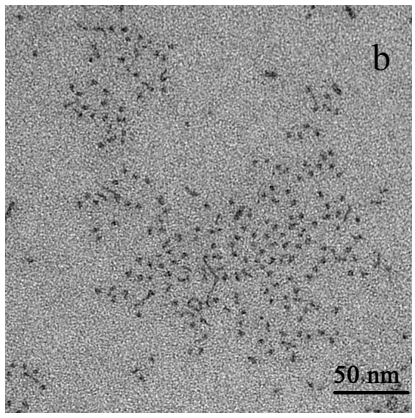


3. **Fig. S2.** TEM image for the GdF_3 prepared with oleic acid.

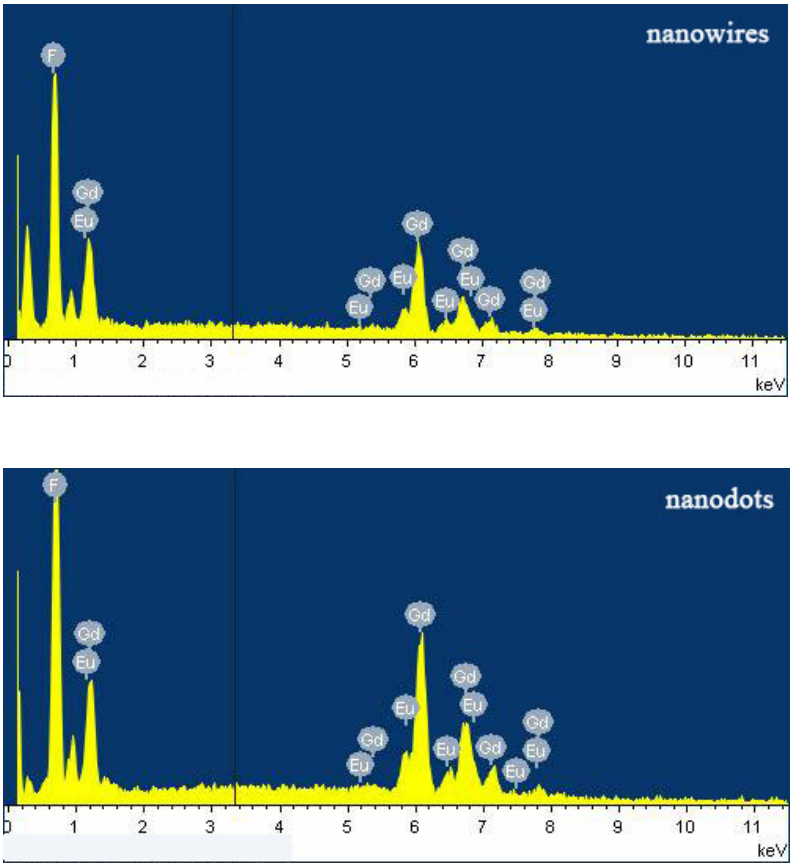


3. **Fig. S3** TEM image of the as-prepared GdF_3 ultrasmall nanowires (a) and nanodots (b) with 20 mol% Eu^{3+} doping





4. **Fig. S4** EDX of the as-prepared GdF_3 ultrasmall nanowires and nanodots with 20 mol% Eu^{3+} doping



5. References

1. X. Xu and X. Wang, *Nano Res.*, 2009, **2**, 891-902