Supporting Information

Facile Synthesis of $GdBO_3$ Spindle Assemblies and Microdisks as Versatile Host Matrixes for Lanthanides Doping

Zhengquan Li, Yubin Zeng, Haisheng Qian, Ran Long and Yujie Xiong**

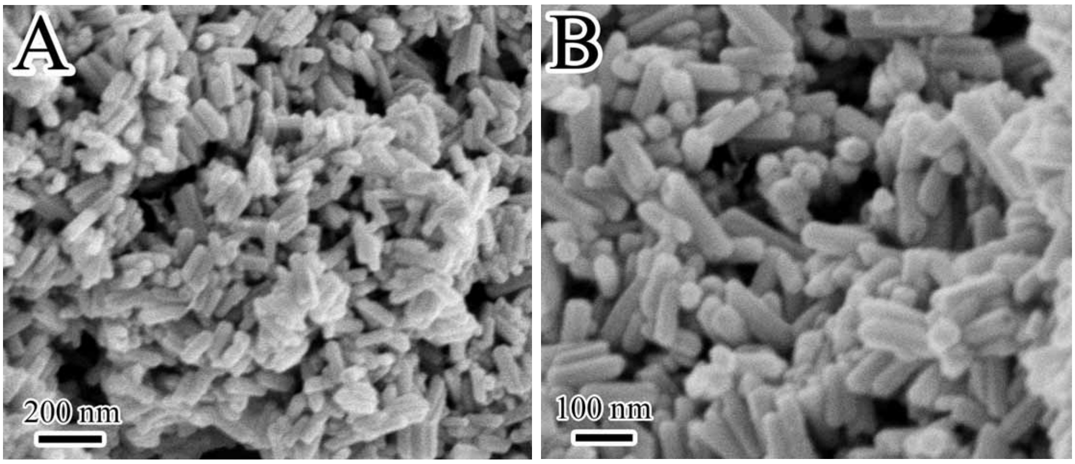

Figure S1. SEM images of $Gd(OH)_3$ nanorods synthesized under the same condition as that in Figure 2 except the absence of H_3BO_3. It indicates that the intermediate $Gd(OH)_3$ colloids may possess a rod-like shape in the synthesis of $GdBO_3$ assemblies.

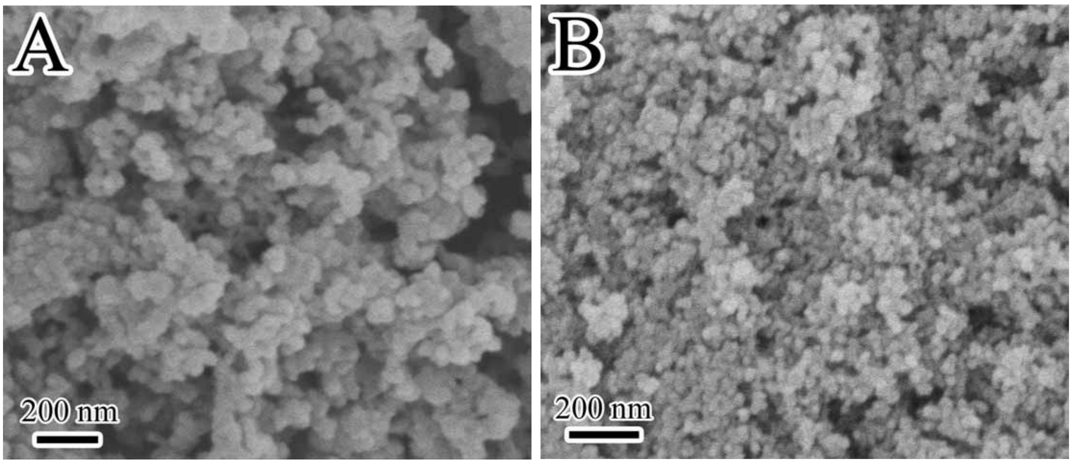

Figure S2. SEM images of $GdBO_3$ nanoparticles prepared under the same condition as that in Figure 2 except (A) the use of 2-mL ammonia (28. wt.%) to control pH; (B) the use of soluble $Na_2B_4O_7$ instead of H_3BO_3 powder. In both cases, the solution maintains alkaline during the entire process. As a result, $GdBO_3$ nanoparticles are of irregular shapes rather than rod-like shape, suggesting that the pH change in the synthesis holds the key to the formation of $GdBO_3$ spindle assemblies.

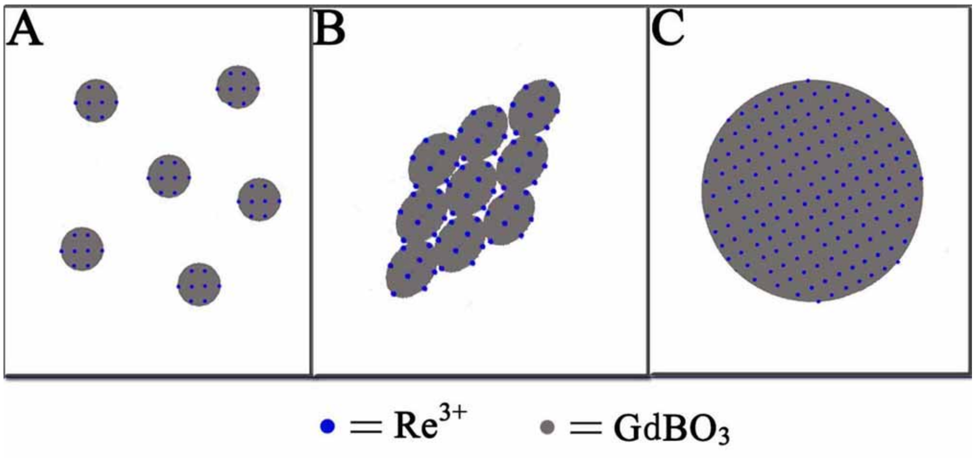

Figure S3. Schematic illustration for various $GdBO_3$ nanostructures containing luminescent lanthanide ions: (A) discrete nanocrystals; (B) a spindle assembly and (C) a single microdisk. The nanocrystals are assembled together to form a spindle assembly (from Panel A to Panel B). In the consideration that each assembly represents a single spot in bioimaging applications, local fluorescence from each spot in Panel B should be stronger than that from each discrete nanocrystal in Panel A. Furthermore, when multiple nanocrystals are assembled and then crystallized into a single-crystal microdisk at a bigger size (from Panel A to Panel C), surface defects will be greatly eliminated, enabling stronger fluorescent intensities in both the down-conversion or up-conversion spectra.

Electronic Supplementary Material (ESI) for CrystEngComm

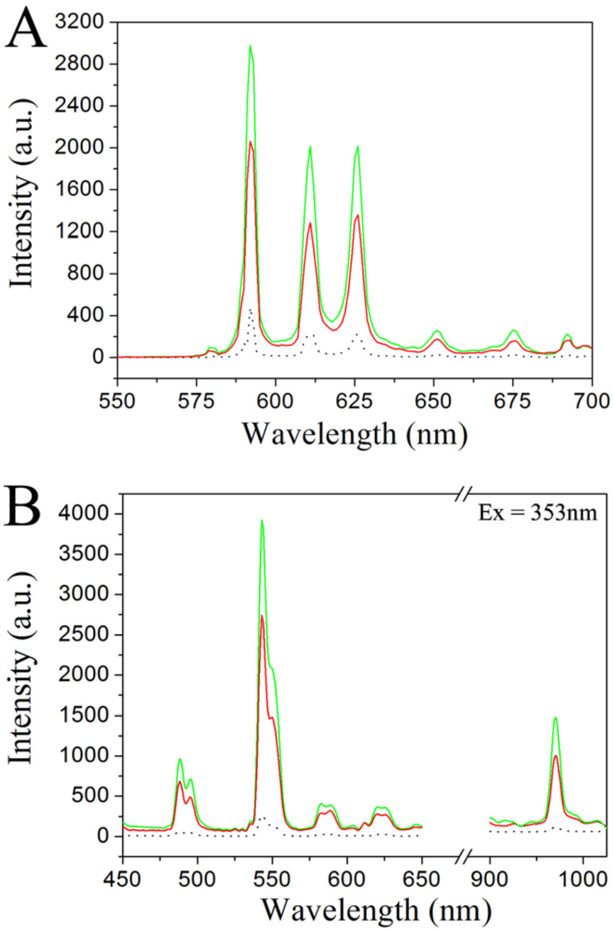

Figure S4. PL spectra of (A) $GdBO_3$:5%Eu and (B) $GdBO_3$:1%Ce,5%Tb,5%Yb samples with different structures: green line: microdisks; red line: spindle assemblies; dash line: small nanocrystals prepared with ammonia solution (see their morphologies in Fig. S2A). Fluorescence intensity of the spindle assemblies is nearly 5 times and 13 times stronger than the small nanocrystals in the Eu-doped and Ce/Tb/Yb co-doped samples, respectively. No obvious up-conversion fluorescence was observed from the small $GdBO_3$:10%Yb,1%Er nanocrystals under the same measuring condition.

Table S1. EDX analysis for the compositions of intermediate samples collected from different reaction stages during the hydrothermal process. The listed data of each sample are obtained by averaging those from three spots in the sample. It is found that the atomic percentage of element B in samples gradually increased in the first 24 h, suggesting that $Gd(OH)_3$ colloids were increasingly transformed into $GdBO_3$ as the reaction proceeded. Note that element H could not be detected by the EDX technique. Signals from the supporting substrates have been excluded during the data analysis.

Atomic% / Samples	Element Gd	Element O	Element B
0h	27%	73%	0%
3h	23%	74%	3%
6h	22%	67%	11%
12h	21%	64%	15%
24h	19%	62%	19%
36h	17%	65%	18%
48h	19%	63%	18%