Synthesis of $YF_3:Yb^{3+}/Er^{3+}$ nanosheets and their upconversion luminescence

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Recently, lanthanide doped upconversion nanomaterials with bright upconversion fluorescence emission have attracted a considerable interest. Most of the upconversion nanomaterials that have been synthesized so far are lanthanide doped fluoride materials, since fluoride materials have low phonon energies which minimize non-radiative losses to enable intense upconversion emissions. Among all fluoride host materials, YF_3 is one of the important fluorides with potential applications in solid-state laser, phosphors, ionic conductors, and scintillators [1-3]. As the control over morphology allows manipulation of emission properties of upconversion nanocrystals, numerious investigations have been devoted to control the morphology of YF_3 nanocrystals.

In the present investigation, we have synthesized $YF_3:Yb^{3+}/Er^{3+}$ nanosheets (Fig. 1(a)). Nanosheets are appeared to be tapered at the middle since the width of the nanosheet is decreasing from both ends to the middle. Length, width and thickness of the nanosheets are 160-240, 70-140 and 10-15 nm, respectively. Fluorescence emission spectrum of $YF_3:Yb^{3+}/Er^{3+}$ nanosheets was measured under an excitation of 980 nm laser (Fig. 2(b)). The emission spectrum shows the characteristic green (546 nm) and red (658 nm) upconverted light with red being more intense than the green. The green and red emission bands can be attributed to $^4S_{3/2} \rightarrow {}^4I_{5/2}$ and $^4F_{9/2} \rightarrow {}^4I_{5/2}$ transitions of Er^{3+} ion, respectively. The observed high photoluminescence intensity and peculiar morphology of $YF_3:Yb^{3+}/Er^{3+}$ nanocrystals are expected to lead to the potential application in biomedical imaging and display applications.

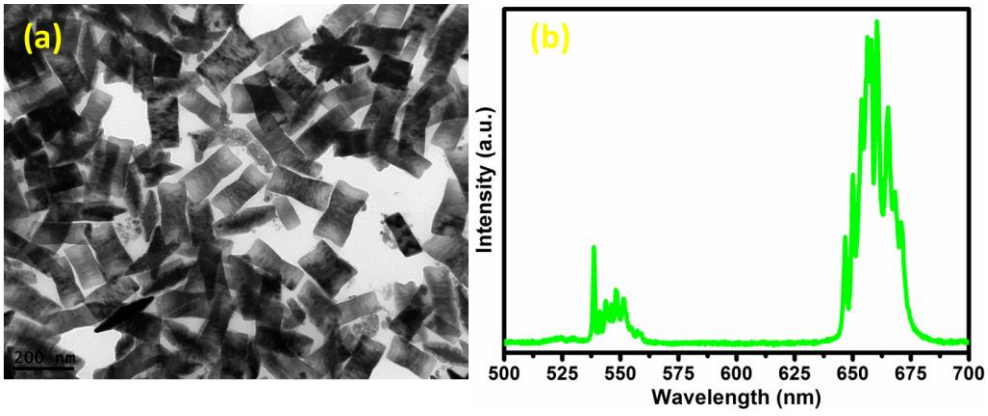

Fig. 1. (a) TEM image and (b) infrared-to-visible upconversion emission spectrum of $YF_3:Yb^{3+}/Er^{3+}$ nanosheets.

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