Supplementary Material (ESI) for Chemical Communications

Supplementary Information:

Detailed Experimental Procedure

Synthesis of $NaYF_4$:Yb,Er Nanocystals:[8]

All the rare-earth trifluoroacetates were obtained by dissolving the respective rare-earth oxides in trifluoroacetic acid (CF_3COOH). Sodium trifluoroacetate was obtained by dissolving sodium carbonate (Na_2CO_3) in trifluoroacetic acid. Then, a mixture of CF_3COONa (2 mmol), $(CF_3COO)_3Y$ (0.78 mmol), $(CF_3COO)_3Yb$ (0.2 mmol), and $(CF_3COO)_3Er$ (0.02 mmol) was dissolved in oleylamine (10 mL), and passed through a 0.22 μm filter. Under vigorous stirring in a flask, the mixture was heated to 330 °C in the presence of argon for protection. The reaction was proceeded for 1 h. The transparent yellowish reaction mixture was cooled to 80 °C before ethanol was added. The nanoparticles were isolated by centrifugation. They were washed three times with hexane and three times with deionized water.

Synthesis of Fe_3O_4 Nanocrystals: [14]

$Fe(acac)_3$ (2 mmol) was mixed in phenyl ether (20 mL) with 1,2-hexadecanediol (10 mmol), oleic acid (6 mmol), and oleylamine (6 mmol) under nitrogen and was heated to reflux for 30 min. After cooled to room temperature, the dark-brown mixture was treated with ethanol under air, and a dark-brown material was precipitated from the solution. The product was dissolved in hexane in the presence of oleic acid and oleylamine and reprecipitated with ethanol.

Synthesis of SiO_2-Coated Fluorescent/Magnetic Nanoparticles:

Triton X-100 (1.8 ml) and octanol (1.0 ml) was dispersed in cyclohexane (7 ml) by sonication for 10 mins. Next, NaYF4:20%Yb,2%Er UCs cyclohexane solution (200 μl, 0.4 mg/ml) and Fe_3O_4 MPs cyclohexane solution (110 μl, 0.4 mg/ml) were added. The resulting mixture was stirred, and ammonium hydroxide (60 μl, 28%) was added to form a brown solution of reverse microemulsion. Last, TEOS (30 μl) and APS (10 μl) was added, and the reaction was continued for 24 h. The resulting SiO_2/UC-SPM composite nanoparticles were collected by magnet or centrifuging, washed, and redispersed in ethanol or deionized water.

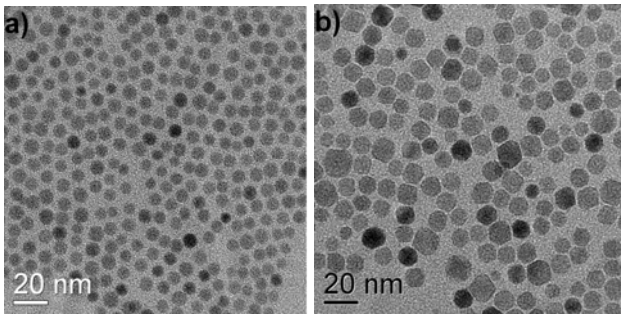

Figure SI1. TEM images of the upconversion fluorescent $NaYF_4$:Yb,Er nanocrystals a) and the magnetic Fe_3O_4 nanocrystals b).

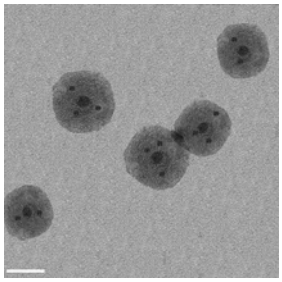

Figure SI2. A higher-magnification TEM image of SiO_2/UC-SPM nanoparticles in Fig. 1 b, showing the relative contents of the two types of nanoparticles. Scale bar is 50 nm.

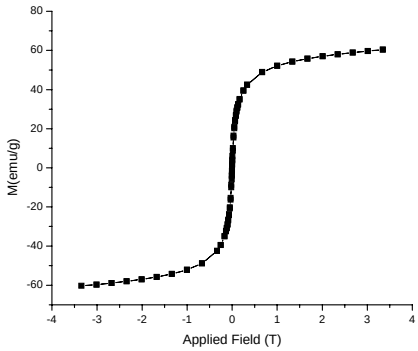

Figure SI3 Magnetic measurements of Fe_3O_4 nanoparticles showing magnetization–applied magnetic field (*M–H*) magnetization curves.

Referrences:

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