Synthesis and Sensing Application of Highly Luminescent and Water Stable Polyaspartate Functionalized LaF3 Nanocrystals

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Figure S1. XPS Ce 3d photoemission spectra for LaF3:Ce3+/Tb3+@PASP NPs in the absence (a) and presence (b) of Fe3+ ions, respectively. The results indicate that the Ce3+ is not oxidized by Fe3+, and thus the luminescence quenching is not caused by the oxidization of Ce3+ by the addition of Fe3+.

Figure S2. Plot of the luminescence intensity ratio (F0/F) of LaF3:Ce3+/Tb3+@PASP and LaF3:Ce3+/Tb3+ colloidal solution (2.4 μg/mL) to the concentration of Fe3+, respectively. F0 and F are the relative luminescence intensity in the absence and presence of Fe3+, respectively. pH = 5.

As shown in Fig. S2, at pH = 5, the luminescence of LaF3:Ce3+/Tb3+ nanoparticles without PASP coating was slightly quenched by Fe3+ ions, which can be attributed to the luminescence absorption by coloured Fe3+ ions. However, for the PASP coated LaF3:Ce3+/Tb3+ nanoparticles, the luminescence was dramatically quenched by the addition of Fe3+ ions. In this case, the Fe3+ ions were drawn to the surface of the NPs due to the enriched carboxylic groups and amino groups in the PASP layer, and thus the energy transfer from excited state Ce3+ to Fe3+ became easier. These results suggest that the luminescence quenching is mainly ascribed to the excitation state quenching of Ce3+ ions by Fe3+ ions and slightly due to the inner filter effect.
Figure S3. Photoluminescence decay of the LaF$_3$:Ce$^{3+}$/Tb$^{3+}$@PASP NPs aqueous solution before (a) and after (b) the addition of $3 \times 10^{-5}$ mol/L of Fe$^{3+}$ ions. $\lambda_{\text{em}}/\lambda_{\text{ex}} = 545$ nm/254 nm. From Figure S3, it is clear that the lifetime of the luminescence shortened after the addition of Fe$^{3+}$ ions.