

Supplementary Information

C-dots Sensitized Eu³⁺ Luminescence from Eu³⁺-Doped LaF₃-C dots Nanocomposites

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2. Materials and methods

2.1. Materials

La₂O₃ (99.98%), Eu₂O₃ (99.9%), Tb₂O₃, Dy₂O₃, Tm₂O₃ were purchased from Sigma Aldrich Chemicals. Triethylene glycol (>98%) was purchased from Loba Chemie Ltd. Deionized water was used throughout. Rare-earth nitrates were prepared by dissolving the corresponding metal oxide in nitric acid and evaporating the acid at elevated temperature.

2.2. Synthesis

All chemicals were of analytical grade and used without further purification. Tb³⁺ doped LaF₃- C dots nanocomposites, Sm³⁺ doped LaF₃- C dots nanocomposites; Dy³⁺ doped LaF₃- C dots nanocomposites were synthesized using same protocol as mentioned in the experimental heading in the main manuscript. Eu³⁺ -doped LaF₃ also synthesized by same protocol using H₂O instead of triethylene glycol.

XRD measurement: The XRD patterns were collected using the Rigaku-SmartLab diffractometer attached with D/tex ultra-detector and Cu K_α source operating at 35 mA and 70 kV. Scan range was set from 10-70° 2θ with a step size of 0.02° and a count time of 2 sec. The samples were well powdered and spread evenly on a quartz slide.

Transmission electron microscopy measurements: TEM images were taken on a UHR-FEG-TEM, JEOL; JEM 2100 F model using a 200 kV electron source. Samples were prepared by placing a drop of aqueous dispersion of the nanocomposites on a carbon coated copper grid and the grid was dried under air.

UV-Vis spectroscopy measurements: Room temperature optical absorption spectra of all the samples were recorded on a Hitachi U4100 spectrophotometer, using 3 ml quartz cuvette (path length, 1 cm).

Photoluminescence measurements: The photoluminescence spectra were measured on a Horiba Jobin Yvon spectrometer equipped with 450 W Xe lamp. The excitation and emission light were dispersed using Czerny-Turner monochromator with an optical resolution of 1 nm. The emitted photons were detected using a Hamamatsu R928 detector. The output signal was recorded using a computer. For the upconversion measurements, a 980 nm diode laser from RgBLase LLC, which was coupled with a fibre with core diameter of 100 μm, was used to excite the samples. The output signal was measured with the Jobin Yvon spectrometer as detailed above. The luminescence lifetime measurements were performed with the Horiba Jobin Yvon Fluorolog CP machine equipped with a pulsed Xe source operating at 25 W.

Scanning electron microscopy measurements: Field emission scanning electron microscopy (FESEM) images were taken on the SUPRA 55-VP instrument with patented GEMINI column technology. Prior to loading of the samples into the chamber, they were coated with a thin film of gold-palladium in order to avoid charging effects.

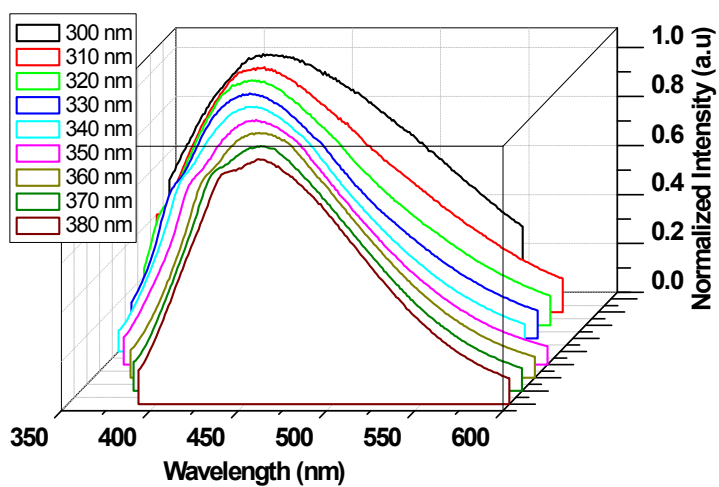


Fig S1. The photoluminescence (PL) spectra of C-dots at different excitation wavelengths.

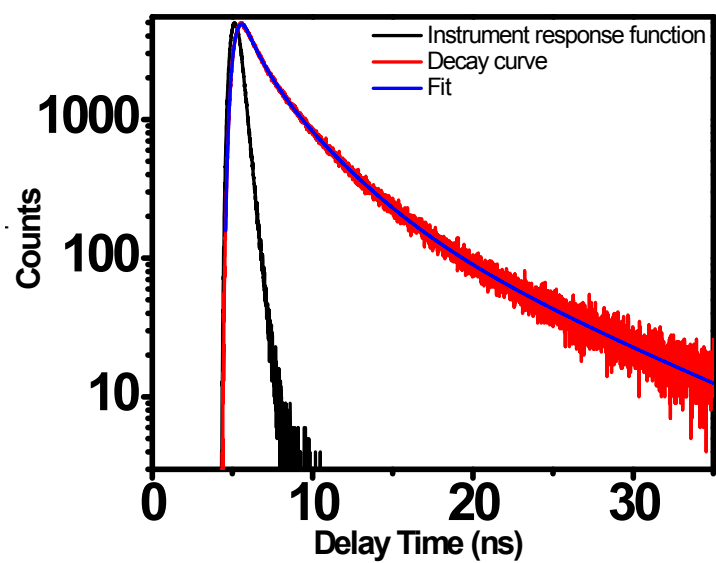


Fig S2. The photoluminescence (PL) decay curve of the C-dots by monitoring the emission at 420 nm.

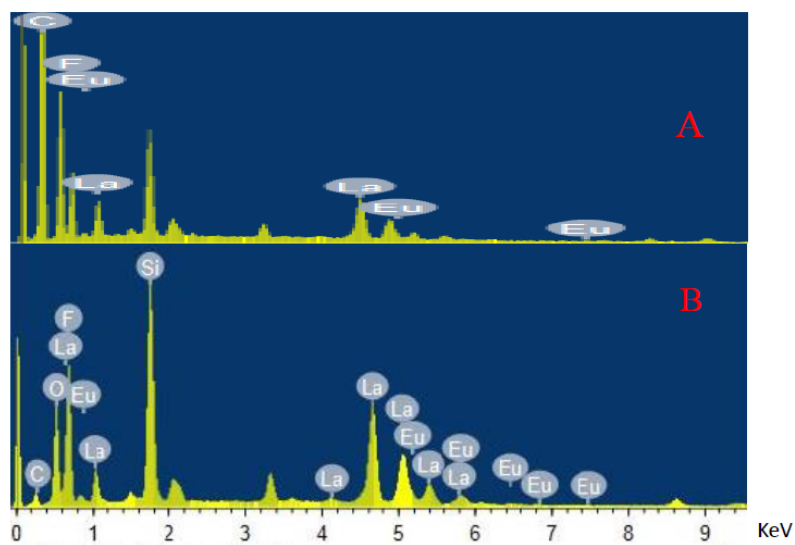


Fig S3. EDX analysis of Eu^{3+} -doped LaF_3 -C dots nanocomposites(A) And same sample after heating at 400°C for 4 h (B)

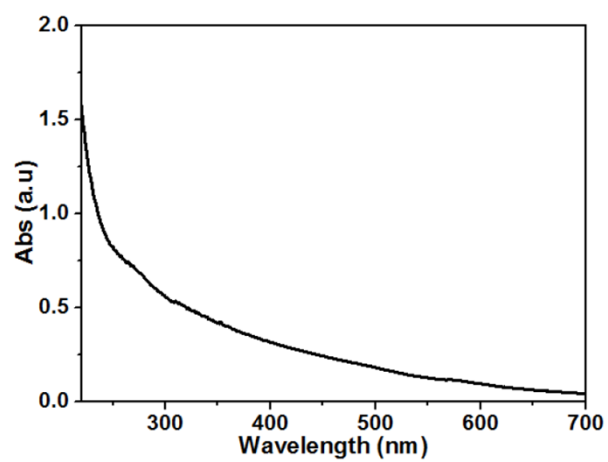


Fig S4. UV-Vis spectrum of water dispersible Eu^{3+} -doped LaF_3 -C dots nanocomposites.

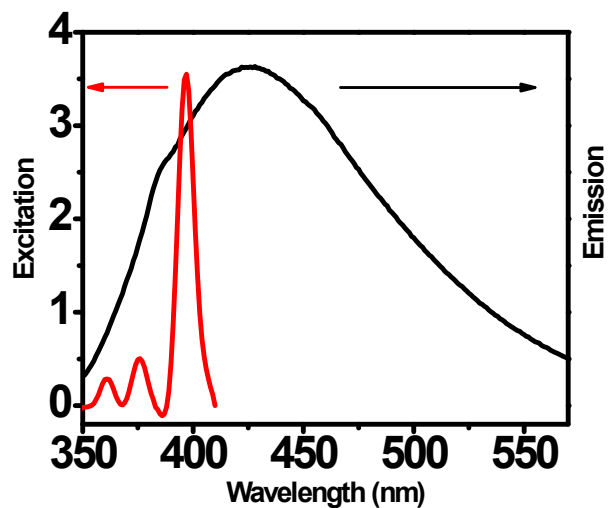


Fig. S5 The PL spectrum of the C-dots (black trace) measured at $\lambda_{\text{exi}} = 340$ nm and the excitation spectrum of Eu^{3+} -doped LaF_3 nanoparticles (red trace) indicating the overlap between them.

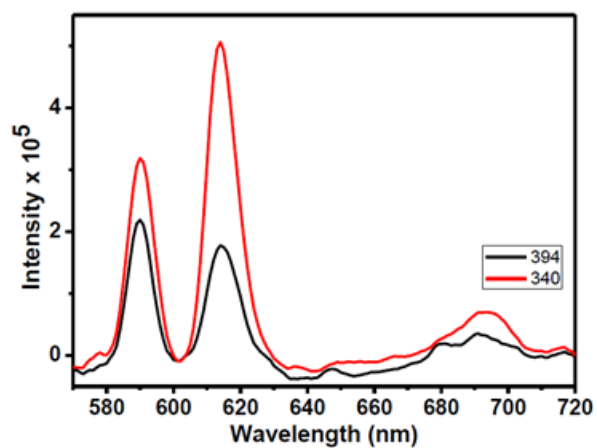


Fig S6. PL of Eu^{3+} -doped LaF_3 -C dots nanocomposites when excited at 340 nm (Red line) and 394 nm (black line)

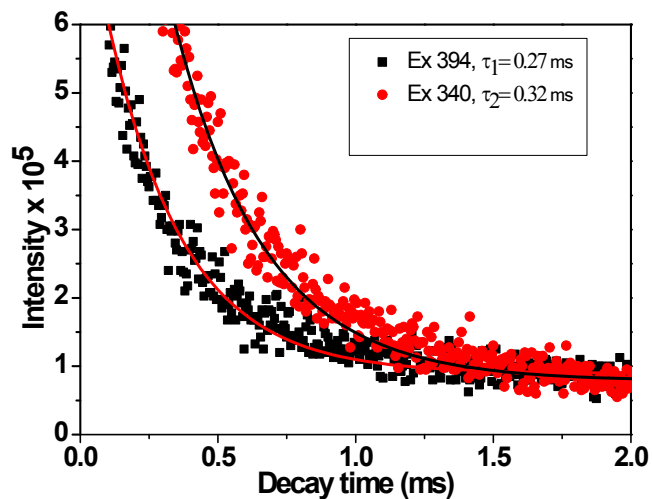


Fig S7. Life time of Eu^{3+} -doped LaF_3 C dots nanocomposites when excited at 340 nm (Red line) and 394 nm (Black line) following the emission at 612 nm.

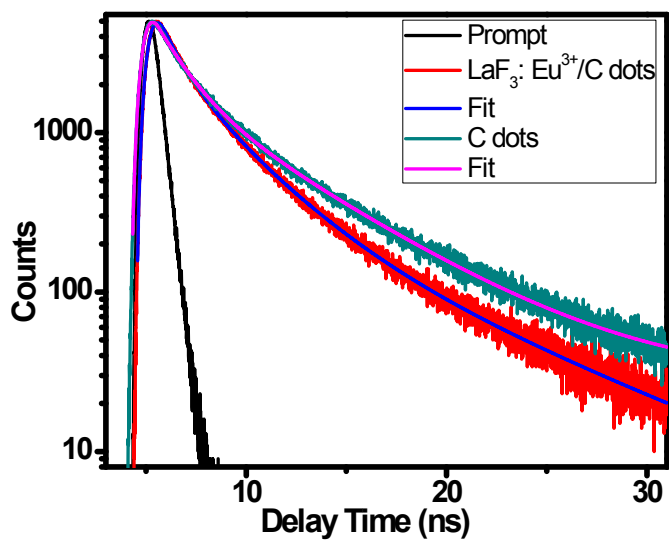


Fig. S8. Graph showing the lifetime decay curves following the C-dots emission by exciting the sample at 340 nm and following the emission at 420 nm.

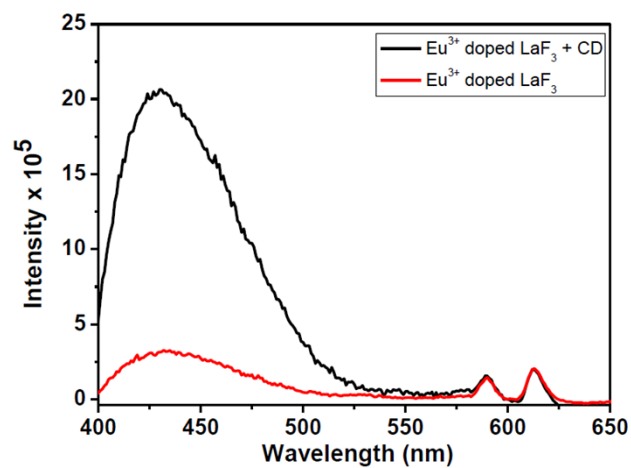


Fig S9. PL of Eu^{3+} -doped LaF_3 nanoparticle (Red line) and PL of Eu^{3+} -doped LaF_3 + C dots (Black line) when excited at 340 nm.

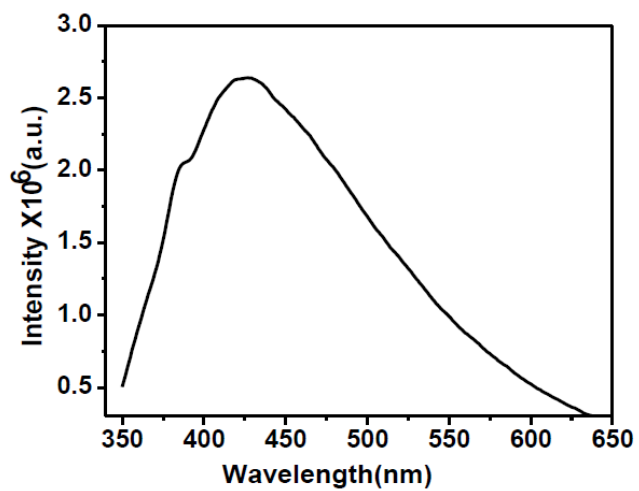


Fig. S10 PL spectrum of a mixture containing C-dots and $\text{Eu}(\text{NO}_3)_3$ upon excitation at 340 nm.

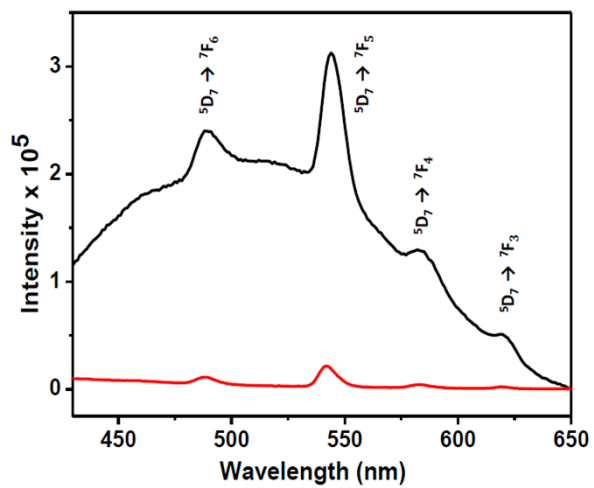


Fig S11. PL of Tb³⁺-doped LaF₃ nanoparticles (Red line) and PL of Tb³⁺-doped LaF₃-C dots nanocomposites (Black line) when excited at 340 nm.