

# Ionic Liquid Mediated Synthesis and Surface Modification of Multifunctional Mesoporous Eu:GdF<sub>3</sub> Nanoparticles for Biomedical Applications

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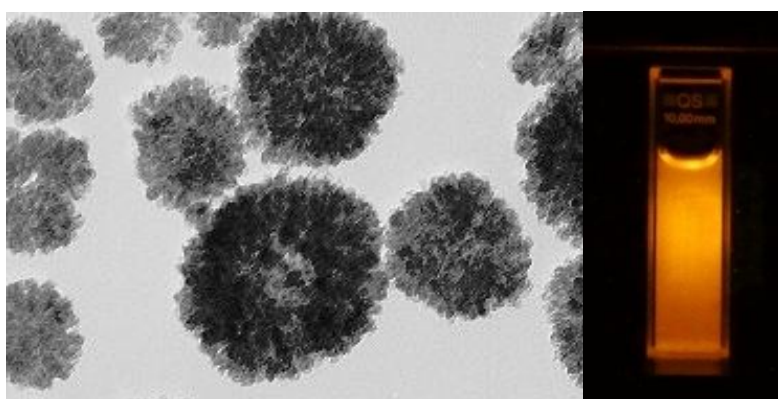
## Abstract

A procedure for the synthesis of multifunctional europium(III)-doped gadolinium(III) fluoride (Eu:GdF<sub>3</sub>) nanoparticles (~85 nm) with quasispherical shape (Fig. 1, left) by precipitation at 120 °C from diethylene glycol solutions containing lanthanide chlorides and an ionic liquid (1-Butyl, 2- methylimidazolium tetrafluoroborate) as fluoride source has been developed [1]. These nanoparticles were polycrystalline and crystallized into a hexagonal structure, which is unusual for GdF<sub>3</sub>. They were also mesoporous (pore size = 3.5 Å), having a rather high BET surface area (75 m<sup>2</sup> g<sup>-1</sup>). The luminescent (Fig. 1, right) and magnetic (relaxivity) (Fig. 2) properties of the Eu:GdF<sub>3</sub> nano- particles have been also evaluated in order to assess their potentiality as “in vitro” optical biolabels and contrast agent for magnetic resonance imaging. Finally, a procedure for their functionalization with aspartic-dextran polymers is also reported. The functionalized Eu:GdF<sub>3</sub> nanoparticles presented negligible toxicity for Vero cells (Fig. 3), which make them suitable for biotechnological applications.

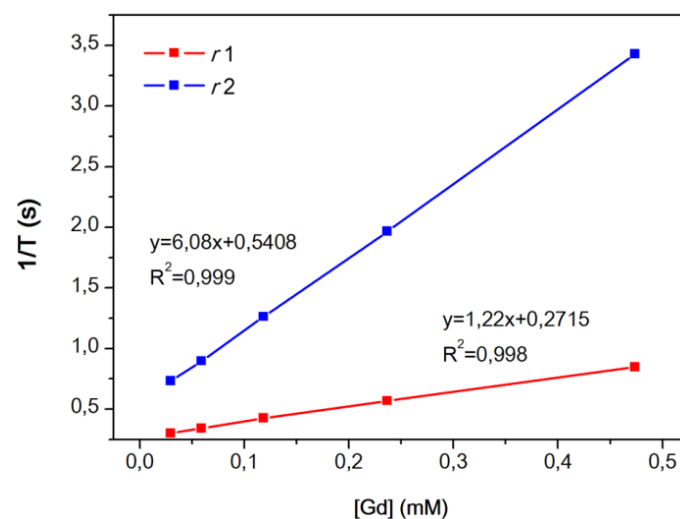
## References

[1] S. Rodriguez-Liviano, N. O. Nuñez, S. Rivera, J. M. de la Fuente, and M. ,  
Langmuir, **29** (2013), 3411-3418

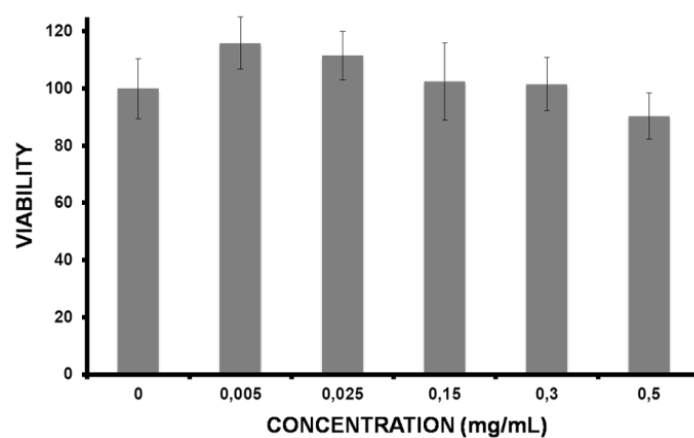
## Figures



**Figure 1** – Left: TEM image of the nanoparticles prepared by heating at 120 °C for 15 h, DEG solutions containing 0.019 mol dm<sup>-3</sup> of GdCl<sub>3</sub>, 0.001 mol dm<sup>-3</sup> of EuCl<sub>3</sub> [Eu/(Eu + Gd) mol ratio = 0.05], and 40% by volume of BMIMBF<sub>4</sub>. Right: Photograph taken under UV illumination for the Eu<sub>0.05</sub>Gd<sub>0.95</sub>F<sub>3</sub> nanophosphor in water suspension.



**Figure 2** –Proton relaxivities ( $r_1$  and  $r_2$ ) measured for the Eu:GdF<sub>3</sub> nanoposphor at 1.5 T.



**Figure 3** – Cytotoxicity profiles of functionalized nanoparticles with Vero cells, as determined by MTT assay. Percentage of viability of cells was expressed relative to control cells ( $n = 5$ ). Results are represented as mean  $\pm$  standard deviations.