Green-emitting Superparamagnetic Nanoparticles of Fe_3O_4@SiO_2@GdOF:Ce^{3+},Tb^{3+}: Toxicity Assessment in Zebrafish Embryos

Z. U. Khan[1], L. U. Khan[2,3,]*, H. F. Brito[3], Magnus Gidlund[1]

[1]*Institute of Biomedical Sceinces-IV, Department of Immunology, University of Sao Paulo, Av. Prof. Lineu Prestes, 1730, 05508-000 São Paulo, Brazil*
[2]*BrazilianNanotechnology National Laboratory (LNNano–CNPEM), Rua Giuseppe Máximo Scolfaro 10000, 13083-100, Campinas-SP, Brazil.*
[3]*Institute of Chemistry, Department of Fundamental Chemistry, University of Sao Paulo, Av. Prof. Lineu Prestes, 748, 05508-000, São Paulo-SP, Brazil.*
** Corresponding author: latif.khan@lnnano.cnpem.br*

The preparation of novel bifunctional Fe_3O_4@SiO_2@GdOF:xCe^{3+},yTb^{3+} (x = 5; y = 5, and 10 mol%) nanocomposites with efficient optical and magnetic properties were reported. The Fe_3O_4 core nanocrystals were coated with thin layer of SiO_2, which were further coated with GdOF:RE^{3+} luminophores via chitosan assisted high temperature co-precipitation method. The static magnetic measurements supported and manifested superparamagnetic behavior of the materials at 300 K. In addition, a verwey transition (T_V) was observed near 120 K on the ZFC/FC curves of the Fe_3O_4. The emission spectra of the nanocomposites showed characteristic narrow emission lines assigned to the $^5D_4 \rightarrow {}^7F_J$ transitions (J = 6-0) of the Tb^{3+} ion (Figure 1). The non-radiative energy transfer process among the $Ce^{3+} \rightarrow Gd^{3+} \rightarrow Tb^{3+}$ ions were discussed. The toxicity of these nanomaterials was studied, employing 96 hours' early life stage assay in *Danio rerio* embryos. The parameters assessed were acute toxicity, hatching rate, growth, yolk sac size, and sarcomere length after the exposure to Fe_3O_4@SiO_2@GdOF:Ce^{3+},Tb^{3+} nanocomposites. It was found that the bifunctional nanoparticles present no acute toxicity to the embryos and larvae of zebrafish until 100 mg L^{-1} concentration. Further, the photoluminescence and magnetic properties as well as nontoxicity of the Fe_3O_4@SiO_2@GdOF:RE^{3+} nanomaterials suggest that they may efficient candidates for multifunctional drug delivery carriers.

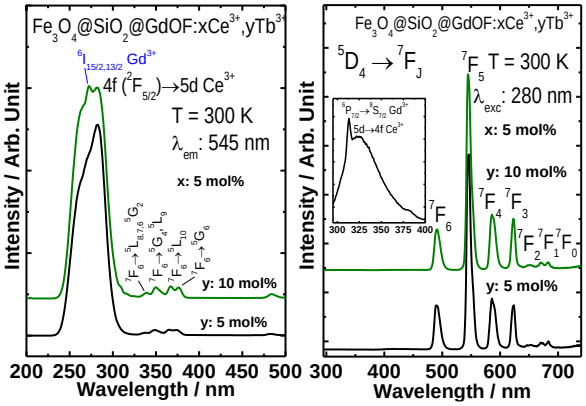

Figure 1. Luminescence spectra of the Fe_3O_4@SiO_2@GdOF:xCe^{3+},yTb^{3+}, recorded at room temperature (300 K): excitation (left) spectrum, monitoring emission at 545 nm assigned to the $^5D_4 \rightarrow {}^7F_5$ transition and emission (right) spectrum under excitation at 280 nm which corresponds to the $4f(^2F_{5/2}) \rightarrow 5d$ interconfiguration transition of

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References

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