

Magnetic-luminescent nanoparticles containing Fe₃O₄ functionalized with rare earth complexes

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In nature, smart materials that exhibit significant magnetic and luminescence properties are very remarkable. For many applications in biotechnology, medicine, and quality inspection this type of bifunctional material is sought [1]. Our particular interest is the development of novel multifunctional magnetic-luminescent nanomaterials that contain magnetite (Fe₃O₄), functionalized with rare earth ions (RE³⁺) inclusion complexes of calixarene. In current manuscript we report novel magnetic luminescent nanoparticles (MLNPs); Fe₃O₄@CC-Eu(TTA) and Fe₃O₄@CC-Tb(ACAC) with remarkable red and green monochromic emissions in the visible range and show distinct super-paramagnetic behavior. Although, magnetite (Fe₃O₄) is strong luminescent quencher [2], this difficulty was solved by coating the magnetic nanoparticles with macrocyclic building block (CC) by in situ co-precipitation method as indicated in HRTEM images (Figure 1) and the synthesis of magnetic-luminescent nanoparticles (MLNPs) by one-pot methodology. This sort of coating produces the distance of magnetite quencher from luminescent center (RE³⁺); in addition macrocycle (CC) also acts as an organic ligand along with the sensitizers (antennae) “ β -diketonates” for rare earth ions (Eu³⁺ and Tb³⁺) to produce highly luminescent MLNPs.

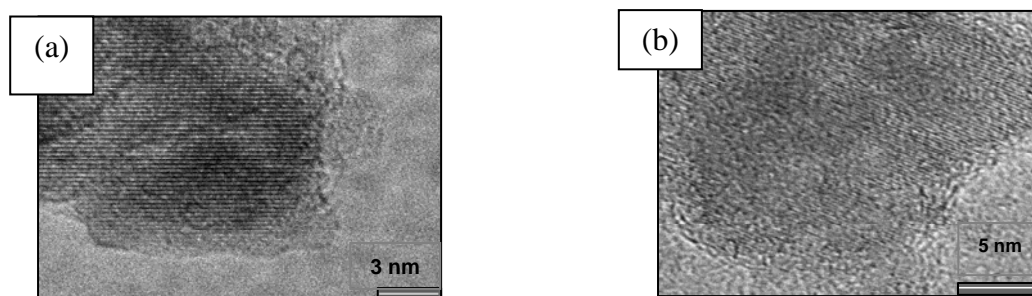


Figure 1: High resolution TEM (HRTEM) images of Fe₃O₄@CC-Eu(TTA) (a) and Fe₃O₄@CC-Tb(ACAC) (b).

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References:

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- [2] Chen, H. et al. Magnetic and optical properties of multifunctional core-shell radioluminescence nanoparticles. *J. Mater. Chem.* 22 (2012) 12802-12809