5th School on X-Ray Spectroscopy Methods
Brazilian Synchrotron Light Laboratory (LNLS)
Campinas, São Paulo, Brazil August 22nd-23rd 2016

Optical and Magnetic Core-Shell Nanomaterials Based on Fe_3O_4 and Rare Earth Phophores

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The bifunctional nanomaterials, co-assembling photonic and magnetic features into single entity nanostructures are remarkable as multifunctional nanoprobes for medical diagnostics and photo thermal destruction of cancer cells. The preparation of these nanomaterials are accessible through facile method, using iron oxide as core nanoparticles and RE^{3+} (Rare Earth) materials as luminescent center. The magnetic properties are usually due to the Fe_3O_4 core nanoparticles, however, the magnetic moments of the RE^{3+} ions are also contributed to the whole magnetization of these nanostructures. The rare earth ions exhibit well-defined narrow emission bands in different spectral ranges from visible to near-infrared due to their 4f intraconfiguration transitions, giving the bifunctional nanomaterials efficient luminescent behavior. In this work, the preparation strategies as well as structural and morphological characterizations of the bifunctional nanomaterials are discussed. The DC magnetic properties (MH and ZFC/FC curves) and photoluminescence behavior of the RE^{3+} nanocomposites based on the emission spectral data and luminescence decay curves are studied. The experimental intensity parameters (Ω_λ), lifetimes (τ), emission quantum efficiencies (η) as well as radiative (A_{rad}) and non-radiative (A_{nrad}) decay rates are calculated, in addition, based on these parameters iron oxide induced luminescence quenching of Eu^{3+} ion is studied.