SILICA CONTAINING IRON OXIDE AND EUROPIUM III OBTAINED VIA SOL-GEL METHODOLOGY

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Over the last years, the magnetic and luminescent properties of nanoparticles have attracted much attention from researchers of various areas, like physics, chemistry, and medicine. This work aims to prepare and characterize luminescent magnetic nanoparticles for application as drug delivery systems during cancer treatment. In this way, it will be possible to direct and probe such nanoparticles magnetically, ensuring that they reach the target site without harming healthy tissues. The samples were synthesized in 5.40 mL of distilled water, 30.54 mL of isopropanol, 15.76 mL of ammonium hydroxide, and 2.28 mL of tetraethylorthosilicate. For the sample whose core consisted of iron and silica, 2.00 mL of iron oxide was also added to the reaction mixture. For the sample whose core consisted of europium and silica, 1.15 mL of europium chloride was also added to the reaction mixture. The samples were coated with a silica layer. Subsequently, the sample containing iron in its core was coated with europium, and the sample containing europium in its core was coated with iron (see Figure). The samples were washed with ethanol, centrifuged, and dried at 50 ^{o}C for 24 h. Before and after coating, the samples were submitted to thermal treatment at 500 ^{o}C. The final materials were characterized by vibrational spectroscopy, photoluminescence, X-ray diffraction, and scanning electron microscopy. The peaks at 2θ = 35.99° and 62.84° evidenced the presence of iron oxide. The infrared spectra displayed the typical silica bands. The sample containing europium(III) core and coated with iron did not present luminescence, whereas the sample containing iron core and coated with europium(III) exhibited the characteristic emission bands of the latter ion. These results showed that the silica layer isolated the iron ions (which suppress luminescence) from the emitting ion (europium(III)). Qualitative tests conducted with a neodymium magnet confirmed that the particles retained their magnetic properties. Scanning electron microscopy revealed that silica coating provided particles with spherical morphology and increased diameter.

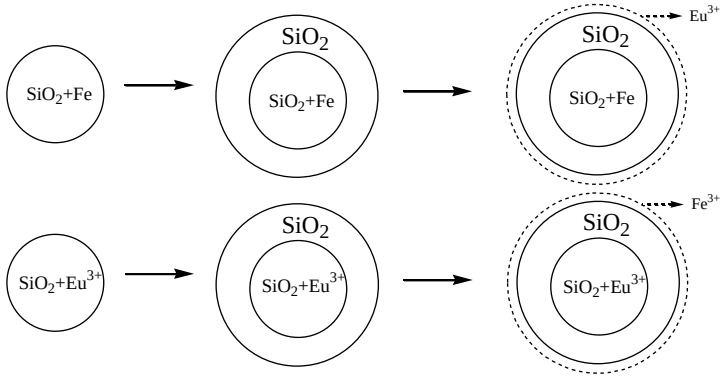

Figure: Schematic experimental preparation of particles.