Synthesis and characterization of polyethylene glycol coated iron oxide nanoparticles for hyperthermia treatment

M. Paresque-1[1,*,#], E. Oliveira-2[2], J. Castro-3[1], M. F. Campos-4[1]

[1]Federal Fluminense University, Post-Graduation Program in Metallurgical Engineering, Volta Redonda, 27255-125, Brazil
[2]CEFET/RJ-Federal Center for Technological Education, Department of Metallurgical Engineering, Angra dos Reis, 23953-030, Brazil

[#]Corresponding author: paresquemara@gmail.com

Advances in the development of nanotechnology allow the creation of nanoparticles with multifunctional properties aimed at the various biomedical applications. In this context, the magnetic nanoparticles present new opportunities as contrast agents for magnetic resonance image, controlled release of drugs, biomolecular separation and treatment of tumors via hyperthermia, of this research theme. The most used nanoparticles for this purpose is magnetite (Fe_3O_4) due to its low cytotoxicity and high biocompatibility with the organism. In this work, the co-precipitation method was used to perform the synthesis of magnetite nanoparticles (Fe_3O_4). The particles were coated with polyethylene glycol (PEG) to prevent aggregation and oxidation, as well as render them viable to biomedical processes. In order to evaluate the influence of the duration time of the coating step in the process of encapsulation of the particles five samples were synthesized by following the same procedure of synthesis for all samples, varying only the time that each sample went through the coating process with PEG. The different times of coatings samples were 10 minutes, 20 minutes, 30 minutes, 50 minutes and finally 60 minutes. The tests performed in the TGA/DSC showed na occurrence of mass loss of samples analysed at a temperature of about 300ºC relative to the loss of the surface coating layer surrounding the magnetic core of the nanoparticles. The Nanosight particle analyzer showed a marked increase in the size of the nanoparticles in the first thirty minutes of coading followed by a stabilization period. The obtained particles presented in general a spherical shape according to analyzes done by MEV. The DRX results showed the peak formations characteristic of the magnetite, as well as a mean diameter in the 18 nm range obtained through the Rietveld analysis. The hysteresis curves present the superparamagnetic behavior as found in the literature for this material

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