Systematic study of Fe_3O_4 and γ-Fe_2O_3 nanoparticles for hyperthermia

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In order to improve the heating performance of magnetic nanoparticles during hyperthermia treatments, a systematic study of different Fe_3O_4 and γ-Fe_2O_3 nanoparticles has been done. There are a lot of parameters that take part in the processes of heating and the main purpose of this work is to compare different samples to investigate the relationship between heating efficiencies and physical properties such as coercive field, nanoparticle size and composition.

Nanoparticles with sizes between 6 and 300 nm with different coatings and synthesis routes have been analized. Magnetic and calorimetric measurements have been carried out, as well as structural and colloidal characterization of the samples.

We have seen that 35 nm magnetite nanoparticles (see Figure 1) reach the highest heating efficiency of all samples, having a size close to the monodomain-multidomain limit [1]. Additionaly, the heating efficiency of the maghemite nanoparticles grows as the particle size grows [2]. The same behavior has been seen wih the coercive field (see figure 2). On the other hand, analizing samples with the same size and composition but different coatings, no magnetic or calorimetric difference has been found.

All the results obtained from this study are very useful and allow a better understanding of the nanoparticle parameters to achieve an optimized hyperthermia treatment.

References

[1] Vergés, M.A., et al., Journal of Physics D: Applied Physics, 41.13 (2008): 134003.
[2] De la Presa, P., et al., The Journal of Physical Chemistry C, 116.48 (2012): 25602-25610.

Figures

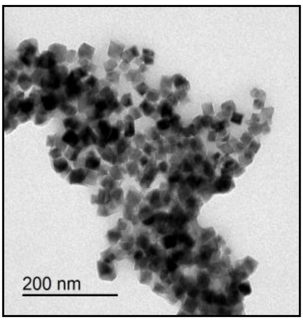

Figure 1: TEM image of 35nm Fe3O4 MNPs.

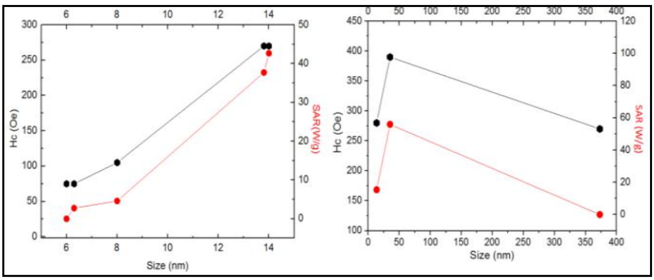

Figure 2: H_C, SAR vs. size. Left: γ-Fe_2O_3. Right: Fe_3O_4. (f=110.5 kHz, 220 Oe).