Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics.


# Anticipating hyperthermia efficiency of magnetic colloids by a semi-empirical model: a tool to help medical decisions.

M. B. Fernández van Raap, D. F. Coral, S. Yu, G. A. Muñoz, F. H. Sánchez, A. Roig

## *Supplementary Information*

**Figure S1.** Shows TEM images and electron diffraction for samples (a-1-3) Cit/MNP5 and (b-1-3) Cit/MNP-8. The MNPs are highly monodisperse and display somehow facetted faces. Mean particle sizes of 5.6 ± 0.8 nm and 8.0±2.0 nm respectively, were obtained from the histograms also shown in the figure. Crystallinityis verified with electron diffraction shown in the insets. The images displaywell-defined lines belonging to cubic spinel structure (JCPDS #19-629) indicating that MNPs are single phase. Then, these colloids consist of almost identical SD-IONPs of uniaxial anisotropy in random directions. (c) The X-ray diffraction for sample U/MNP-14 patterns display well-defined peaks belonging to the cubic spinel structure, indicating a single phase. The whole patterns were refined, including peak broadening due to crystallite size, using a cubic spinel structure (space group Fd3m) with lattice parameter a =8.378 Å and the O atoms arranged in a face-centered-cubic lattice. The patterns were determined with an X'Pert Diffractometer within a 2θ range from 20 to 80°. Refinement was performed using MAUD program [1].

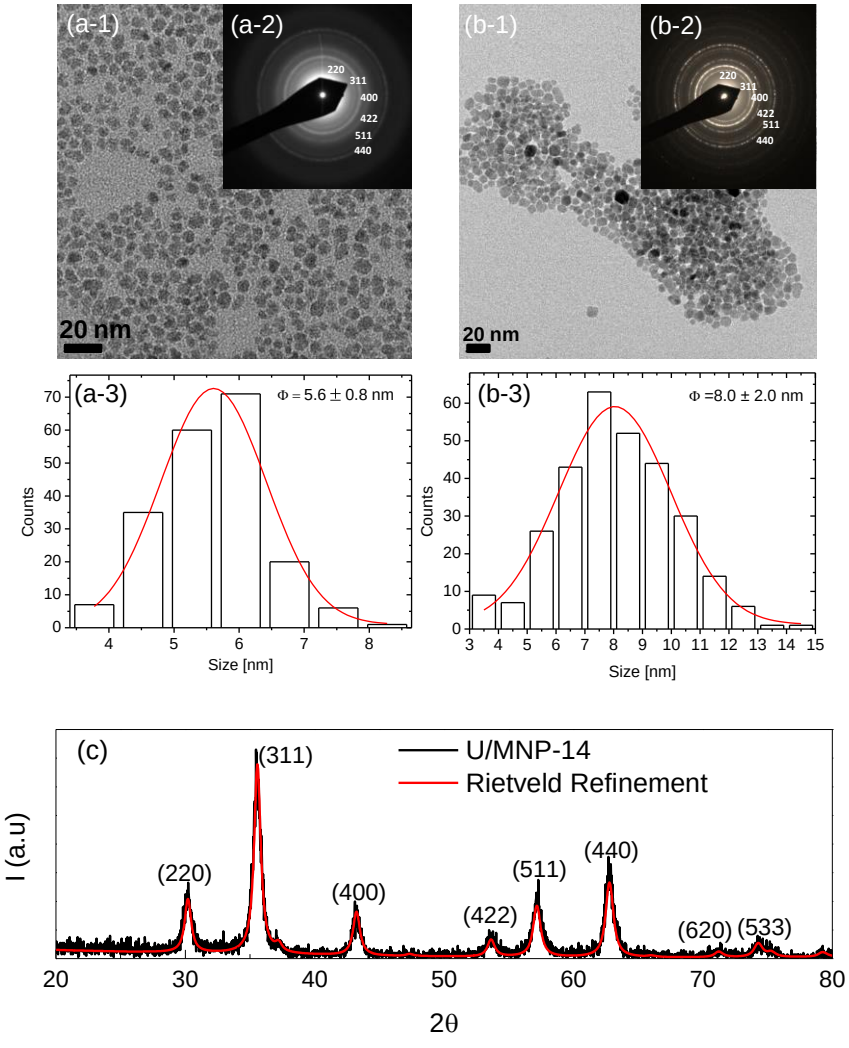


**Figure S2:** Size dependence of the energy barrier (*U*). Our results are compared with other values reported in literature for iron oxides particles in the same range size.

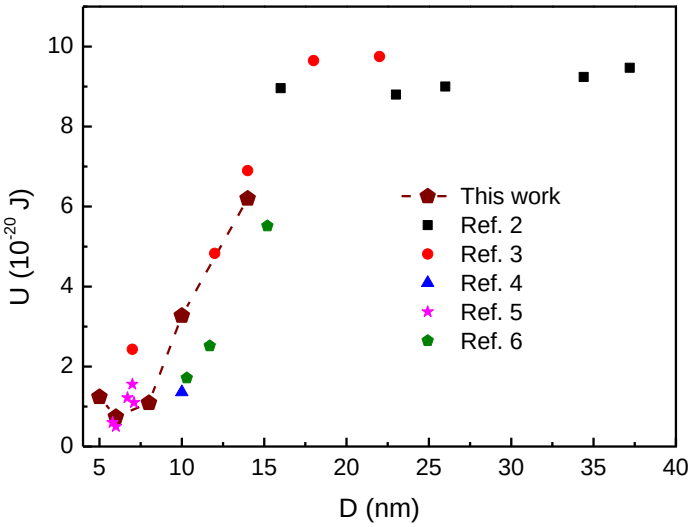



**Figure S3** Magnetization curves at 300 K for colloids Cit/MNP-6, Cit/MNP-8 and U/MNP-14.

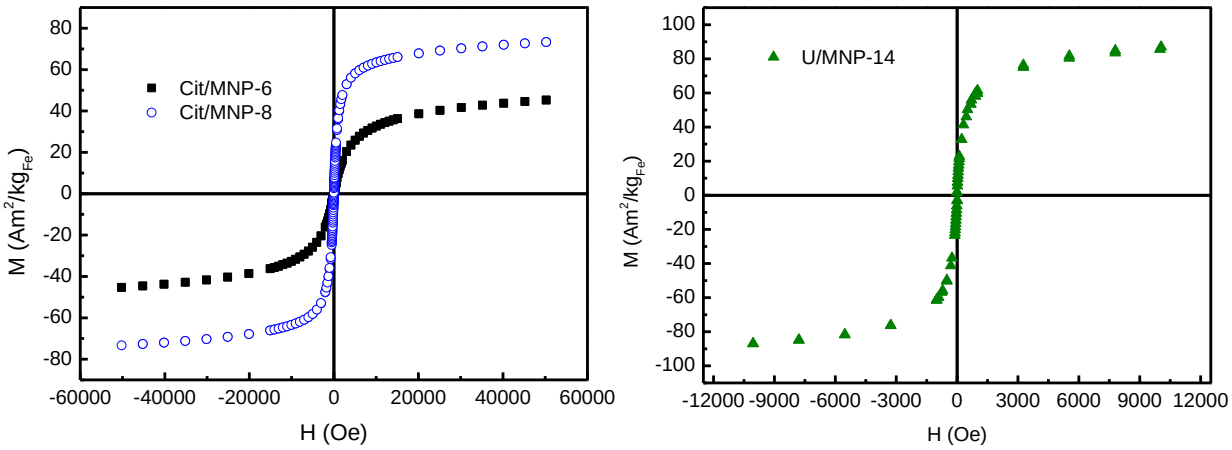


**Figure S4.** A.C. Susceptibility measurements for samples (a) Cit/MNP-6, (b) Cit/MNP-8, (c) CS/MNP-5 and (d) CS/MNP-10. Insets shows a zoom of the data around the maximum to more clearly display its shift with increasing temperature

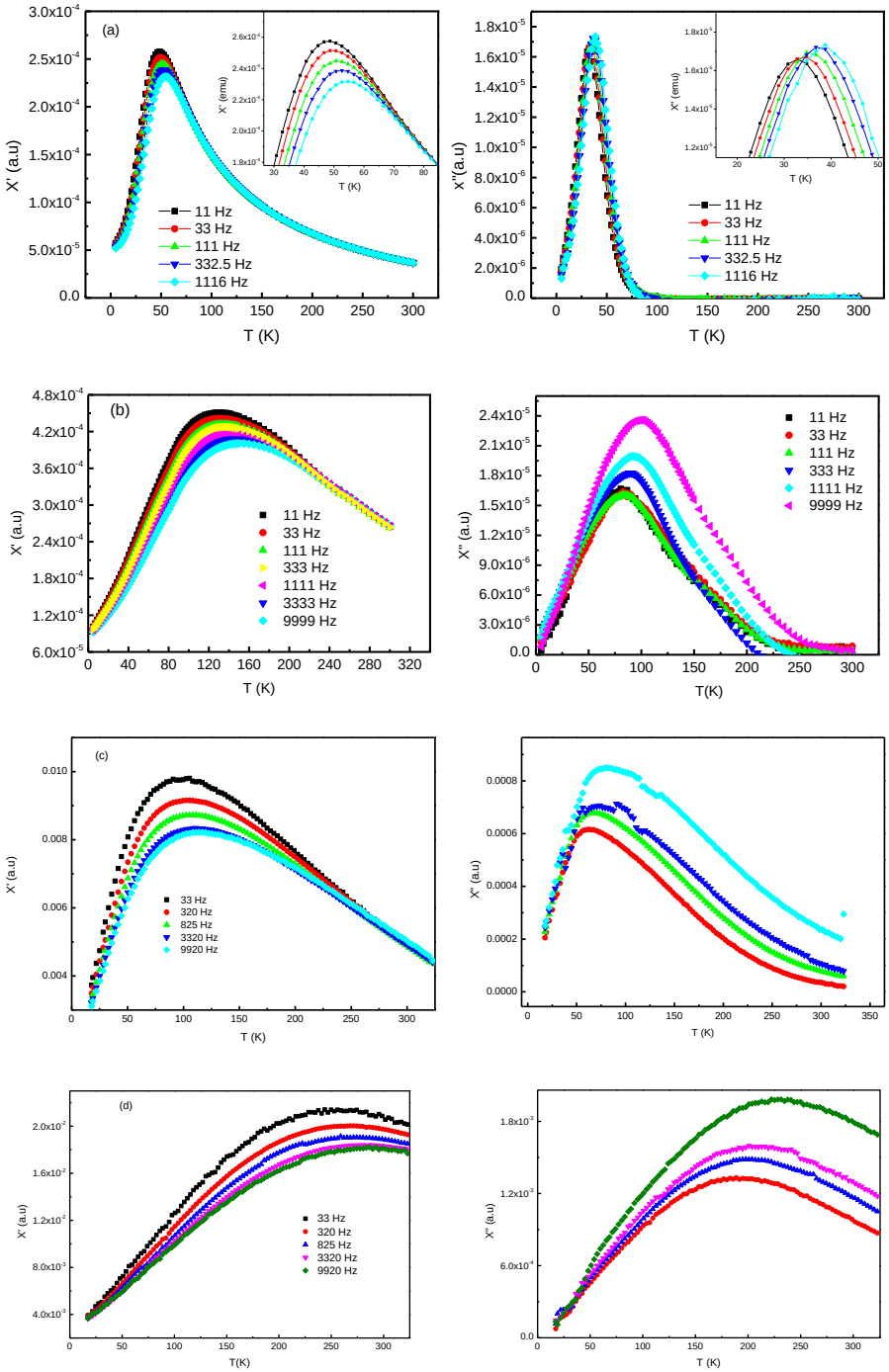
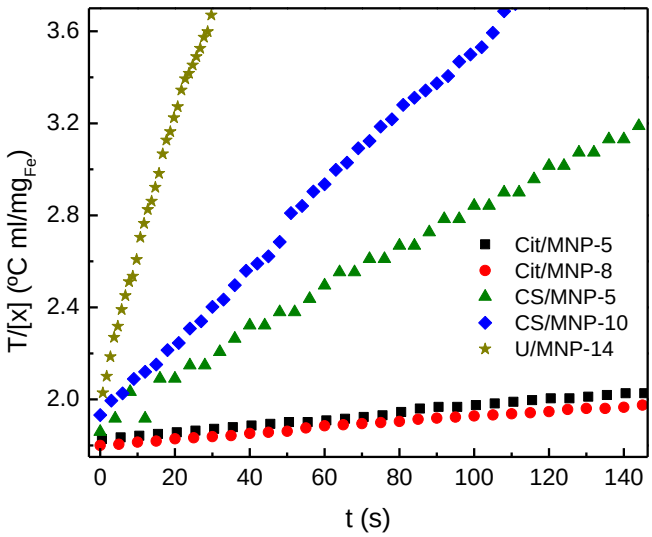


**Figure S5.** Concentration-normalized heating curves measured at 52 kA/m and 260 kHz.




**References**


[1] L. Lutterotti, S. Matthies and H. -R. Wenk, "MAUD (Material Analysis Using Diffraction): a user friendly Java program for Rietveld Texture Analysis and more", Proceeding of the Twelfth International Conference on Textures of Materials (ICOTOM-12), 1, (1999), 1599.

[2]. V. Dolgovskiy, V. Lebedev, S. Colombo, A. Weis, B. Michen, L. Ackermann-Hirschi, A. Petri-Fink. Journal ofMagnetismandMagneticMaterials, 2015, **379**, 137–150.

[3]. G. Salas, J. Camarero, D. Cabrera, H. Takacs, M. Varela, R. Ludwig, H. Dähring, I. Hilger, R. Miranda, M. del Puerto Morales, F. J. Teran, The Journal Physical Chemistry C, 2014, **118 (34)**, 19985.

[4]. R. Di Corato, A. Espinosa, L. Lartigue, M. Tharaud, S. Chat, T. Pellegrino, C. Ménager, F. Gazeau, C. Wilhelm, Biomaterials, 2014, **35**, 6400.

[5]. M. E. de Sousa, M. B. Fernández van Raap, P. C. Rivas, P. Mendoza Zélis, P. Girardin, G. Pasquevich, J. Alessandrini, D. Muraca, F. H. Sánchez, The Journal of Physical Chemistry C. 2013, **117 (10)**, 5436.

[6]. G. Vallejo-Fernandez, O. Whear, A.G. Roca, S. Hussain, J. Timmis, V. Pattel, K.O'Grady. Journal of Physics D: Applied Physics, 2013, **46**, 312001.