magnetochemistry

MDPI

Supporting Information of

Fluorescent Single-core and Multi-core Nanoprobes as Cell Trackers and Magnetic Nanoheaters

Pelayo García Acevedo[1,*,†], Manuel A. González Gómez [1,*,†], Ángela Arnosa Prieto[1], Lisandra de Castro Alves[1], Román Seco Gudiña[1], Yolanda Piñeiro [1] and José Rivas[1]

[1] NANOMAG Laboratory, Applied Physics Department and iMATUS Materials Institute, Universidade de Santiago de Compostela, 15782 Santiago de Compostela, Spain;
angela.arnosa@usc.es (Á.A.P.); lisandracristina.decastro@usc.es (L.C.A); roman.seco@rai.usc.es (R.S.G.); y.pineiro.redondo@usc.es (Y.P.); jose.rivas@usc.es (J.R.)

* Correspondence: pelayo.garcia.acevedo@usc.es (P.G.A.); manuelantonio.gonzalez@usc.es (M.A.G.G.)
Tel.: +34-881813097 (P.G.A. and M.A.G.G.)

† The authors contributed equally to this work.

Figure **S1** shows the diffractograms of magnetite cores NPs synthesized by co-precipitation method (Fe_3O_4@PEG and Fe_3O_4@OA) and the thermal decomposition method (Fe_3O_4@OA). All the diffraction peaks match the nine diffraction peaks at (1 1 1), (2 2 0), (3 1 1), (4 0 0), (4 2 2), (5 1 1), (4 4 0), (6 2 0) and (5 5 3) by comparison with Inorganic Crystal Structure Database (ICSD card No. 98-015-8742), which correspond with an inverse spinel structure crystalline phase of magnetite. [1]

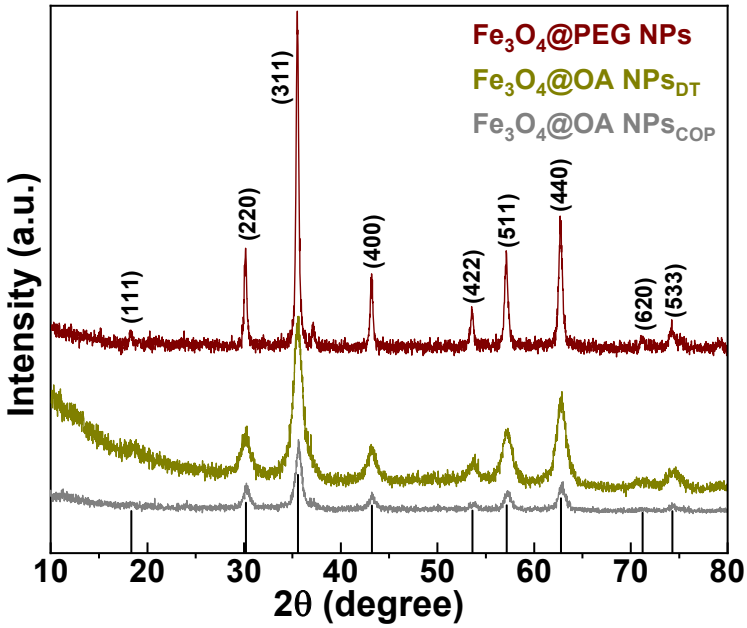

Figure S1. XRD patterns of Fe_3O_4@PEG NPs (wine pattern), Fe_3O_4@OA NPs, synthesized by decomposition method, DT (dark yellow pattern) and Fe_3O_4@OA NPs, synthesized by co-precipitation method, COP (grey pattern), compared to the XRD pattern of magnetite from the ICDS card No. 98-015-8742 data base.

In figure S2, the FTIR spectra of coated MNPs synthesized by co-precipitation method (Fe_3O_4@PEG and Fe_3O_4@OA) and the thermal decomposition method (Fe_3O_4@OA) are shown. As it can be seen, all samples show similar absorption bands between 530-550 cm^{-1}, associated with the stretching vibration of the tetrahedral groups (Fe^{3+}–O^{2-}) for Fe_3O_4. [2] For both OA coated Fe_3O_4 NPs, two absorption peaks can be observed at 2925 and 2848 cm^{-1} , that can be attributed to the asymmetric and symmetric CH_2 stretching of the oleic acid, respectively. [3,4] Besides, two peaks appear around 1598 and 1521 cm^{-1} which correspond to the asymmetric and symmetric stretching vibrations of COO^- groups of this stabilizing agent[4]. In addition, the CH_2 bending mode of aliphatic chains appears around 1406 cm^{-1}[4]. In addition, PEG coated Fe_3O_4 NPs show a broad band around 3400 cm^{-1} associated to the presence -OH groups adsorbed on the nanoparticle surface. The absorptions bands at 2860 and 1469 cm^{-1} are correlated to the stretching modes of CH_2 and C=C groups, respectively, in the polymer. [5]

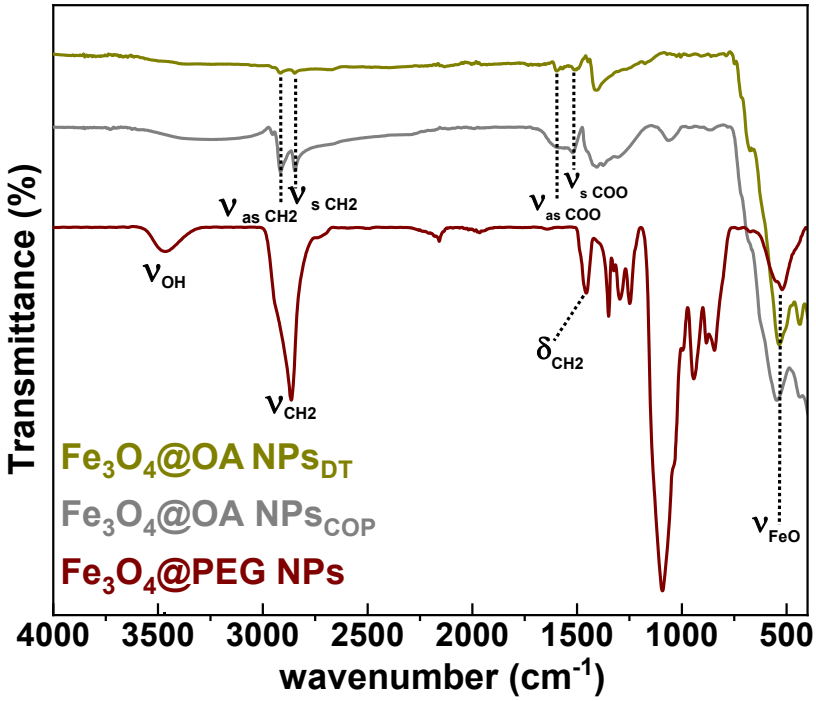

Figure S2. XRD patterns of Fe_3O_4@PEG NPs (wine pattern), Fe_3O_4@OA NPs, synthesized by decomposition method, DT (dark yellow pattern) and Fe3O4@OA NPs, synthesized by co-precipitation method, COP (grey pattern), compared to the XRD pattern of magnetite from the ICDS card No. 98-015-8742 data base.

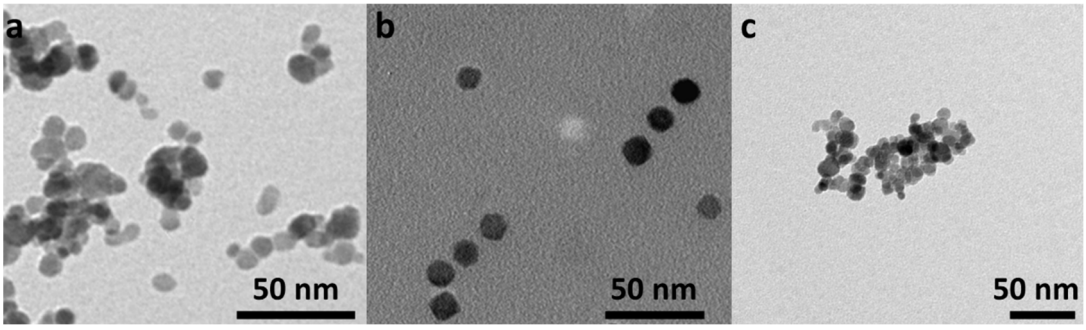

Figure S3. Representative TEM micrographs of Fe_3O_4@OA NPs, synthesized by co-precipitation method, Fe_3O_4@OA NPs, synthesized by decomposition method and Fe_3O_4@PEG NPs.

1. Coker, V.S.; Bell, A.M.T.; Pearce, C.I.; Patrick, R.A.D.; van der Laan, G.; Lloyd, J.R. Time-Resolved Synchrotron Powder X-Ray Diffraction Study of Magnetite Formation by the Fe(III)-Reducing Bacterium Geobacter Sulfurreducens. *American Mineralogist* **2008**, *93*, 540–547, doi:10.2138/am.2008.2467.
2. Rajan, A.; Sharma, M.; Sahu, N.K. Assessing Magnetic and Inductive Thermal Properties of Various Surfactants Functionalised Fe3O4 Nanoparticles for Hyperthermia. *Scientific Reports* **2020**, *10*, doi:10.1038/s41598-020-71703-6.
3. Wei, Y.; Han, B.; Hu, X.; Lin, Y.; Wang, X.; Deng, X. Synthesis of Fe3O4 Nanoparticles and Their Magnetic Properties. In Proceedings of the Procedia Engineering; Elsevier Ltd, 2012; Vol. 27, pp. 632–637.
4. Yang, K.; Peng, H.; Wen, Y.; Li, N. Re-Examination of Characteristic FTIR Spectrum of Secondary Layer in Bilayer Oleic Acid-Coated Fe 3 O 4 Nanoparticles. *Applied Surface Science* **2010**, *256*, 3093–3097, doi:10.1016/j.apsusc.2009.11.079.
5. Gopal, S.V.; Chitrambalam, S.; Joe, I.H. Coherent Source Interaction, Third-Order Nonlinear Response of Synthesized PEG Coated Magnetite Nanoparticles in Polyethylene Glycol and Its Application. *Optics and Laser Technology* **2018**, *98*, 84–91, doi:10.1016/j.optlastec.2017.07.047.