Submitted

on January 04, 11:55 AM

for intermag

Proof

CONTROL ID: 457636

PRESENTATION TYPE: Poster

CATEGORY: Life Sciences & applications

PRESENTER: Virginia Bouzas

TITLE: Fe Oxide Nanoparticles produced by laser pyrolysis for biomedical applications

AUTHORS (LAST NAME, FIRST NAME): Bouzas, Virginia[1]; Costo, Rocío[2]; García, Miguel Ángel[1]; Morales, María Del Puerto[2]; Veintemillas-Verdaguer, Sabino[2]

INSTITUTIONS (ALL): 1. Dpt. Material Science, Universidad Complutense de Madrid, Madrid, Madrid, Spain.
2. Institute of Materials Science, CSIC, Madrid, Madrid, Spain.

Digest Body: Iron oxide nanoparticles are commonly used in biomedical applications as contrast agent for Magnetic Resonance Imaging [1]. The magnetic properties of the nanoparticles strongly depend on their features and small changes in shape and size can alter significantly the magnetic response of the nanoparticle. Therefore nanoparticle production methods with a narrow size distribution are required for these purposes. Among the different methods that can provide this kind of nanoparticles, laser pyrolysis has the advantage to produce homogeneous material in quantities fairly larger than other chemical methods, that requires a long time to produce few milligrams and results expensive. Here, we report on the preparation and magnetic characterization of Fe oxide nanoparticles by laser pyrolysis and the relationship between the preparation conditions and the magnetic response.
Iron oxide nanoparticles were prepared by pyrolysis laser (CO_2 laser W=79watts, P=400mbar) using the method described previously [2]. Table 1 summarizes the main preparation parameters.
XRD and TEM analysis confirmed the existence of Fe oxide nanoparticles (compatible with maghemite and magnetite) with size between 2 and 4 nm, except for BONFEX06 which showed bimodal size distribution with maxima at 3.7nm and 14.9 nm

The magnetization curves measured at 10 K are presented in figure 1
At this temperature, all the samples exhibit ferromagnetic behaviour and no one is saturated at a field of H=7T. Results are quite similar for samples BONFEX02, BONFEX03, BONFEX04 and BONFEX05 (all these prepared using the same flux of C_2H_4). For these particles is also observed that the magnetization under a 7T field increases as the particle size does as expected: it is well known that Fe oxide nanoparticles present a surface shell with a reduced magnetization [3], and the fraction of atoms in this surface shell increases as the particle size decreases.
Sample BONFEX06 has a very different behaviour. For this heterogeneous sample the curve presents an almost linear behaviour but the graph opens, indicating that, this is not paramagnetic. Although it is very tough to reach conclusions about this complex sample the presence of large and likely more crystalline particles could arise a higher anisotropy. Therefore a field of H=7T is far away to saturate the material and larger fields are required to saturate it. This also could explain the low magnetization of the sample.
Sample BONFEX08 present an intermediate behaviour between the others with the larger HC but the lower magnetization at 7T that, as well, can be understood as a large anisotropy (larger than for BONFEX02, BONFEX03, BONFEX04 and BONFEX05, but lower than BONFEX06).
Comparison of the magnetic measurements with the preparation conditions shown in table 1, it is inferred that that the magnetic features of the nanoparticles can be controlled in a wide

range of values through the carrier flux during the preparation, while the addition of an air flux or the evaporation temperature of $Fe(CO)_5$ seems not to alter dramatically the magnetic properties of the nanoparticles. In particular, larger flux leads to smaller values of the magnetization of the samples under a 7T field.

References: [1] J. W. Jung and P. Jacobs, MAgne. Reson. Imag. 13 (1995) 661.
[2] S. Veintemillas-Verdaguer, M.P. Morales, C.J. Serna, Mater. Lett. 35 (1998) 227.

[3] A. E. Berkowitz, W. J. Schueleand P. J. Flanders J. Appl.Phys. 39 (1968) 1261

(No Table Selected)

SAMPLE	GAS FLUX			EVAPORATION T(C°) $Fe(CO)_5$
	CARRIER	COAXIAL	WINDOWS	
BONFEX02	$9C_2H_4$+9Air	22 He	726 N_2	26
BONFEX03				10
BONFEX04	9 C_2H_4		726 N_2+40Air	10
BONFEX05				22
BONFEX06	18 C_2H_4	190 He	1517He+40Air	22
BONFEX08	$12C_2H_4$+6Air		1517He	10

Table 1 Main preparation parameters for the Fe oxide nanoparticles

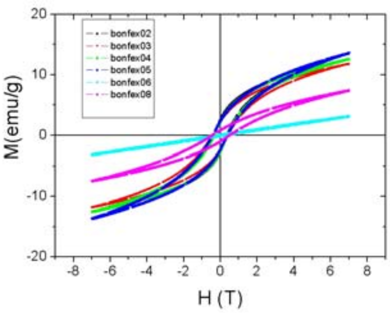

Figure 1. Magnetization curves measured at 10 K after zero field cooling