

GB06

Magnetic Nano-structured Polymeric Composite Obtained Using Nano-magnetic Fluids

N. Crainic¹, Doina Bica², A. Torres Marques³, N. C. Popa², P. J. Novoa⁴, N. Correia⁴,
Oana Marinica¹, C. P. Moreira de Sá⁴, and L. Vékás²

¹„Politehnica” University of Timisoara, National Center for Engineering of Systems with Complex Fluids (NCESCF),
Bd. Mihai Viteazul nr. 1, 300222 Timisoara, Romania;

²Romanian Academy-Timisoara Branch, Center for Advanced and Fundamental Technical Research (CAFTR),
Bd. Mihai Viteazul nr. 24, 300223 Timisoara, Romania; e-mail: nepopa@acad-tim.ro

³Universidade do Porto, Faculdade de Engenharia da Universidade do Porto (FEUP), e-mail: marques@fe.up.pt
⁴Instituto de Engenharia Mecânica e Gestão Industrial (INEGI), Unidade de Materiais Compositos (CEMACOM),
Porto, Portugal; e-mail: pmovoa@inegi.up.pt, nuno.correia@inegi.up.pt

⁵Universidade do Porto, Centro de Materiais da Universidade do Porto (CEMUP), Porto, Portugal; e-mail: cmsa@cemup.up.pt

*Corresponding author: ncrainic@flumag2.mec.ut.pt, Phone/Fax: +4 0256 403700

As advanced technologies are expanding, the need for novel functional materials significantly increases. Nowadays, materials with a special combination of properties (e.g., magnetic-transparent, conductive-transparent, catalytic-magnetic, etc.) are strictly required. Materials based on nano-sized metals will surely represent an adequate solution to many present and future technological demands, since they exhibit both novel properties (e.g., plasmon resonance, superparamagnetism, etc.) and unique properties combinations ([1]).

The paper presents the possibility to create a new category of nano-magnetizable composite materials, using nano-magnetic fluids (ferrofluids) and resins ([2]). The target of these investigations is to obtain new materials having magnetic controllable properties. We prepared samples of different mixtures of resins, carrier liquids (of nano-magnetic fluids), and concentration of magnetic nano-particles.

We used nano-magnetic fluids with cyclo-hexane, and methyl-ethyl-ketone, as carrier liquids. In the cyclo-hexane carrier liquid, the Fe₃O₄ nano-particles are monolayer sterically stabilized (with oleic acid). In the methyl-ethyl-ketone carrier liquid, the magnetite nano-particles have double steric stabilization (chemisorbed oleic acid and physically adsorbed dodecyle benzene sulphonic acid).

The polymerisation process took place with and without magnetic field. We investigated the magnetic properties of these solid samples with the measurement of magnetic field parallel and perpendicular to the polymerisation magnetic field ([3]), the microstructure of the samples, and, the mechanical properties (three points bending test, elastic properties, gel time determination, etc.) corresponding to different preparation methods ([4]).

REFERENCES

- [1] L. Nicolais and D. Carotenuto, (eds.): *Metal-Polymer Nanocomposites*, Wiley Interscience, 2005.
- [2] N. Crainic, A. Torres Marques, Doina Bica, L. Vékás, P. J. Novoa, and C. P. Moreira de Sá, *Mol. Cryst. Liq. Cryst.* **418** (2004) pp. 297(757)-401(768).
- [3] N. C. Popa, A. Sibilini, and C. Nader, *J. Magn. Magn. Mater.* **293** (2005) pp. 259-264.
- [4] N. Crainic, Doina Bica, A. Torres Marques, N. C. Popa, P. J. Novoa, N. Correia, Oana Marinica, C. P. Moreira de Sá, and L. Vékás, *Proceedings of the 4th International Symposium on Nanomanufacturing*, ISBN2006, Cambridge, November 1-3 (2006) MA USA, pp. 70-75.

GB07

Magnetic Properties of Barium-hexaferrite Prepared by the Sol-gel Method

Ngo Viet Tuan¹, Huynh Dang Chinh^{*1}, Nguyen Hanh¹, and Nguyen Chau²

¹Department of Inorganic Chemistry, Hanoi University of Technology, 1 Dai Co Viet, Hanoi, Vietnam

²Centre for Materials Science, Vietnam National University of Hanoi, 334 Nguyen Trai, Hanoi, Vietnam

*Corresponding author: chinhdh-fc@mail.hut.edu.vn, Phone: +84 4 868 0110, Fax: +84 4 868 6583

A hard magnetic barium ferrite has relatively large saturation magnetization, high coercive force and high resistivity as well as excellent properties in a nano particles can be used for many application such as microwave absorption, high-density magnetic and magneto-optic recording media... Most of the research has studied the magnetic properties of Ba-ferrite, Sr-ferrite and Sr-substituted Ba-ferrite. However, the magnetic properties of La-substituted Sr-ferrite have not been reported. Therefore, in this work, synthesis conditions and magnetic properties of La_{0.05}Sr_{0.95}Fe₁₂O₁₉ have been studied by X-ray diffraction, scanning electron microscopy and vibrating sample magnetometer. Samples were prepared by a sol-gel method that has been advantageously used for the synthesis and control of nano-crystalline particles at the lower annealing temperature.

It may be said that the sol-gel technology is a suitable method for preparing the nanocrystalline single phase hexagonal La_{0.05}Sr_{0.95}Fe₁₂O₁₉ at low temperature with these conditions as ions ratio at 1.5 and pH range 6-7. In comparison with the conventional solid state reaction the temperature necessary for the production of single phase compounds is much lower by the homogeneous mixed at atomic level. After pre-decomposing the xerogel into ultrafine compounds at 550 °C, the ultrafine single phase La_{0.05}Sr_{0.95}Fe₁₂O₁₉ can be obtained at low temperature. The magnetization, coercive force and particle size are dependent on the annealing treatment of heated xerogel. The hexagonal La_{0.05}Sr_{0.95}Fe₁₂O₁₉ sample prepared at 900 °C for 3h exhibits the large hysteresis loop with the saturated magnetization of 70.3 emu/g, remanence of 34.7 emu/g, and high coercive force H_c of 6689.5 Oe, which are values of the potential application for the microwave absorption.

REFERENCES

- [1] Rulhner M.J., Proc. of ICF7, Bordeaux-France, 9/1996, C1.53-56
- [2] Sohn S.B., Choi S.Y., Shum I.B., J. Magn. Magn. Mater., **239** (2002) 533
- [3] Roy R., Amer. J., Ceram.Soc. **39** (1956) 145
- [4] Maggio P. Peccini US Pat. N° 3.330.697 July 11, 1967



Fig. 1. Nano-magnetic composite polymerised in magnetic field.