Magneto-optical properties of magnetite nanoparticles prepared by chemical and biomineralization process

A. Dzarova(a), D. Jamon(b), M. Timko(a), F. Royer(b), V. Zavisova(a), P. Kopcansky(a), F. Choueikani(b), J.J. Rousseau(b)
(a)Institute of Experimental Physics Slovak Academy of Sciences, Watsonova 47, 040 01 Kosice, Slovakia
(b)Laboratoire Dispositifs et Instrumentation en Optoélelectronique et Microondes-EA3523, Université Jean Monnet, 21 Rue Paul Michelon, 42023 Saint Etienne cedex 2, France

timko@saske.sk

Transversal and longitudinal magneto-optic measurements were taken on 1 mm a thick plate which consists of parallelepiped glass cells, free of residual stress, filled with suspension of magnetosomes prepared by mineralization process of magnetotactic bacteria and spherical nanoparticles prepared by coprecipitation method, respectively. A classical electromagnet with axial holes drilled through the pole pieces was used to produce DC magnetic field up to 10 kOe. Ellipsometric angles were measured using a null ellipsometer described elsewhere [1]. Linear effects such as birefringence and dichroïsm obtained with a transversal field have shown that magnetosomes suspensions require a very low field around 20 Oe to be well oriented compared to 300 Oe for classical spherical particles. If we assume that a chain of magnetosomezs is an optical anisotropic element, bearing an effective magnetic moment whose easy magnetization axis is aligned with the chain direction, we can calculate a normalized dichroïsm using Langevin orientation theory. The good agreement to experimental data was obtained for magnetosomes with diameter 37nm what is comparable with diameter values obtained by X-ray, TEM and magnetic measurements.

[1] S. Djendli, D. Jamon, F. Donatini, J. Monin, J. Magn. Magn. Mater., 217 (2000), 170

Acknowledgments

This work was supported by the Slovak Academy of Sciences, in the framework of CEX-NANOFLUID, Project SAV-FM-EHP-2008-01-01, MNT-ERA Net 2008-022-SK, projects VEGA 0077, APVV SK-FR-0022-07, 0173-06 and 0509-07 and Ministry of Education Agency for Structural funds of EU no. 26220120021 and 26220120003.