MAGNETICALLY INDUCED LIGHT SCATTERING IN Fe_3O_4 NANOPARTICLE SUSPENSION

S.Z. Malynych[1,2], John Ballato[1], S.B. Ubizskii[3], and K. Kornev[1]

[1] School of Materials Science and Engineering, Clemson University
Clemson, SC 29634, USA
[2] V.E. Lashkaryov Institute for Physics of Semiconductors NAS of Ukraine, Kyiv, Ukraine
[3] Lviv Polytechnic National University, Lviv, Ukraine
E-mail: smalyny@clemson.edu

There has been growing interest in studying of the properties of ferrofluids over the last decade. Ferrofluids are colloids of subdomain paramagnetic particles dispersed in a liquid carrier. Magnetite or Fe_3O_4 nanoparticle suspensions are among the most appealing systems due to their wide potential applications.

In this work, we report magnetically induced optical effects in ferrofluid including time variations in the transmitted light intensity and appearance of a characteristic diffraction pattern. The ferrofluid is an aqueous suspension of ca. 10 nm Fe_3O_4 nanoparticles with volume fraction of 0.0012. Magneto-optical measurements were performed with the use of DC operated magnet within 0…0.72 T magnetic flux density range. He-Ne laser with a 632.8 nm wavelength was used as a light source.

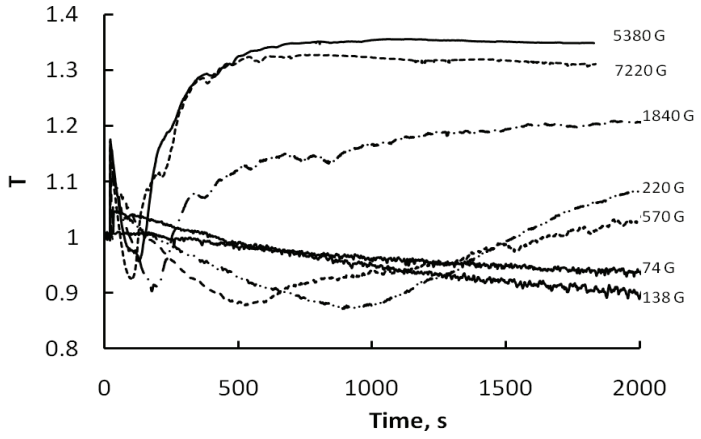

Fig. 1. Time variations of relative transmission coefficients of ferrofluid exposed to the magnetic field of different magnitudes.

Time evolution of the transparency of ferrofluid after the magnetic field was switched on (Fig. 1) could be successfully explained in terms of chain formation composed from the magnetite nanoparticles parallel to the applied magnetic field [1]. Another evidence of chain formation in ferrofluid follows from emerging of a diffraction pattern, which can be visualized on an opaque or translucent screen placed at a certain distance from a sample.

References

[1] C. Rablau, P. Vaishnava, C. Sudakar, R. Tackett, G. Lawes, and R. Naik, Phys. Rev. E 78, 052502 (2008).