Composite materials consisting of ferromagnetic nanoparticles in inorganic matrix

E. Sówka and M. Leonowicz

Faculty of Materials Science and Engineering, Warsaw University of Technology
Wołoska 141, 02-507 Warsaw, Poland

Nanoparticles exhibit unique physical properties due to surface or quantum-size effects. Particular attention has been focused on magnetic nanoparticles and substantial progress has been done in this field. This is mainly due to the advances in the processing methods and development of characterization techniques. Substantial achievements in that field enabled fabrication of composite systems consisting of metallic particles embedded in various organic or inorganic matrices.

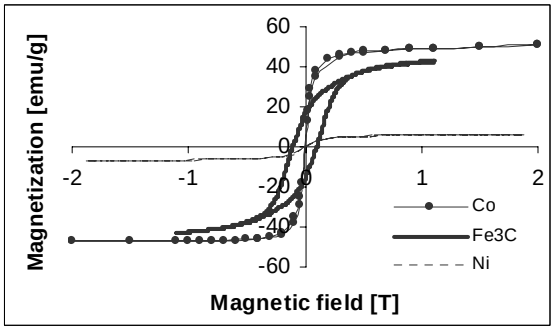

Fig. 1. Room temperature hysteresis loops for the nanocomposites containing Co, Ni and Fe_3C.

Ferromagnetic composites, consisting of Co, Ni and Fe_3C nanocrystallites stabilized in an inorganic matrix, were prepared by the procedure including formation of appropriate metal acrylamide complex, followed by frontal polymerization and pyrolysis of the polymer at various temperatures [1, 2]. The pyrolysis products were in a form of coarse powder particles having irregular shape and size. These particles contained randomly distributed nanocrystallites having various composition and size from few to tens of nanometres, depending on the starting monomer and pyrolysis temperature [3]. Application of this procedure stabilizes the nanostructure and enables processing of spherical nanoparticles within a narrow window of sizes. The ferromagnetic properties of the systems were confirmed by the magnetic measurements. Their magnetic properties depend on the chemical composition and pyrolysis temperature.

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[2] N.M. Chechilo, R.Ya. Khvilitskij, and N.S. Enikolopyan, Dokl. Akad. Nauk SSSR **204** (1972) 1180
[3] A.D. Pomogailo and G.I. Dzhardimalieva, Polimer Science A **46** (3) (2004) 250

Name of the presenting author (poster session II): Ewa Sówka
e-mail address: ewasowka@inmat.pw.edu.pl
http://www.inmat.pw.edu.pl