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Three components of magnetic fluids as three sources of their new properties.

Author: Aleksandr Lebedev[1]

Co-author: Sergey Lysenko[2]

[1] *Institute of Continuous Media Mechanics UB RAS*

[2] *Institute of Technical Chemistry UB RAS*

Magnetic liquids (colloidal solutions of finely dispersed magnets) contain three main components: a base liquid, magnetic particles dispersed in it, and a so-called stabilizer covering the surface of the particles. All these components determine the properties of a magnetic fluid – rheological and magnetic. Naturally, the use of new types of components gives magnetic liquids new, previously unknown properties. In this paper, the influence of all three components of magnetic fluids is considered.

The first part describes the stabilization of magnetic particles by a double layer of surfactants. A number of fatty acids were used as the first layer, starting with decanoic acid and ending with oleic acid. The second layer was formed either by an ionic stabilizer (sodium oleate, sodium dodecyl sulfate), or by a nonionic one (TWIN20). The rheological and magnetic properties of the synthesized samples were investigated.

The second part of the work contains experiments with the basic medium of a magnetic fluid. The main purpose of the experiments was to obtain a magnetic liquid with low operating temperatures. It was possible to synthesize liquids based on aqueous solutions of alcohols and calcium chloride. Low-temperature magnetic liquids based on tetraethoxysilane, methanol, allyl chloride, and di-diethylsiloxane were also obtained.

The third part of the work was related to the synthesis of magnetic particles based on ferrites other than magnetite. The technology of synthesis of fine particles of ferrites of divalent metals was developed recently at the Institute of Technical Chemistry of the Ural Branch of the Russian Academy of Sciences [1]. Thanks to this technology, fine particles of ferrite of copper, cobalt, manganese, cadmium, zinc, etc. were obtained. It turned out that their magnetic properties differ significantly from the properties of "classical" ferrites listed in the reference books. In particular, zinc ferrite synthesized in this way showed noticeable magnetic properties, although ordinary zinc ferrite is nonmagnetic. In mixed ferrites, the addition of zinc reduces the induction of ferrite saturation.

The use of these innovations made it possible to synthesize a magnetic liquid with cobalt ferrite particles stabilized by a double layer of surfactants in water and oleic acid in isooctane. The frequency dependence of its dynamic susceptibility indicates the predominance of the Brownian relaxation mechanism.

References

[1] Lysenko S.N., Yakusheva D.E., Astafyeva S.A. Method for producing ferrite particles. Patent of the Russian Federation No. 2725231.

Type:

Oral