Modifier of dispersions of ferromagnetics

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Abstract

The colloidal solutions of ferromagnetics have application for preparation of magnetic fluids and toners for copying apparatus. Synthesis of dispersed ferromagnetics includes the two main stages: a) preparation of primary particles with magnetic properties and b) formation of magnetic dispersion which is the assembly of clusters.

Formation of primary magnetic particles is carried out by codeposition of metal hydroxides from their salt solutions and potassium hydrate. At the initial stage of synthesis the ferromagnetic substances have the monodomain structure. For its preservation the special dopes of electrolytes may be introduce in reaction mixture.

The regulation of clusters size and form is accomplished with the help of surface modifiers of magnetic particles. As modifiers of surface the mordant and direct dyes may be using.

Because of this it is possible to produce the colloidal solution of ferromagnetics dispersed assembly of clusters.

The magnetic suspensions find wide application for manufacturing of magnetic liquids. They are included into structure of compositions, on the base of which the magnetic fillets for the information recording and toners for copying engineering are made.

The magnetic liquids are ultra dispersible stable colloids ferro- or ferrimagnetic one-blast particles, dispersed in various liquids. In these liquids the heavily Brownian motion is made. The magnetic permeability μ such colloids reaches ~10, whereas at usual liquids ≤ 1. The magnetization of saturation of the concentrated magnetic liquids can reach ~100 Gs. The viscosity of them can be comparable with the viscosity of water. Sometimes by magnetic liquids are called rather stable suspensions of magnetic particles by a size 0.1-10 microns. However really stable suspensions are ultra dispersible colloids of particles by a diameter about 0.01 microns. Suspensions of ferromagnetic substances passes characteristic: the forces of a magnetic attraction act between particles of such dispersible systems. If colloidal particles represent the single domains, it means they are homogeneous and before saturation magnetized, then such particles interact among themselves as magnetic dipoles. The multiblast particles also should interact among themselves for the account of fields of scattering. The part of a magnetic flux of domains located at a surface does not become isolated through adjacent domains and leaves in an external medium. The magnetic fields of scattering of macrosamples stipulate attractions to the interblast boundaries of small-sized particles, including polyblast. Thus, it is possible to observe a configuration of domains on the surface of the macrosample. Under the investigation of a blast structure of microparticles of iron it is found, that the particles of ferromagnetic sol are concentrated near microparticles of iron in the correspondence with their blast structure.

Superfine ferromagnetics are widely used in the research work. However, to study of interaction between particles on stability of these systems is not given of due attention. For prevention adhesion of particles in a system containing a superfine ferromagnetic, it is put a stabilizer, surface-active substance (SAS). Usually SAS consists of polar organic molecules of length of 1.5-2 nm. These SAS create on a surface of particles adsorption-solvate blanket, which hinder with rapprochement and adhesion of particles under an operation of intermolecular forces. One from most used SAS is the oleic acid, which by its polar part is attracted to a surface of a rigid phase, generating on it a dense molecular layer by a thickness about 2 nm. In non-polar dispersing mediums the flexible non-polar ends of SAS are directed from a particle to a liquid. The stability of dispersed particles in the polar liquid, for example, water, is stipulated by a characteristic disposition of two SAS layers.

For increasing of aggregate stability of magnetite particles, the modification of their surface is made. Etching and direct dyes are applied as the modifier. The modification of magnetite particles was making during the process of their synthesis. For this purpose they mixed solutions containing equivalent amounts of ferric sulfate (II) and ferric sulfate (III) with plenty of boiling solution of caustic potash. Under synthesis, 5% water solution of caustic potash is used. Settling of iron ferrite, forming in the reaction process, is washed out by hot water, by the way of decantation. The volume of obtained suspension is led to two liters. For the modification of particles surface of ferrite, obtained at blending of solutions containing 60.0 g $Fe_2(SO_4)_3 \cdot 9H_2O$ in 500 ml H_2O and 29.7 g $FeSO_4 \cdot 7H_2O$ in 500 ml H_2O, 2.0 g of dye direct black, previously dissolved in 200 ml of water by small portions under intermixing is put in suspension. Modified magnetite is separated from water by filtering and dehydration is carrying out at the temperature not above than $60^{O}C$.

The modification of magnetite particles can be also carried out by putting in a reactionary mixture, 1.0 g of etching dye 1-nitrozo-naphtol-2, previously dissolved in 200 ml of water instead of direct black dye. The process of the modification occurs at the temperature of $60^{O}C$.

On the indicated synthesis of modificated magnetite it is possible to make synthesis of modified ferrite of copper, cobalt, nickel etc. The process of the modification of different simple ferrite can not essentially depend on a nature Me^{2+}, because, the ferritization process does not pass up to an extremity. As result of it there are always hydroxides of $Fe(OH)_3$, $FeO(OH)$, $Me(OH)_2$, which first of all interact with dye in products.

At the modification of ferrite, the modifier acts as a means for decrease of surface energy of dispersible particles. In an outcome, it does not happen formations of aggregates by them. It is possible at the account of aggregate stability of magnetite to simplify process of manufacturing of magnetosensitive developers of the latent electrostatic image.

Biography

Iryna Opaynych received her M.S. in Physical Chemistry from the University of L'viv in 1965, and her Ph.D. in Chemistry from the University of L'viv in 1983. Dr. Opaynych is current an associate professor of chemistry at the chemical faculty of the L'viv University. She has published over one hundred papers, including inventions, one of inventions has been patented in USA, France, UK, Japan and others countries. Iryna Opaynych works in the area of polymeric composite materials chemistry.