RHEOLOGICAL AND MAGNETIC PROPERTIES OF MAGNETORHEOLOGICAL FLUIDS WITH COMPLEX DISPERSED PHASE

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In fluid media containing non-colloid magnetic particles as a dispersed phase, effective viscosity can increase by some orders under the magnetic field influence because of structurization of particles. Such media are called magnetorheological fluids (MRF). Ability of MRF to be structured in the magnetic field is defined substantially by their magnetic properties – magnetic permeability, saturation magnetization, remnant magnetization, coercive force.

MRF containing the complex dispersed phase consisting of two types of particles in various ratios are investigated. A series of compositions with volume concentration of the dispersed phase near maximum possible (about 50 %) is studied. These compositions contained as one component of a dispersed phase particles of soft magnetic material – carbonyl iron, as the second – particles of hard magnetic material (chrome dioxide CrO_2 or iron gamma-oxide γ-Fe_2O_3). The low-concentrated MRF which contained as the second components particles of iron alpha-oxide α-Fe_2O_3, or iron gamma-oxide γ-Fe_2O_3, or non-magnetic particles of goethite α-FeOOH, or aerosil SiO_2 were investigated also.

Rheological measurements are carried out by means of rheometer Physica MCR 301 by Anton Paar with using of a measuring cell of parallel plate type with diameter of 20 mm. Flow curves in the mode of continuous deformation are received, and also values of static yield stress τ_0 are defined by the procedure of shear stress growth at various induction of the magnetic field B in the range up to 1 T.

Magnetic properties of MRF are defined by the standard technique of measurement of magnetization with two Hall sensors. Magnetization curves (dependences of magnetization J on magnetic field strength H) are received, values of magnetic susceptibility χ=J/H and magnetic permeability $\mu=1+\chi$ of investigated fluids are defined depending on concentration of dispersed phase particles in the range of magnetic field strength up to 450 kA/m.

Dependences of value of magnetization and shear stress increase of MRF in the magnetic field on concentration of carbonyl iron particles, and also character of influence of a material of particles of the second type on rheological and magnetic properties of MRF are established.