

THE RHEOLOGICAL CHARACTERISTICS OF MAGNETORHEOLOGICAL FLUIDS IN SQUEEZE MODE

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Magnetorheological fluids (MRF) are able to be structured and to change quickly (on the order of millisecond) and reversibly their rheological properties under the magnetic field influence. This ability allows using MRF in various devices and technologies: shock absorbers, valves, clutches, finishing of optical and semi-conductor parts and others. Fluids can work in shear, flow or squeeze mode in the devices. The rheological properties of MRF must be known for evaluation of their efficiency and for design of magnetorheological devices.

The rheological characteristics of high-concentrated MRF based on carbonyl iron particles are investigated in squeeze mode. Experiments were 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. Three kinds of experiments were done. In first one, the gap between plates filled with MRF decreased from 1 to 0.9 mm by means of upper mobile plate lowering, then it increased back to 1 mm, and then cycle was repeated. The normal force acting on the plates were measured depending on the gap size and induction of the applied magnetic field. In second set of experiments in addition to squeezing the upper plate rotated with constant given shear rate. At that normal force and shear stress were measured. In third set of experiments the upper plate rotationally oscillated with constant frequency and amplitude simultaneously with lowering. The normal force, modulus of elasticity and loss modulus were determined.

Hysteresis was occurred for all experimental techniques and for all determined values. Normal force, shear stress, modulus of elasticity and loss modulus were larger at gap decrease than at gap extension. The most abrupt fall of these values (about one order under the magnetic field influence) occurred in the beginning of gap increase stage. The rheological characteristics didn't change in the next cycle of deformation when the magnetic field was applied. In the case without magnetic field action the values diminished in the next cycle.