VIII. ABSTRACT

The paper presents the results of tests on the properties of fluids and magnetorheological elastomers of various physicochemical compositions obtained in a constant magnetic field. In the initial stage of the work, criteria for the selection of individual components of the fluids and magnetorheological (MR) elastomers were established, and then samples were prepared, which in their composition, apart from magnetic particles, carrier in the form of oil, stabilizer, also contained various additives. The tests concerned both complete compositions of a given MR material, as well as base samples (not containing particles with ferromagnetic properties). Research was carried out to determine the rheological changes that occur in the material, depending on the amount and type of individual components, in the presence and without the action of a permanent magnetic field. The first type of research was aimed at examining the nature of the rheological response of the tested liquids to shear excitation. The second type of research allowed us to determine the influence of the magnetic field induction value on the rheological properties of the liquid. The produced samples of magnetorheological fluids were tested under shear conditions for different amplitude and frequency values at different values of the external magnetic field strength. A series of tests were carried out to determine such parameters as dynamic viscosity, shear stress or damping coefficient. The influence of the modulus of elasticity and the loss modulus on the properties of the liquid as a function of the oscillatory deformation, as well as the viscosity of the liquid as a function of the shear rate, was also determined. This stage of research allowed us to determine the structural properties of the tested materials, and also provided information about the plasticity and elasticity of the samples. Based on the observations and as a result of the tests carried out, it was found that the differences resulting from the physicochemical properties of the magnetic particles may be the basis for explaining the discrepancies in the results of rheological tests, and also affect the form and consistency of the samples. The further part of the research showed the influence of the selection of individual components of magnetorheological fluids on their rheological properties, as well as the important role of the stabilizer, which contributes to the formation of a fixed structure inside the fluid. On the basis of the tests carried out, it was observed that the type, size and concentration of individual components of the liquid cause changes in the yield point and determine the viscosity values of the tested samples.

In the next stage of the work, magnetorheological elastomers were tested. The thermo-oxidative aging process and Shore A hardness before and after the aging process were tested. Changes in the color of the samples after the aging process were also

determined. Elastomer samples were also subjected to additional evaluation by performing measurements of water absorption, frost resistance and chemical resistance. In addition, strength and microscopic tests were performed for selected samples. The last stage of work concerned the measurements of the contact angle and surface free energy (SEP).

Conclusions resulting from the conducted research allow us to explain the nature of the occurrence of many rheological phenomena that occur in the material under the influence of a constant magnetic field. They also confirm the importance of the type and amount of components used, in particular additives, as well as stabilizers needed to prepare a specific sample of fluid or magnetorheological elastomer.