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MP01 Structural-mechanical modification of clay suspensions

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Clay is one of the most common types of rocks that form up to 11 % of the total volume of the earth crust. They are widely used as raw materials for the production of ceramics, bricks, cement, and as an ingredient in the manufacture of rubber, paper, drilling fluids, cosmetic substances, etc. Despite such widespread use of clay, there is still a lot of questions related to the peculiarities of structure formation of clay. Especially the appearance of fissure at drying, which results in the appearance of macro cracks and to unsuitable material. This problem can be solved with the help of various chemical additives that regulate the process of structure formation in the coagulation structures of hydro dispersion and their rheological properties. Rheological properties of clays of Kazakhstan (Koskudyk deposit) are not well researched. Therefore the purpose of our work - the study and regulating of structural and mechanical properties of highly concentrated clay paste.

Structural-mechanical type of clay suspension is set on the basis of the structural-mechanical properties of clay suspensions by means of Weyler-Rehbinder device. Structural-mechanical modification of kaolin clay particles with sodium carboxymethylcellulose was studied in the range of concentration (10^{-3} - 10^{-4} %). Modifying effect of water-soluble polymers (WSP) consists of their and in the presence of absorption in inter-packet space of the clay and continuous coagulation structure.

The water-clay paste without additives referred to the zero type. Pastes of this type have poor formability and prone to brittle fracture. The main causes of bad formability of such pastes is cracking due to high relaxation period ($\theta = 1133.2$ s), and because of the high viscosity ($\eta = 1.68 \cdot 10^7$ Pa·sec). They have other deviations from the required quality criterion, low elasticity of $\lambda = 0.288$ and low plasticity ($P = 1.19 \cdot 10^{-2}$ s⁻¹). In the presence of NaCMC ($C_{NaCMC} = 10^{-3}$ % and $C_{NaCMC} = 10^{-4}$ %) is the second type of clay paste. Not systematically the elasticity and plasticity of all systems increase in the presence of NaCMC compared to pure clay suspension.

The different concentrations of NaCMC effect differently in the formation of contacts between the clay particles in the process of structure formation. Depending on the concentration of NaCMC change the number density of bonds between particles. The specifics of individual contacts and their number are important indicators of rock structures which control its strength and deformation properties. Clay particles can interact by van-der-Waals forces and molecular, electrostatic forces. Therefore NaCMC may have blocked or structuring actions. The nature of the interaction and the number of contacts change the structure of the clay paste.

Thus, the possibility of control of structural-mechanical properties of hydro suspension of Koskudyk kaolin with small amounts of water-soluble polymer - NaCMC is showed.

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