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THEORETICAL BASES OF ISOLATION TECHNOLOGY FOR SWALLOWING HORIZONS USING THERMOPLASTIC MATERIALS

Abstract. The aim of the paper is to develop a general concept of a computational experiment for processes of heat-and-mass-transfer while eliminating the swallowing of washing liquid in a borehole using thermoplastic materials melts. Problems are set from the point of view of physics and mathematics. The general concept of the computational experiment is considered under theoretical modeling of processes of heat-and-mass-transfer in the elimination of washing liquid swallowing in a borehole. Theoretical foundations of swallowing horizons isolation using melts are developed, with an algorithm to make a software system allowing to calculate the heat-and-mass-transfer processes in a wide range of conditions. Practical value of the findings lies in the development of isolation technique for swallowing and unstable horizons, which requires the following technological operations: delivery of granulated thermoplastic material to the borehole bottom, local heating of the washing liquid, melting and squeezing of the thermoplastic material melt into the swallowing channels.

Keywords: drilling of the hole, swallowing horizon, thermoplastic materials, heat-and-mass-transfer.

Introduction. Technical-economic indicators of borehole drilling are mainly determined by time and costs spent on trouble-shooting. One of the most frequent troubles is swallowing of washing liquid. According to statistics, up to 20% of all the time and costs spent on borehole drilling are used to eliminate this problem. Swallowing leads to disturbances of process conditions of drilling, resulting in accidents.

Many researchers studied the formulation of washing liquids, plugging materials and methods to eliminate the swallowing of washing liquid. These studies were analyzed previously [1, 2].

The analysis shows that presently there are a number of various methods and materials used to eliminate and prevent the swallowing of washing liquid.

The swallowing of washing liquid can be prevented through regulation of washing liquid properties and reduction of pressure differential in the swallowing horizon [3, 4], whereas these methods are in a sense limited in applicability and in most cases are inefficient.

In the majority of cases, elimination of swallowing is fulfilled by plugging of channels swallowing the washing liquid by hardening or nonhardening plugging mixtures by means of creating a waterproof screen in the rock around the borehole. As a rule, to eliminate the swallowing of washing liquid, the used plugging materials are not sufficiently effective, being water-based and containing a mineral-cementing component or synthetic substances [4]. The main drawback of these materials is that they are very sensitive to water dilution – the solutions are easily mixed with washing liquid and stratal waters, especially in case of inter-reservoir communication. This results in dilution, sedimentation of plugging mixtures which leads to increased setting-up time, spreading across considerable area around the borehole, and as a consequence, to the overuse of plugging materials, and repeated plugging operations.

The above conclusions are confirmed in the findings provided in the research by Rafienko I.I., Titkov I.I., Mekhtiev E.H., Ivachev L.M. [1]. Ivachev L.M. points out in his paper that hardening plugging