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ALUMINATE DRILLING SOLUTIONS

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Abstract: The article shows the preparation of aluminate drilling solutions using synthetic methods. Aluminum hydroxide formed in the solution, adsorbed on the drilled rock, prevents its transition into solution. When hydroxide gets into cracks and pores, it clogs them, reducing the water supply to the formations and strengthening the well walls.

Key words: synthetic method, aluminate drilling fluids, aluminum hydroxide, drill cuttings, reducing water cut into the formation

INTRODUCTION

In recent years, the issue of using hydrocarbon-based and synthetic-based solutions has become increasingly pressing, especially during offshore drilling and drilling in difficult geological and technical conditions. Recently, drilling fluids have been subject to ever new and more stringent requirements for their chemical composition, environmental friendliness, and the corresponding set of parameters [1-4]. The geometry of wells is becoming more complex, their depths, temperatures and pressures are increasing. Collapses of unstable clay rocks often occur. In this regard, the concept of complex geological and technical conditions is introduced. Drilling productivity largely depends on the selection of drilling fluid, the type and properties of which affect the quality of constructed wells. Currently, a large number of drilling fluid formulations have been developed and are used, differing in the type of dispersion medium and dispersion phase. The most important feature of any drilling fluid is that the interaction between the fluid and the rock being drilled should have minimal impact on the mechanical properties of the rocks. This is an essential requirement in order to maintain the nominal diameter of the well and successfully complete drilling. In cemented rocks, drilling will inevitably cause stress reduction in the rock and create a "suction potential". When using a water-based drilling fluid, water will enter the rock and will certainly change its mechanical properties. These changes may not be so large as to lead to disruption of stem stability and, of course, they can be minimized by the use of inhibited systems, such as a polymer solution with potassium chloride[5-8]. However, these systems cannot prevent water from wetting the rock pores. This process can be stabilized in the only way: a solution must come into contact with the rock that will not wet it and, therefore, will not enter the pores and cause changes in the mechanical properties of rocks. Therefore, drilling fluids have been developed whose dispersion medium is aluminate solutions.

METHODS AND RESULTS

Aluminum salts are used as an inhibitory additive in turbulent solutions. They have a very high degree of inhibition and require less stabilizer consumption than other inhibited fluids. Aluminate solutions are prepared with a low content of clay phase. This is explained as follows. Aluminum hydroxide formed in the solution, adsorbed on the drilled rock, prevents its transition into solution. When hydroxide gets into cracks and pores, it clogs them, reducing the water supply to the formations and strengthening the well walls. But when hydroxide forms, a hydration shell is created around it, which reduces the strength of the positive charge. If the clay is moistened, a powerful hydration barrier also forms around its particles. Negatively charged clay particles in such cases are unable to attract hydrated, positively charged aluminum hydroxide. They do not dehydrate or coagulate. Thus, aluminate solutions can only be used when drilling mudstones and low-moisture (10% moisture) highly colloidal clays. Aluminum hydroxide combines well with polymer reagents that prevent hydration and dispersion of clays. With such combined treatment, the stability of the wellbore increases and the contamination of the solution by drilled rock decreases. At the same time, heat resistance reaches 200 C and higher.

EXPERIMENTAL PART

The following recipe for aluminate solution is known: 2 - 3% sodium aluminate or 1 - 1.5% gypsum alumina cement, 7 - 13% sulfite - alcohol stillage or 7 - 10% oxyl, 3 - 4% ferrochrome lignosulfonate, lubricating additive (5 - 7% oil or 1.5 – 2% smad – 1). In this case, the solution has a pH of 9 – 9.5, which can be adjusted by adding caustic soda. The parameters of such a solution during the drilling process are maintained within the following limits: density 1.17 – 1.15 g/cm^3, nominal viscosity 17 – 28 s, fluid loss 5 – 10 cm^3, static shear stress 0.2 – 1.4 Pa.

CONCLUSION

Aluminate solutions are prepared in mixing devices or in wells during the drilling process. In the first case, it is necessary to introduce a defoamer into the aluminate solution. Possessing fastening properties and being insensitive to contamination with cement, aluminate solutions, when enriched with drill cuttings, retain low structural and mechanical properties even with a clay capacity of up to 700 kg/m^3.

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