Thermochemical fluids of delayed action with the application of a viscoelastic surface-active substance for treatment of the borehole formation zone

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To date, various thermochemical compositions have been developed and used for treating the bottomhole formation zone (BFZ). The most effective in solving the problems of cleaning the bottom-hole zone from organic deposits are thermochemical compositions. thermochemical fluids (TCF) are aqueous solutions of two inorganic salts, during the reaction a large amount of gas and heat are released. The components of thermochemical fluids are most often mixtures of nitrogen-containing compounds capable of entering into a redox reaction with each other.

The idea of the method of thermochemical treatment (TCT) using TCF is to creat a kind of thermochemical gas generator, during operation, a chemical reaction occurs with the release of a large amount of gas and heat. Both of these factors together create favorable conditions for cleaning the bottomhole zone from asphaltene-resin-paraffin deposits (ARPD), increasing well productivity and oil recovery.

The reaction of ammonium nitrate with sodium nitrite is described by the following equation:

$NH_4NO_3 + NaNO_2 \leftrightarrow NH_4NO_2 + NaNO_3$

$NH_4NO_2 = N_2 + 2H_2O + Q.$

As a result of the reaction between the components of the TCF, an ion exchange reaction occurs at the first stage, with the formation of ammonium nitrite, which in turn, due to the decomposition, forms a large amount of an inert gas - nitrogen and heat.

An important step in using the TCT method with the use of TCF is the selection of the initiator of the chemical reaction.

In this work, we study several initiators that make it possible to increase the onset time of the TCF reaction up to two hours, as well as the use of a viscoelastic surfactant (surfactant) together with an initiator based on carboxylic acids.

It has been determined that higher carboxylic acids make it possible to achieve a reaction delay time of up to two hours, while lower carboxylic acids, such as formic and acetic acids, do not provide sufficient time to delay the start of the reaction, but they have sufficient potential to create a technology for thermal foam acid treatment of the bottomhole zone.

Now, thermofoam-acid compositions based on inhibited 24% hydrochloric acid are known. However, these compositions have a number of disadvantages, among which - are the resinous ability of concentrated hydrochloric acid in relation to oil, the need to use expensive stabilizers of ferric ions (Fe^{3+}) and high-temperature corrosion inhibitors.

The main advantages of using lower carboxylic acids together with a gas-generating thermochemical composition are the slow reaction rate of the acid with the rock, low corrosiveness, and high stabilizing properties in relation to ferric ions (Fe^{3+}). The combined use of lower carboxylic acids and an amphoteric viscoelastic surfactant makes it possible to achieve a high washing capacity of thermofoam-acid compositions, simultaneously with high foam expansion values, which in turn makes it possible to involve low-permeability sections of the reservoir in the treatment.