

EVOLUTION OF MARKER DIAGNOSTICS OF HORIZONTAL WELL FLOW PROFILES

CHALLENGE

The interest in constructing flow profiles of horizontal wells using marker technologies is due not only to objective challenges in conducting and interpreting the results of well logging, but also to the fact that existing technologies allow to obtain data on the flow profile only at a very short time range when the well logging tool is inside a borehole. Marker technologies facilitate the data acquisition in a much larger volume for several years without changing the well performance profile, which in turn allows for recording the influence of multiple external factors on the performance of the horizontal borehole sections.

In 2016, Gazpromneft STC, LLC initiated a pilot project for the injection of marked proppant into the 29340GS well of the Priobskoye field to carry out 11-stage hydraulic fracturing. Based on the results of reservoir fluid samples interpretation, the service company recorded 10 and 11 code markers, which, by coincidence, were not injected into this well. As a result, the technology was updated by a number of directions, including enhancing quality control, production, as well as improvement of existing and adoption of new means of data interpretation and markers in fluid identification.

SOLUTION

To improve the technology, the measures taken were as follows:

1. The marker-reporters synthesis procedure was changed in order to obtain a more thermally stable product and change the content of quantum dots in polymer spheres to increase the accuracy of determination.
2. Chemical composition of the proppant polymer coating was completely changed in order to create oleophilic (OF) and hydrophilic (HF) markers, enabling to use the product for different reservoir fluid phases. In addition, the new coating, which became more technologically advanced, allowed to increase the duration of the release of markers from the proppant coating from one year in the basic version to three years with a liquid flow rates of 200-250 tons per day.
3. In-house documentation was revised - «Regulations on Production», «Quality Management System». In particular, in addition to the already adopted standard studies of the proppant strength and physical properties, a double quality control of the manufactured products was adopted - at the production site and in the laboratory, as well as the procedure for taking retained samples of marked proppant during multi-stage hydraulic fracturing.
4. Two typical sampling schedules were introduced to account for the plug flow in the well, the effect of periodic operation of the ESP unit and possible well performance range fluctuations. These schedules were used to create packaging that provides for reliable storage of fluid samples during transportation. Moreover, a label was developed that is resistant to data erasure when in contact with oil, with frostproof felt-tip pens used to input data.



CONCLUSION

The conducted set of tests and field application allows us to conclude that the technology of marker monitoring of the horizontal well flow profiles is functional and that there is a potential for its development. To date, the technology has been successfully used in 5 wells with multi-stage hydraulic fracturing (10-15 stages) on the perimeter of the Bazhen Technology Center.