

Scientists propose new method to increase extraction of hard-to-recover hydrocarbons

June 4 2018

More than 40 percent of oil reserves in Russia are hard to recover. Scientists from the National Research Nuclear University MEPhI have proposed an effective method of increasing the production of such fields that does not harm the environment. Heating of a casing pipe by high-frequency electric current leads to melting of accumulated paraffin-resinous deposits.

Usually, extraction of difficult hydrocarbons requires the use of chemical reagents, heated steam, acoustic waves, and other methods. Specialists of MEPhI proposed a non-standard solution. A spiral coil of copper wire is placed into a casing [pipe](#) inside the well. A high-frequency current is passed through the coil, and the alternating magnetic field excites a strong current in the pipe, which heats its small section to a temperature of 120-150 degrees Celsius. Then the deposits on the internal walls fall off. Pumps evacuate it together with oil. Then the coil moves 15 cm higher or lower, heats another area, etc.

"Productive capacity of wells with high viscosity of oil can be increased without the use of expensive and environmentally hazardous methods," says co-author Alexey Ponomarenko.

According to Ponomarenko, existing methods are connected with huge energy costs. One technique is using a special reagent to induce a chemical reaction with the release of a large amount of heat. Here, energy consumption is lower, but the environmental consequences are more severe. Another option is to clean off scurfs from the inner surface

of the pipe using remotely controlled scrapers; it is associated with high labor costs. This method leaves deposits inside the perforation holes as oil from the reservoir is "pressed" into the casing pipe through them. These hardened heavy oil components complicate production.

"The advantage of our method is that the heat treatment of a pipe occurs without interrupting the work of a well. Promptly removing sediments prevents their accumulation and consequently reduces the bandwidth of the perforations," said Alexey Ponomarenko.

According to the scientist, the use of the technology will allow domestic oil industry to save millions. "If the oil well is clogged, its operation is often suspended," said Ponomarenko.

Tests of a model of a high-frequency generator with an induction heater were held in the laboratory of MEPhI. Today, scientists are developing a high-strength body for it and optimizing the generator circuit. The hydrostatic pressure in the well casing at a depth of two km can be up to 200 atmospheres. Therefore, a shell of an immersion apparatus should be comparable with the hull of a submarine in strength.

Natalia Skibitskaya at the Institute of oil and gas problems of RAS believes that the technology developed in MEPhI is more effective than the use of scrapers.

"During the extraction of heavy oil, asphalt-resin paraffins that clog perforation holes and pipes reduce the debit of the well. From time to time, it is necessary to stop production and clean the bore with a scraper or solvent. The proposed [method](#) is, of course, not a revolution, but an innovation," said Natalia Skibitskaya.

Associate Professor Alexey Dengaev fears that the installation of new equipment inside a well can increase the accident rate. It is not clear how

the additional power supply will affect the existing instrumentation, the expert believes.

Provided by National Research Nuclear University

Citation: Scientists propose new method to increase extraction of hard-to-recover hydrocarbons (2018, June 4) retrieved 16 August 2024 from <https://phys.org/news/2018-06-scientists-method-hard-to-recover-hydrocarbons.html>

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