Nanoparticles for Efficient Oil Production

Researchers from Siberian Federal University and Kutateladze Institute of Thermophysics have found out how nanoparticles affect the efficiency of oil extraction. Adding them to water, which displaces oil from the formation, improves the separation of oil droplets from rock and their washing out to the surface. The work was published in the Journal of Molecular Liquids.

According to the authors, nanomaterials have a number of unique properties that allow them to be used in many areas of the oil and gas industry — they are small and have high chemical and temperature stability. Because of these characteristics, low-concentration nanoparticle suspensions can be used as a water-injecting agent which is pumped into an oil well to enhance oil recovery. Due to the properties of nanoparticles, the wettability of oil-bearing formations increases — this contributes to better washing of rocks from oil. Production efficiency is also affected by interfacial tension — the force that occurs at the interface between two fluids. Oil in the rock is held back by capillary forces. To weaken their effect, it is necessary to reduce the interfacial tension. To do so, the industry uses nanoparticles.

The scientists studied the effect of nanoparticle size, concentration, composition and surface on changes in the wettability and interfacial tension of crude oil. The task was to develop a fluid with special additives that would improve oil recovery. For the experiment, they prepared special nanofluids based on distilled water. Powders of silicon dioxide (SiO_2) and aluminium oxide (Al_2O_3).were used as nanoparticles. An automatic strain gauge was used to measure the wettability and interfacial tension. The principle of operation of the device bases on measuring the geometric parameters and, accordingly, the surface tension of a drop of the liquid under study. The results of the study showed that adding even a small number of nanoparticles can radically change the characteristics of the wettability of rocks, thereby contributing to an increase in oil recovery.

„Systematic studies of the application of nanosuspensions and nanoemulsions in technologies for the development and operation of oil and gas wells is extremely important for the oil and gas industry. The implementation of the project is also relevant from the point of view of obtaining fundamental knowledge. The properties of nanosuspensions are still poorly understood, although it is already clear that they radically differ from the properties of ordinary coarse suspensions," commented **Andrey Minakov**, manager of the project, Assistant Professor of the Department of Thermophysics of Siberian Federal University.

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