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Tight Media Wettability Analysis by High Pressure and High Temperature Spontaneous Imbibition

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Summary

Wettability is an important reservoir property and must be well understood as it gives an indication of how fluids are distributed through the porous media. In tight reservoirs, which generally have been produced using hydraulic fracturing, the measurement of wettability and its alteration become even more important for enhancing oil recovery.

The wettability tendency of rock/oil/water systems is determined by either quantitative indicators such as contact angles, Amott-Harvey index, and USBM index, or through qualitative methods such as spontaneous imbibition and nuclear magnetic resonance (NMR) among others. These wettability measurements are also affected by multiple factors (core preservation state, fluid properties, temperature and pressure); however, the most representative values are obtained by using conditions as similar to the reservoir as possible.

The objectives of this study are to validate the methodology and the equipment for running high pressure and high temperature spontaneous imbibition tests, and to evaluate the wettability of tight media samples as closer as possible to reservoir conditions by performing spontaneous imbibition tests at pressures up to 6900 kPa and temperatures up to 100°C.

In the first part of the study, the equipment is calibrated and tested under the desired conditions. A special visual window cell is used for the high pressure and high temperature spontaneous imbibition tests, where the sample and fluids can be continuously monitored through the visual window.

In the second part of the study, unconventional samples from the Montney formation and conventional sandstone samples are prepared by measuring the basic petrophysical properties. Additionally, heptane (0.03% Sudan II) and brine (2% NaCl) are used as the oil and water saturation fluids.

Finally, in the last stage of the study, the wettability tendency of the Montney formation and sandstone samples is analyzed by running spontaneous imbibition tests under room conditions by using a regular glass Amott cell, and under high pressure and high temperature conditions by using the special visual window cell.