

Advances in Water Cut Metering with Low Field NMR

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ABSTRACT

Thermal recovery methods are widely used in heavy oil production. Under steam injection, the viscosity of oil will be significantly decreased and will be produced. With oil production, gas, steam and water will be produced simultaneously. The question of how to accurately meter oil, water and steam or gas content accurately comes up. Solving this problem and precisely measuring oil production rate in heavy oil production is becoming an increasingly important issue. The goal of this study is to build a three-phase water cut meter laboratory device using low field NMR. If successful it will then be applied in an oil field.

Preliminary results of laboratory testing at ambient temperature obtained to date are presented here. Three kinds of oil of light, conventional heavy and heavy, with corresponding viscosities around 10 cp, 1500 cp and 1000,000 cp respectively, were used to perform the NMR experiments. 2% NaCl brine was used as the water phase. Air was used as the gas phase. The fluids were mixed in a fixed volume vial. The weight percentage of oil was from 5% to 95% respectively. At each oil percentage, the weight percentage of water is from 5% to 95% respectively. The gas takes the void volume of the vial. Totally around 200 mixtures were measured for each of the oil samples. Before the measurement of each mixture, the amplitude index of the oils and water were measured separately. The amplitudes obtained from mixture for oil and water were compared with the values of pure oil and water amplitude. The water and oil content calculated from NMR results were compared from mass balance. The three-phase volume percentage was displaced in the ternary graphs. The results of this work will be presented.