

In-Situ Viscosity Predictions Using Low Field NMR: Core and Log Calibrations

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ABSTRACT

Low field nuclear magnetic resonance has great potential as a tool for performing in-situ viscosity predictions. Previous laboratory work has shown that low field NMR signals can be related to fluid viscosity, even for high viscosity fluids like bitumen. A bulk liquid NMR model was developed that can make order of magnitude viscosity predictions for a wide range of samples from different fields in Alberta. The model can be tuned for individual oils to yield quantitative viscosity predictions with temperature. The model was further extended to predict viscosity of bitumen solvent mixtures successfully. Preliminary investigations showed that there is potential for measuring the viscosity of in-situ fluids. However, the models require additional tuning.

The present work details a series of laboratory and NMR logging tool measurements performed for specific wells in a bitumen reservoir. Laboratory NMR measurements were performed on core samples. The core samples underwent Dean Stark extraction and the mass balance was used to calibrate the logs for bitumen and water content. The constituent bitumen was removed from the core and its viscosity was measured both with NMR and with conventional methods. These tests were used to calibrate NMR logging data with respect to viscosity. A summary of the work performed and the results obtained is presented.