

Interface Minimum Miscibility Pressure Measurements

Equinor and Interface partner to develop fastest and most accurate measurement for minimum miscibility pressure

Challenge

- Develop an alternative method for measuring miscibility conditions including Minimum Miscibility Pressure (MMP) and Minimum Miscibility Enrichment (MME)
- Reduce the time, cost, and sample requirements compared to slim tube method
- Validate the method for the distinct miscibility drive mechanisms, Condensing, Vaporizing, and combined Condensing/Vaporizing drive

Solution

- Miniaturize the traditional slim tube style apparatus using microfluidic technology

Results

- Time per measurement reduced by over 95% (1 week per MMP)
- Achieved ± 2.5 bar (± 35 psi) measurement accuracy
- Sample volume requirement reduced by 99% (10 mL live oil sample)
- Validated miscibility drive mechanisms for most field applications

Quote from Equinor:

Interface's minimum miscibility pressure measurement is a disruptive technology that has changed how we work at Equinor. MMP measurements are now cost effective and timely which has changed them from a nice to have to a need to have for our team.

- Tao Yang, Reservoir Technology Specialist



The Goal

Equinor is an international producer of oil, gas, and renewable energy headquartered in Stavanger Norway with operations in major onshore and offshore basins worldwide. The team at Equinor approached Interface with a challenge – develop a replacement for slim tube testing for the determination of Minimum Miscibility Pressure. The measurement is critical in all of Equinor's fields where gas injection is used or will be implemented, but the cost, time, and logistics associated with the traditional measurement technique was prohibitive.

Result

Interface developed, in close collaboration with Equinor on design, a slim-tube style microfluidic device. It was validated by measuring the minimum miscibility pressure of three live oil samples and selected gas mixtures from different fields with different mechanisms. Interface's technology reduced time per measurement by over 95%, reduced of sample volume by 99%, and eliminating the need for mathematical interpolation of results by increasing the number of measurements taken per sample by 10-20X. The samples chosen exhibited most observed drive mechanisms in field operation.

Results were compared to slim-tube experimental data and deviations were 2.3% on average.

A paper describing the field results and method from this work has been accepted for publication at the 21st European Improved Oil Recovery Symposium (IOR 2021) in Vienna, Austria.

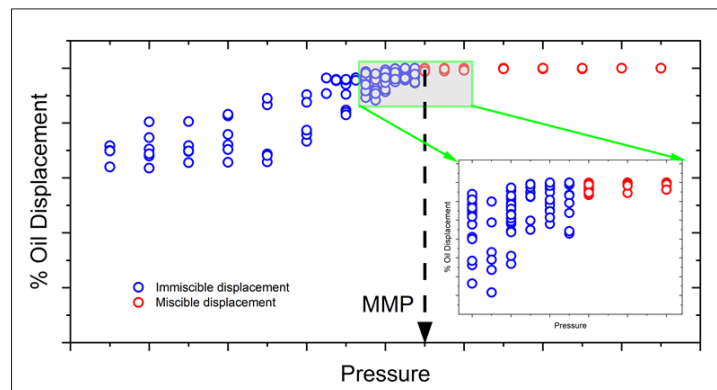


Figure 1. Example results table from testing.