Guest lecture by Research Associate Ali Telmadarreie, University of Calgary

Place: Meeting room 162, PTS1

Time: Friday 21. June, 13:00.

Title: *High-Resolution Inline Density Measurements: Insight on Multiphase Flow and Transport Phenomena in Porous Media*

Abstract

Understanding fluid flow in porous media is essential with complex and multiphase fluid flow. We demonstrate that high-resolution in-line density measurements are a valuable tool in this regard. An in-line densitometer is used in fluid flow in porous media applications to quantify fluid production and obtain quantitative and qualitative information such as breakthrough times, emulsion/foam generation, and steam condensation.

In order to determine the potential applications for in-line densitometry for fluid flow in porous media, a series of sandpack floods were performed with a densitometer placed at the outlet of a sandpack. All fluids passed through the measurement cell at experiential temperatures and pressures. An algorithm was developed and applied to the density data to provide a quantitative determination of oil and water production. The second series of tests were performed at high temperature and pressure, with a densitometer placed at the inlet and outlet of a sandpack, for steam applications. In both series of experiments, data acquisition was collected at 1 hertz and the analyzed density data was compared to results from the conventional effluent analysis, including Dean-Stark, toluene separations, magnetic susceptibility measurement, and flash calculations where applicable.

The high-resolution monitoring of effluent from a flow experiment through porous media in a system with two phases of known densities enables two-phase production to be accurately quantified in the case of both light and heavy oil. The frequency of measurements results in a high-resolution history of breakthrough times and fluid behavior. In the case of monitoring steam injection processes, reliable laboratory tests show that in-line density measurements enable the determination of steam quality at the inlet and outlet of a sandpack and qualitative determination of steam condensation monitoring.

The use of in-line densitometry provides insight on monitoring of complex fluid flow in porous media, which typical bulk effluent analysis is not able to do. The ability to measure produced fluids at high resolution and extreme temperatures reduces mass balance error associated with the effluent collection and broadens our understanding of complex fluid flow in porous media.