# Effects of Temperature on Fines Migration during Low Salinity Water Injection

*Yamin* Wang, *Muhan* Yu, *Furqan* Hussain

**Abstract.**

Objective:

Some experimental studies have shown that the effect of fines migration in sandstone rocks is more prominent at a higher temperature. According to these studies, the increased fines migration is generally attributed to temperature dependent zeta potential. In this paper, we investigated if mineral dissolution induced pH increase can be responsible for increased fines migration.

Methodology:

Outcrop Berea sandstone cores were used in this experimental study. X-Ray Powder Diffraction (XRD), X-Ray Fluorescence (XRF) and Scanning Electron Microscopy (SEM) analysis were run to characterize these cores. All cores were subjected to single-phase injections of water at salinities 40, 10, 2.5, 0.5, and 0 g/L NaCl. Three different temperatures were used in experiments: (1) 25°C - room temperature, (2) 50°C - represented the temperature of aquifers and (3) 80°C - represented the temperature of petroleum reservoirs. Liquid permeability of cores was measured throughout the injection experiments. Energy Dispersive X-ray Spectroscopy (EDS) was run on the post-injection SEM images to identify the mineralogy of fines blocking the pores. Samples of produced water were used to measure the concentration of produced fines, ionic chromatography and pH.

Results:

At 50°C and 80°C, a significant increase in Ca2+ ions production was observed which was accompanied by a pH increase upto 9. These observations were missing during the experiment performed at 25°C. This indicates that increasing temperature leads to cement dissolution and increases pH values. Permeability drop was highest at 80°C and lowest at 25°C which indicates that dissolution induced pH increase can stimulate fines migration and therefore, permeability drop. Analytical models were used to match the experimental data.

Novelty:

Most laboratory studies on fines-assisted low salinity water injection are conducted at room temperature. While this paper proves that increasing temperature stimulates fines migration during low salinity water injection in sandstone by rock dissolution. These observations are critical to design fines migration in aquifers and petroleum reservoirs.