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Enhanced Oil Recovery Strategies in nanofluidics Relevant to Tight Oil Reservoirs

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Production from tight oil reservoirs is challenging mainly due to low rock permeability and the resulting rapid decline in well production performance, specifically when the pressure drops to below the bubble point. Currently, there are several pilot tests focusing on different enhanced oil recovery (EOR) strategies to improve the recovery performance in these reservoirs. Specially in Canada, natural gas and water flooding methods have been applied on the Bakken tight oil formation to improve the recovery. However, continuous flooding processes, in general, result in early breakthrough, making the displacement process inefficient. Addition of chemicals is a proved strategy to delay the breakthrough time and increase the recovery through improving the mobility ratio. While the flooding processes in conventional reservoirs have been well analyzed and characterized to date, there have been very limited studies under nano-scale, with pore geometry and operating conditions (temperature and pressure) relevant to tight oil formations. In this project, we fabricated a high-temperature high-pressure micro/nanofluidic platform to resolve the pore-scale of EOR strategies under relevant reservoir conditions. The nano porous medium contains a pore structure with a pore size in a range of 70 to 80 nm together with a micro channels connected to the fluid sources. We tested various surfactant solutions and compared their pore-scale recovery efficiency with that of conventional water flooding. The micro/nanofluidc method developed here provided high-resolution pore-scale data under a well-controlled environment whereby the influence of individual variables can be quantified and compared, not obtainable with conventional methods.

References

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