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Please fill in your abstract title.	Salinity-Sensitive Polymeric Particles for Improved Recovery in Fractured Carbonate Reservoirs

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Abstract

Objectives/Scope:
Many carbonate reservoirs are oil-wet and have natural fractures. Both of these features reduce the sweep efficiency of water floods and gas floods. Polymeric particles have been developed in the past which swell at a low salinity and plug fractures. We have a developed a new type of polymeric particle that swells at a high salinity. The goal of this work is to evaluate the effect of particle size and fracture width on the improved oil recovery.

Methods, Procedures, Process:
High salinity induced swelling polymeric particles (SISPP) have been synthesized by a simple one-step reaction at the room temperature. The dry particle size has been varied. The swelling of the particles has been studied as a function of brine salinity, temperature, and pH. Fractured cores have been prepared with different fracture widths. SISPP is placed between the two halves to mimic a fractured reservoir. Water flood and gas flood experiments have been conducted varying the fracture width and the dry particle size. The experiments are modeled in UTCHEM to understand the flow diversion mechanisms.

Results, Observations, Conclusions:
SISPP particles were synthesized in sizes from 100 µm to 2 mm. The particle volume increased about 2 times of their original (dry) size in deionized water and about 30 times in 10 wt% salinity brine. Lowering the pH from neutral to 3 did not change their size. They were stable up to 80 C. The pressure drop across a 1-ft long fractured core increased about 100 times when the particles got swollen at 10% brine. This increase was a function of fracture width and SISPP size. The deionized water flood recovered about 30% OOIP. The high salinity brine injection after the water flood increased the oil recovery to about 50% OOIP when the particle size was about 2 mm. A subsequent CO2 flood increased the recovery to 60% OOIP. The polymeric particles are effective in plugging the fracture and directing the fluids into the matrix at the high salinity. This increase in oil recovery is studied as a function of particle size and fracture width.

Novel/Additive Information:
The novelty lies in synthesizing polymeric particles of a certain size that swell at a high salinity. These particles can be placed in fractures at a low salinity and selectively plug fractures during high salinity brine injection, typical of formation brine or sea water. They can be used in CO2 and WAG floods because their swelling is persistent between a pH of 3-7.