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A comparative experimental study of sweep efficiency in naturally fractured reservoirs

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To improve sweep efficiency in naturally fractured reservoirs, different types of polymers are used. In this study, we compared the performance of two polymers in fractured core plugs in laboratory. One is crystallized superabsorbent copolymer. The particles of this co-polymer swell after hydration and the solution has a very high viscosity like a gel. We call it gel in this paper. The other one is a polymer like partially hydrolyzed polyacrylamide whose viscosity is much lower than that of a gel. We simply call it polymer.

In our experiments, we generated a fracture along a core plug using the approach similar to the Brazilian disc test. The core plug was initially saturated with oil. The core plug was flooded by water, and then by gel or polymer solution followed by water again. Our experimental results show that the improvement of sweep efficiency in a fractured core plug by a polymer solution is limited because the polymer solution could flow through the fracture channel from the inlet to outlet of the core, if the fracture width is large enough. And a limited polymer solution flowed through the matrix. The incremental oil recovery was limited mainly depending on the fracture width. A solution of gel particles initially flowed through a fracture channel, but very limited gel particles could flow through matrix because the gel particles are larger than pore sizes. The gel particles swelled after they stayed in the water in the fracture for about half an hour. Then the gel solution filled the fracture. The subsequent water flowed through matrix and displaced oil out. As a result, the incremental oil recovery could be high up to 70%.

The experimental results show that in a naturally fractured reservoir, the best solution to improve oil recovery should be such that the particle sizes are larger than the pore sizes, and the solution viscosity becomes very high after the particles contact with water.

Biography

James Sheng is an Associate Professor in the petroleum department of Texas Tech University. He holds a Ph.D. degree from University of Alberta. He received several professional awards including the Outstanding Technical Editor Award (2005) and Outstanding Associate Editor Award (2008) for SPEREE, and the Best Paper Award in JCPT (1997). He is an author of many papers and a book of Chemical Enhanced Oil Recovery.

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