Boaz van der Plas, J Pet Environ Biotechnol 2014, 5:4
http://dx.doi.org/10.4172/2157-7463.S1.007

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2nd World Congress on
Petrochemistry and Chemical Engineering

October 27-29, 2014 Embassy Suites Las Vegas, USA

Fracture flow control

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Approximately 65% of all the oil discovered cannot be recovered. Uneven fluid flow resistance in a reservoir is a major restriction in efficient oil recovery. In particular fractures dramatically decrease the recovery factor because they divert injected water rapidly away from the permeable matrix to the producer well.

We are researching Shear Induced Structure (SIS) material in order to selectively retard fluid flow in fractures preventing so-called "short circuits". SIS fluids show non-monotonic shear rate viscosity dependence and because at fixed pressure drop gradients higher shear rates are present in larger fractures, this unique non-monotonic behavior can be used to control fluid flow in fractures. Thus for small fractures, with small shear rates, the fluid has a relative small apparent viscosity. While for large fractures, with much larger shear rates, the apparent viscosity of the fluid peaks. For very large shear rates, which are presents at well bore sizes, the viscosity should become small again preventing the fluid forming a highly viscous gel.

We measure Darcy velocities as a function of pressure drop gradients in a single capillary flow experiment and obtain a relative velocity ratio for different sized capillary diameters. It is shown that, depending on the pressure drop gradient, relative retardation in large capillaries take place.

Biography

Boaz completed his BSc. in physics and his MSc. in theoretical physics at the University of Amsterdam. After seven years of teaching physics he is currently working on his PhD in Mechanical Engineering at the Eindhoven University of Technology in collaboration with the Royal Dutch Shell. His work mostly consists of research in the rheology of Viscoelasic Surfactant for selective fluid flow retardation in fractures for geothermal heat mining, oil recovery, and fracturing.

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