InterPore2021



Contribution ID: 373

Type: Poster (+) Presentation

Effect of pore geometry and contact angle on the capillary pressure and oil recovery factor in models of porous media

Tuesday, 1 June 2021 19:00 (1 hour)

We model the displacement of oil from idealized porous media by simulating the quasi-static injection of gas into oil-filled channels with uniform cross-section under different wetting conditions.

We consider channels with triangular or rectangular cross-section that are initially filled with a single fluid (e.g. oil). A second, displacing, fluid (e.g. gas) is introduced at one end of the channel, first having to overcome the capillary entry pressure pce; we estimate pce based on the largest hemisphere that fits inside the crosssection of the channel.

The Surface Evolver software [1] is then used to simulate the invasion of the pore space by this second fluid. It allows us to find the shape of the interface with minimum surface energy separating the two fluids, for a given contact angle at which they meet the pore walls, and a highly-accurate measurement of the capillary pressure. By making small changes in the gas volume and repeating the minimization, we predict in a quasi-static manner the variation of capillary pressure during the displacement flow. As well as neglecting viscous losses, we assume that the effects of gravity are negligible (small Bond number, based on the usual pore size being small).

When the interface is far from the ends of the channel the flow reaches a steady state. In this regime we predict the oil recovery factor, i.e. the proportion of the first fluid that is displaced by the second. We show that in any channel:

• The capillary pressure decreases as the oil volume increases, for given contact angle;

• The capillary pressure decreases as the contact angle increases, for given oil volume;

and hence that the volume of oil that remains in the corners of the channel is greater for smaller contact angles, decreasing the recovery factor.

Time Block Preference

Time Block B (14:00-17:00 CET)

References

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