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Contribution ID: **356** Type: **Oral Presentation**

Pore-by-pore modeling, calibration, and prediction of two-phase flow in mixed-wet rocks

Tuesday, 1 June 2021 15:25 (15 minutes)

In this study, a pore-network model as an upscaled representation of the pore space and fluid displacement is used to simulate and predict two-phase flow through porous media. The results of micro-CT pore-scale imaging experiments are used to calibrate the model, and specifically to find the pore-scale distribution of wettability. As wettability is an uncertain parameter in two-phase flow modeling, we employ energy balance to estimate an average, thermodynamic, contact angle in the model. This thermodynamic contact angle is used as the initial estimate of wettability. We then adjust the contact angle of each pore to match the observed fluid configurations in the experiment at the pore level as a nonlinear inverse problem. The proposed algorithm is implemented on two sets of steady-state micro-computed-tomography experiments for water-wet and mixed-wet Bentheimer sandstone. As a result of the optimization, the pore-by-pore error of fluid distribution between the model and experiment is decreased to less than that observed between repeat experiments on the same rock sample. After calibration and matching, the model predictions for upscaled parameters of capillary pressure and relative permeability are in good agreement with the experiments. The proposed algorithm leads to a distribution of contact angles around the thermodynamic contact angle. We show that the contact angle is spatially correlated over around 4 pore lengths, while larger pores tend to be more oil-wet. Using randomly assigned distributions of optimized contact angles in the model results in poor predictions of relative permeability and capillary pressure, particularly for the mixed-wet case. Also, analyzing the spatial correlation show a stronger for mixed-wet Bentheimer sandstone.

Time Block Preference

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

References

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