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A Novel Mehtod to Correct Steady-State Relative Permeability for Capillary End-Effects Based on Simulation Approach

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In laboratory steady-state measurements of relative permeability, capillary discontinuities at sample ends give rise to capillary end-effects (CEE) and keep a higher water saturation toward the core end. The water saturation measured is higher than ideal saturation without CEE and result of erroneous relative permeability curves[1] finally. Especially in tight sand cores, high capillary force and low flow rates can cause end-effects to become more important in the interpretation of the steady-state experiment tests.
On the basis of capillary force measurement data， a novel method was initiated to make correction to relative permeability data combined experiment data and numerical simulation[2] for tight sand cores. First, one dimensional numerical simulator was created for oil and water two phase flow considering the mechanism of CEE. Water saturation distribution and CEE region could be clarified corresponding to the relative permeability curve input. And then correct relative permeability input constantly until the average water saturation simulated consistent with the saturation measured by experiment. The new method could make correction to relative permeability based on the traditional experiment data of multiple fractional flow and same total flow rate, which is more practical than "intercept method"[3]. The impact of end-effects and practical means of reducing the end effects for tight sand cores are also discussed in this paper.

References

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