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Using Lattice Boltzmann Method to Study Polymer Viscoelasticity Effect for Polymer Flooding

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Polymer flooding is one of the most commonly applied enhanced oil recovery technique. The main mechanism of polymer flooding is the increased sweep efficiency by increase injected water viscosity, which would reduce fingering, improve water injection profile and reduce the relative permeability of water flow. Meanwhile, viscoelasticity of polymer is suggested that it can improve displacement efficiency. However, the results were not consistent regarding whether viscoelasticity of polymer can lower residual oil saturation over water during flooding process by different researchers.
The numerical simulation of viscoelasticity of polymer and how does it affect residual oil saturation is of important value in engineering application. Although researchers have made a lot effort, there still exist various problems in this aspect. Lattice Boltzmann methods (LBM) is a relatively new simulation technique for complex fluid systems and has attracted interest from researchers in computational physics. In this paper, the LBM model for two phases non-Newtonian fluid is proposed based on the constitution equation. Depended on digital core data from micro-CT and the lattice Boltzmann color model, the viscosity of polymer, relaxation process, and other parameters are studied whether viscoelasticity of polymer can lower residual oil saturation. The paper also analyzed how pore size and inject rate affect polymer flooding in pore scale model.

References

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