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# Lattice Boltzmann Simulations of the Capillary Pressure Bump Phenomenon in Heterogeneous Porous Media

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## ABSTRACT

In this work, the Lattice Boltzmann method (LBM) is used to simulate the fluid displacement processes of primary drainage and imbibition in a randomly generated heterogeneous porous medium. The present procedure is based on the single-relaxation-time Bhatnagar–Gross–Krook (BGK) approximation and the original Shan-Chen multi-component multiphase (MCMP) model. The developed model is validated against classical single and multiphase flow problems, which include the single-phase Poiseuille flow and lid driven cavity flow, and the multiphase miscibility test, bubble test, and contact angle test. Simulation results show that the Lattice Boltzmann method successfully captures the capillary pressure bump phenomenon, which is a frequently encountered phenomenon in petroleum reservoirs. The bump in capillary pressure is shown to correspond to the instant when the fluid invades the narrow pore throats, which require a higher capillary pressure threshold.

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