LATTICE-BOLTZMANN MODELING OF IMMISCIBLE DISPLACEMENT EXPERIMENTS IN A HOMOGENEOUS MICROMODEL

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Immiscible fluid displacement in porous media is important in several engineering applications, including geological carbon sequestration operations, enhanced oil and gas recovery, non-aqueous phase liquid (NAPL) remediation in the subsurface, vadose zone processes, and packed bed reactors. In recent years, engineered micromodel porous media have been used to investigate pore-scale physics and interfacial phenomena (e.g.,specic fluid-fluid interfacial length) in order to improve upon empirical re lationships required for macroscale models used at the field scale. In this work, we model immiscible displacement micromodel experiments using Taxila LBM, a Los Alamos National Laboratory (open source) lattice-Boltzmann simulator for single- and multi-phase flows through porous media. We estimate the accuracy of the LB method via resolution tests for flow through simple porous media. We also investigate possible sources of error due to inaccuracies in the representation of the porous media geometry, which arise in the segmentation process. Finally, we validate the LB simulation predictions by comparing the specific interfacial length and the amount of capillary trapped fluid to that measured in the experiments.