Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Dynamic pore-level modeling of multi-phase displacement processes in noncircular capillary tubes using a particle-based method SAEED OVAYSI, MOHAMMAD PIRI, University of Wyoming — We present a fully dynamic particle-based model of incompressible two-phase flow in capillary tubes with angular cross section. Two-phase drainage and imbibition processes are simulated and the effects of wettability are also studied. The model takes into account viscous pressure drop in both invading and defending phases in addition to the capillary and gravity forces. It uses novel methods to handle particle inconsistencies and wetting strength of fluids. A fully parallel version of the model is used to simulate unsteady-state two-phase (oil and water) processes. The results for the capillary dominated limit are then compared against the values predicted using the MS-P theory. Hydraulic conductivity of fully saturated tubes are computed and compared against the available data in the literature. Dynamic effects are also discussed and it is shown that results for the dynamic system deviate from the MS-P limit. The success of this method in simulating multi-phase displacement processes in noncircular capillary elements provides the platform upon which multi-phase flow problems in highly irregular porous systems (encountered, for instance, in underground oil reservoirs) can be simulated.

Saeed Ovaysi
University of Wyoming

Date submitted: 24 Aug 2007 Electronic form version 1.4