Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Flow and Sedimentation of particulate suspensions in Fractures[1]

TAK SHING LO, JOEL KOPLIK, Levich Institute and Department of Physics, City College of CUNY — Suspended particles are commonly found in reservoir fluids. They alter the rheology of the flowing liquids and may obstruct transport by narrowing flow channels due to gravitational sedimentation. An understanding of the dynamics of particle transport and deposition is, therefore, important to many geological, enviromental and industrial processes. Realistic geological fractures usually have irregular surfaces with self-affine structures, and the surface roughness plays a crucial role in the flow and sedimentation processes. Recently, we have used the lattice Boltzmann method to study the combined effects of sedimentation and transport of particles suspended in a Newtonian fluid in a pressure-driven flow in self-affine channels, which is especially relevant to clogging phenomena where sediments may block fluid flows in narrow constrictions of the channels. The lattice Boltzmann method is flexible and particularly suitable for handling irregular geometry. Our work covers a broad range in Reynolds and buoyancy numbers, and in particle concentrations. In this talk, we focus on the transitions between the "jammed" and the "flow" states in fractures, and on the effects of nonuniform particle size distributions.

[1]Work supported by DOE and NERSC.

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Date submitted: 07 Dec 2010 Electronic form version 1.4