Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Pulsed-pressure driven displacement of a non-Newtonian fluid in a radial Hele-Shaw cell CAROLINE PEREIRA, ANDREW WHITE, THOMAS WARD, Iowa State University — Displacing non-Newtonian fluids in porous media is an extremely challenging problem. While Newtonian fluids typically experience fingering instabilities, non-Newtonian fluids yield dendritic type fingering patterns. In this talk we present experimental data for the displacement of a finite volume of viscoelastic liquid by using pulsed-pressure driven gas flow. Experiments are performed using a radial Hele-Shaw cell at gap spacings ranging from 50-200 microns. The viscoelastic liquids are a mineral oil mixed with high molecular weight poly-isobutylene (M.W. 4.7 million) at concentrations 100-1000 ppm. Air injection pressures range from 0.1-0.5 psi and pulse frequencies range from 0.1-10 Hz. Analysis of the finite liquid volume allows for measurement of the residual film thickness. Also, the gas expansion rate as a function of the pulse frequencies will be presented. The experiments reveal a clear correlation between the pulse frequency, film formation and stability (as measured by the finger formation rate) for a wide range of experimental parameters.

Thomas Ward
Iowa State University

Date submitted: 02 Aug 2013 Electronic form version 1.4