Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Drainage in Two-dimensional Porous Media: From Capillary Fingering to Viscous flow HUGUE BODIGUEL, CHRISTOPHE COTTIN, ANNIE COLIN, LOF, CNRS UMR 5258, univ. Bordeaux 1, Rhodia — We report some experimental results on two-phase flows in model 2D porous media. Standard microfluidic techniques are used to fabricate networks of straight microchannels having a controlled throat size distribution. We focus on the drainage of a wetting fluid by a non-wetting one of various viscosities and take advantage of image analysis to characterize the velocities of the menisci that are simultaneously moving. In the range of applied capillary numbers (Ca) from 10^7 to 10^2, the system exhibit a clear transition from a fractal fingering to a stable front, which depends mainly on the size heterogeneity of the medium. The experimental results are accounted by a simple model that accounts for the scaling behaviour of the local velocities as a function of Ca. We also obtain a very good quantitative agreement when comparing the experimental results to numerical simulations based on a pore network model. This allows us to propose a general prediction of the capillary fingering extent as a function of the capillary number, the channel geometries and the pore size heterogeneity.

Hugues Bodiguel
LOF, CNRS UMR 5258, univ. Bordeaux 1, Rhodia

Date submitted: 07 Aug 2010 Electronic form version 1.4