



Gas penetration into a deformable porous medium

B. Sandnes (1), K.J. Måløy (2), and E.G. Flekkøy (2)

(1) Dep. of Physics, NTNU, Norway (bjornar.sandnes@ntnu.no), (2) Dep. of Physics, University of Oslo, Norway

Here we shall investigate the displacement of wet granular mixtures and deformable porous media by an invading gas. The experiment is straight forward: a mixture of grains and fluid is loaded into the gap between two glass plates, followed by injection of gas at constant rate.

As it turns out, the resulting dynamics is far from simple. Several forces are at play including pressure, viscous, capillary and frictional forces. It is the interplay between these that determine the flow and displacement patterns. We vary three parameters in the experiment: the filling fraction of granular material, the rate of injection, and the elasticity of the system as a whole. The experiments display a surprising diversity in the displacement dynamics that results, producing striking morphologies including frictional fingers, stick slip bubbles, viscous fingers and fractures.

We present experimental results, images and movies of the various dynamic modes that the system displays, and discuss the physical mechanisms that govern the different pattern formation processes. The results are summarized in phase diagrams displaying the various dynamic modes and the transitions between them.