Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Viscous fingering in an elastic channel[1] ANDREW L. HAZEL, LUCIE DUCLOUÉ, ANNE JUEL, University of Manchester, UK — We investigate experimentally the fingering instability of a flat, steadily propagating interface in a Hele-Shaw channel, where the top boundary has been replaced by an elastic membrane. In order to create a steadily propagating flat front, we exploit the reopening modes of fluid-filled elasto-rigid channels. The collapsed upper boundary reopens through the steady propagation of a wide finger, when air is injected from one end at a constant flow rate. For high levels of collapse and high finger speed, the tip of the finger becomes flat, creating a leading edge normal to the direction of propagation, which in turn is subject to a smaller scale viscous fingering instability. By modifying the cross-sectional geometry of the channel, we can actuate the finger shape to observe a variety of small-scale fingering phenomena including growth in a direction normal to the propagation and dendrite formation. The instability of the flat front exhibits constant-length fingers, very similar to the stubby fingers observed in radial compliant Hele-Shaw cells, and reminiscent of the printers instability travel with the front. We investigate the geometry of those fingers in terms of the speed of the front, and the geometry of the reopening region.

[1]The financial support of the Leverhulme Trust is gratefully acknowledged.

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Date submitted: 27 Sep 2016 Electronic form version 1.4