Viscous Fingering in Deformable Systems[1] JIAN HUI GUAN,
CHRIS MACMINN, University of Oxford — Viscous fingering is a classical hydrodynamic instability that occurs when an invading fluid is injected into a porous medium or a Hele-Shaw cell that contains a more viscous defending fluid. Recent work has shown that viscous fingering in a Hele-Shaw cell is supressed when the flow cell is deformable. However, the mechanism of suppression relies on a net volumetric expansion of the flow area. Here, we study flow in a novel Hele-Shaw cell consisting of a rigid bottom plate and a flexible top plate that deforms in a way that is volume-conserving. In other words, fluid injection into the flow cell leads to a local expansion of the flow area (outward displacement of the flexible surface) that must be coupled to non-local contraction (inward displacement of the flexible surface). We explore the impact of this volumetric confinement on steady viscous flow and on viscous fingering.

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