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Suppression of viscous fingering by elastic membranes DRAGA PIHLER-PUZOVIC, University of Manchester, PIERRE ILLIEN, University of Manchester, ENS Paris, MATTHIAS HEIL, ANNE JUEL, University of Manchester — We report the suppression of interfacial fingering instabilities resulting from the injection of air into the narrow, fluid-filled gap between two parallel plates (a Hele- Shaw cell), when one of the boundaries is replaced by an elastic membrane. In a rigid cell, if the air is injected at a sufficiently fast flow rate, the interface is unstable, ultimately resulting in the development of a complex dendritic fingers. In the elastic- walled cell, interfacial instabilities develop at much larger air-injection rates because membrane deformations reduce destabilising pressure perturbations ahead of the propagating interface, and fundamentally alter the interfacial pattern that develops. We characterise the dependence of the instability on the parameters of the system, and present simple scaling arguments to explain the experimentally observed behaviour.

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