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Experimental viscous fingering in a tapered radial Hele-Shaw cell¹ GREGOIRE BONGRAND, PEICHUN AMY TSAI, University of Alberta, COM-PLEX FLUDIS GROUP TEAM — The fluid-fluid displacement in porous media is a common process that finds direct applications in various fields, such as enhanced oil recovery and geological CO2 sequestration. In this work, we experimentally investigate the influence of converging cells on viscous fingering instabilities using a radially-tapered cell. For air displacing oil, in contrast to the classical Saffman-Taylor fingering, our results show that a converging gradient in a radial propagation can provide a stabilizing effect and hinder fingering. For a fixed gap gradient and thickness, with increasing injection rates we find a stable displacement under small flow rates, whereas unstable fingering occurs above a certain threshold. We further investigate this critical flow rate delineating the stable and unstable regimes for different gap gradients. These results reveal that the displacement efficiency not only depends on the fluid properties but also on the interfacial velocity and channel structure. The latter factors provide a useful and convenient control to either trigger or inhibit fingering instability.

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