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The Impact of Miscible Viscous Fingering on Mixing JANE CHUI, PIETRO DE ANNA, RUBEN JUANES, MIT — Viscous fingering is a hydrodynamic instability that occurs when a less viscous fluid displaces a more viscous one. Instead of progressing as a uniform front, the less viscous fluid forms fingers that vary in size and shape to create complex patterns. The interface created from these patterns affects mixing between the two fluids, and therefore understanding how these patterns evolve in time is of critical importance in applications such as enhanced oil recovery and microfluidics. In this work, we focus on experimentally quantifying the impact of miscible viscous fingering on mixing. We use a radial Hele-Shaw cell as an analog of radial flows in porous media, and the local concentration field is measured temporally and spatially with the use of a fluorescein tracer. We first observe two distinct growth regimes in the evolution of the diffuse invading front: an initial regime of rapid growth due to the viscous fingering instability, and a latter regime of growth equivalent to a stable uniform displacement. We propose a scaling framework that predicts the time of transition between these two regimes, and subsequently the total length of the invading front. This framework will help to accurately determine the interface available for mixing when viscous fingering is observed.

Jane Chui
MIT

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