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The Impact of Miscible Viscous Fingering on Mixing JANE CHUI, PIETRO DE ANNA, RUBEN JUANES, Massachusetts Institute of Technology — 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 is of critical importance in applications such as enhanced oil recovery and microfluidics. This work focuses on how the evolution of the fingering interface affects mixing between two miscible fluids, specifically in a radial configuration. We measure the local concentration field temporally and spatially with the use of a fluorescent tracer in the injected fluid, and with this high resolution information are able to calculate various measures of mixing, such as mixing efficiency, scalar dissipation rate, and the areal mixing zone for different fluid injection rates and various viscosity ratios. We propose a scaling theory based on experimental observations for the growth of the mixing zone and the overall rate of mixing.

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