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Fingers and Toes in Miscible Viscous Flows RADHA RAMACHANDRAN, IRMGARD BISCHOFBERGER, SIDNEY NAGEL, University of Chicago — The displacement of a more viscous fluid by a less viscous one in a porous medium produces complex fingering patterns. To study this phenomenon a Hele-Shaw geometry is used in which the gap-averaged equations for flow between two parallel plates has the same form as Darcy's law for flow in porous media. Our experiments use a radial Hele-Shaw cell as well as a two dimensional porous medium of densely packed granular beads between two circular glass plates, to study viscous fingering in miscible fluids. For immiscible fluids it is known that the most-unstable wavelength for interface growth depends on surface tension, viscosity difference, velocity and plate spacing. In contrast, we find that for *miscible fluids* the large-scale structure (i.e., the ratio of finger length to overall size of the pattern) is set entirely by the viscosity ratio rather than the viscosity difference of the two fluids. We further investigate the role played by other dimensionless parameters in determining the fine structure and evolution of these fingering patterns in the two geometries.

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