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Schlieren Imaging of Gravitational Instabilities during Miscible Viscous Fingering of Glycerol-Water Systems[1] DANIELA MARIN, SIMONE STEWART, PATRICK BUNTON, Department of Physics, William Jewell College, Liberty MO U.S.A., ECKART MEIBURG, Department of Mechanical Engineering, Center for Interdisciplinary Research in Fluids University of California at Santa Barbara Santa Barbara, U.S.A., ANNE DE WIT, Nonlinear Physical Chemistry Unit, Service de Chimie Physique et Biologie Thorique, Universit Libre de Bruxelles, Brussels, Belgium — Viscous fingering occurs when a lower viscosity fluid displaces a higher viscosity fluid causing interfacial instabilities creating finger-like patterns. In a typical flow, the less viscous fluid is injected into the higher viscous fluid that is between the plates of a Hele-Shaw cell. In most cases for transparent flows, dye is dissolved into the displacing fluid in order to observe it. This work uses Schlieren imaging of miscible fluid displacements in a horizontal Hele-Shaw Cell, which reveals new information about the three-dimensional nature of VF. A Schlieren system is composed of a parallel light beam, a lens that brings the light to a focus, a cutoff of some type, and a camera. Schlieren does not require dye, ensuring the natural flow of the fluids is undisturbed. Here the imaging system is described followed by results of miscible flows of water in to aqueous glycerol solutions. Structures attributable to three-dimensional buoyancy-driven flows are readily observed. These results are interpreted in light of recent three-dimensional calculations.

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