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Immiscible Fingering Instability via Alternating Injection: Experiments and Simulations[1] CHI-CHIAN CHOU, WEI-CHENG HUANG, CHING-YAO CHEN, Department of Mechanical Engineering, National Chiao Tung University, Taiwan, R.O.C. — Viscous fingering instability on an immiscible interface via alternating injection is investigated by both experiments and numerical simulations. Multiple fluid annuluses associated with unstable and stable interfaces are resulted by injecting the less and more viscous fluid alternatively. We focus on the influences of two control parameters, e.g., the alternating injection interval and viscosity contrast, to the development of fingering instability. It is interesting to observe less prominent instability, determined by the shorter interfacial length, in the case with higher viscosity ratio by the alternating injection, which is contradictory with the conventional continuous injection. This inconsistent behavior is mainly due to rupture of the fluid annuluses of the less viscous fluid. Because of surface tension, the ruptured less viscous fluids tend to form separated drops, so that the total interfacial length decreases. On the other hand, the fluid annuluses appear more stable in the cases of lower viscosity contrast, so that the annuluses are stretched to prolong the overall interfacial length.

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