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Viscous Fingering on an Immiscible Reactive Interface with Variation of Interfacial Tension REIKO TSUZUKI, YUICHIRO NAGATSU, Tokyo University of Agriculture and Technology, QIAN LI, Harbin Institute of Technology, CHING-YAO CHEN, National Chiao Tung University — The effects of chemical reaction, in which surfactants are produced on the interface of two immiscible fluids, on viscous fingering in a radial Hele-Shaw flow are numerically investigated. The presence of surfactants reduces interfacial tension, which is an important factor to the fingering pattern formation. In the present study, influences of reaction rate and dispersion of produced surfactants, represented respectively by dimensionless parameters of Damkohler number and Peclet number, are evaluated systematically. Secondary fingering instability, e.g., tip-splitting and side-branching, is triggered by chemical reactions. Weaker surface tension generally induces tip-splitting. For the case of high Damkohler number, because of the vortex pairs generated within each finger, surfactant tends to accumulate significantly on the side of finger, so that side-branching is preferred. Nevertheless, side-branching is suppressed in the cases associated with low Peclet number, in which strong dispersion reduces the local variation of surfactant concentration. Considering the coupled effects by Damkohler number and Peclet number, the patterns obtained by the simulations qualitatively agree with the observations in the experiments.

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