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Stabilization of miscible viscous fingering by chemical reaction decreasing viscosity SHUNTARO ARAI, YUICHIRO NAGATSU, Department of Chemical Engineering,Tokyo University of Agriculture and Technology, PRIYANKA SHUKLA, Department of Mathematics, Indian Institute of Technology Madras, ANNE DE WIT, Université libre de Bruxelles (ULB), Nonlinear Physical Chemistry Unit, 1050 Brussels, Belgium — Viscous fingering (VF) occurs when a more viscous fluid is displaced by a less viscous one in porous media or Hele-Shaw cells. In this study, experiment on miscible VF with chemical reaction is conducted by using a Hele-Shaw cell. Here, the chemical reaction takes place between a polymer dissolved in the more viscous solution and hydrochloric acid (HCl) dissolved in the less viscous one in the miscible interface region. The reaction decreases the viscosity of the polymer solution. The experiment shows that the reaction stabilizes VF when the flow rate is small. In the present study, the corresponding numerical simulation is also conducted. The simulation is able to reproduce the experimental results mentioned above when different diffusion coefficients are considered meaning that HCl diffuses faster than the polymer. However, the stabilization cannot be found under conditions of the same diffusivity of the reactants. These numerical results show that the different diffusivity is responsible for the stabilization of miscible VF by the chemical reaction decreasing viscosity.

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