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Reaction-driven viscous fingering A. DE WIT, Nonlinear Physical Chemistry Unit, Universite Libre de Bruxelles, Brussels, Belgium (ULB), L.A. RIOLFO, ULB, S. IWATA, Nagoya Institute of Technology, 466-8555, Japan (NIT), R. MAES, P.M.J. TREVELYAN, ULB, Y. NAGATSU, NIT, ULB TEAM, NIT TEAM
— An experimental demonstration of reaction-driven viscous fingering developing when a more viscous solution of a reactant A displaces a less viscous miscible solution of another reactant B is presented. In the absence of reaction, such a displacement of one fluid by another more mobile one is classically stable. However, a simple $A + B \rightarrow C$ reaction can destabilize this interface if the product C is either more or less viscous than both reactant solutions. Using the pH dependence of the viscosity of some polymer solutions, we provide experimental evidence of both scenarios. We demonstrate quantitatively that reactive viscous fingering results from the build-up in time of non-monotonic viscosity profiles with patterns behind or ahead of the reaction zone respectively depending on whether the product is more or less viscous than the reactants. The experimental findings are backed up by numerical simulations.

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