Abstract Submitted for the DFD09 Meeting of The American Physical Society

Viscous Fingering of Reactive Finite Slices in a Hele-Shaw Cell¹ S. HOSSEIN HEJAZI, JALEL AZAIEZ, University of Calgary — Coupling of hydrodynamics and chemical reactions have been studied for a miscible reactive slice of fluid displaced by another fluid in a rectilinear Hele-Shaw cell. Under this configuration, one of the two reactants is sandwiched between two layers of the other one. Assuming an exponential dependency of viscosity on the solution concentrations, the fluid fronts at both ends of the finite slice may become unstable. Full nonlinear simulations are conducted to solve the continuity equation, the momentum balance equation in the form of Darcy's law, and a volume-averaged mass balance equation in the form of convection-diffusion-reaction equations for the transport of solute and solutions. Simulation results indicate the importance of the frontal instabilities on the disappearing rate of the reactant fluid in the slice. The effects of the viscosity ratios between the two reactants and chemical product on the finger structures, the slice distortion and chemical reaction progress are examined both qualitatively and quantitatively.

¹The authors acknowledge the financial support by Alberta Ingenuity Fund (AIF), the Alberta Ingenuity Centre for In-Situ Energy (AICISE) and also the use of the computing resources of the West-Grid cluster.

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Date submitted: 07 Aug 2009

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