Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Suppression of viscous fingering instability by a chemical reaction producing gel YUICHIRO NAGATSU, TOSHIZO KANBARA, MASAFUMI TANIGUCHI, Department of Chemical Engineering, Tokyo University of Agriculture and Technology — Viscous fingering (VF) is a well-known hydrodynamic instability which is observed when a more viscous fluid is displaced by another less viscous one in porous media or Hele-Shaw cell. In such a situation, the interface between two fluids formed finger-like patterns. Recently, several techniques for suppress VF instability has been developed, which include time-dependent injection (Dias et al. PRL 2012), addition of permeability gradient (Al-Housseiny Nat. Phys. 2012), and use of viscoelastic plates of Hele-Shaw cell (Pihler-Puzović PRL 2012). Here, we demonstrate our trial to suppress VF by chemical reaction producing gel. We have succeeded to find a system of solutions and reaction in which the reaction producing a gel is able to completely suppress VF. In addition, we have performed rheological measurement of the gel produced at the reactive interface. The VF experiment and the rheological measurement have been performed by varying concentrations of the reactants. We show the storage modulus (G') of the gel, which corresponds to elastic response to small amplitude oscillatory shear, is responsible for the ability of suppression of VF in the present reactive system.

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Date submitted: 01 Aug 2016 Electronic form version 1.4