Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Dissolution-driven convection of partially miscible fluids in porous media[1] CHING-YAO CHEN, National Chiao Tung University, QIAN LI, WEI HUA CAI, Harbin Institute of Technology, ECKART MEIBURG, UC Santa Barbara — Dissolution-driven convection produced at a free interface between CO2 and brine in porous media is numerically studied to mimic the complex diffusion and flow process in the geological sequestration of CO2. A Darcy-Cahn-Hilliard model with a particular free energy distribution is employed to simulate the partially miscible feature between the CO2 and the brine. Simulations reveal that the evolution of the CO2 plume exhibitsseveral distinct stages, such as triggering, growing, merging and damping. Consequently, for the temporal development of the solute flux we can distinguish three major time periods, such as free convection, constrained convection and shutdown. In the free convection period, the time-averaged solute flux decreases with Rayleigh number. On the other hand, the solute flux is independent of the Rayleigh number in the periods of constrained convection and shutdown. Correlations of the solute flux and the Rayleigh number are proposed based on the simulations, which are able to predict the solute flux and the dissolved quantity of CO2 into brine.

[1]Ministry of Science and Technology of Taiwan (MOST 105-2221-E-009-074-MY3) , National Natural Science Foundation of China (Grant Nos. 51576051 and 51421063)

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Date submitted: 28 Jul 2019 Electronic form version 1.4