

Abstract Submitted
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Unstable Diffusion Layers: Laboratory Experiments on Carbon Sequestration Phenomena ROBERT ECKE, SCOTT BACKHAUS, KONSTANTIN TURITSYN, Los Alamos National Laboratory — The sequestration of carbon dioxide in aqueous porous media involves a process where the initial formation of diffusion layers subsequently becomes unstable with respect to fingering. We will present experimental examples of this transient growth process from mass diffusion to fingering instability using a pair of fluids that mimic the behavior of carbon dioxide and salt water (brine), namely water and propylene glycol. In this experiment, performed in a Hele-Shaw cell, the permeability is adjusted by the plate thickness, the porosity is unity, and the Rayleigh number depends on the cell height. The diffusion layer and the fingers are visualized using optical shadowgraph techniques. We obtain the time evolution of the selected pattern wavelength, the distribution and scaling of the plume velocities, and the mass transfer rates for Ra in the range 5000 to 90,000 and for permeabilities in the range $5 - 20 \times 10^{-5} \text{cm}^2$. Comparisons with linear stability calculations and implications for carbon sequestration are discussed.

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