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Coarsening dynamics of 3D convective dissolution in porous media XIAOJING FU, LUIS CUETO-FELGUEROSO, RUBEN JUANES, Massachusetts Institute of Technology — Dissolution by convective mixing is an essential trapping mechanism during CO₂ sequestration in deep saline aquifers. Dissolution of the buoyant supercritical CO₂ into the underlying brine leads to a local density increase initially. The resulting CO₂-brine mixture is denser than the two initial fluids, leading to a Rayleigh-Bénard type instability, which greatly accelerates the dissolution process. Both bench-scale experiments and high-resolution computer simulations have shown the initiation and nonlinear interaction of gravity fingers during this density-driven convection process. While 2D analyses of this phenomenon have elucidated important aspects of the dominant flow mechanisms, fundamental issues regarding the coarsening of gravity fingers remain unclear from these studies. In this work, we present high-resolution, 3D simulations of convective dissolution. We observe a previously unreported phenomenon of self-organization of fingers that form coherent network structures in the top boundary layer. Based on this network pattern, we study the coarsening dynamics of convective dissolution in 3D.

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