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Thermodynamically Consistent Fluid Mixing in Porous Media Induced by Viscous Fingering and Channeling of Multiphase Flow MOHAMMAD AMIN AMOOIE, MOHAMMAD REZA SOLTANIAN , JOACHIM MOORTGAT, The Ohio State University — Fluid mixing and its interplay with viscous fingering as well as flow channeling through heterogeneous media have been traditionally studied for fully (im)miscible conditions in which a (two-) single-phase system is represented by two components, e.g. a solvent and a solute, with (zero) infinite mutual solubility. However, many subsurface problems, e.g. gas injection/migration in hydrocarbon reservoirs, involve multiple species transfer. Multicomponent fluid properties behave non-linearly, through an equation of state, as a function of temperature, pressure, and compositions. Depending on the minimum miscibility pressure, a two-phase region with finite, non-zero mutual solubility may develop, e.g. in a partially-miscible system. Here we study mixing of fluids with partial mutual solubility, induced by viscous flow fingering, channeling, and species transport within and between phases. We uncover non-linear mixing dynamics of a finite-size slug of a less viscous fluid attenuated by a carrier fluid during rectilinear displacement. We perform accurate numerical simulations that are thermodynamically-consistent to capture fingering patterns and complex phase behavior of mixtures. The results provide a broad perspective into how multiphase flow can alter fluid mixing in porous media.

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