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Convective dissolution in partially miscible systems: classification of the effect of reactions V. LOODTS, C. THOMAS, L. RONGY, A. DE WIT, Université libre de Bruxelles (ULB), Nonlinear Physical Chemistry Unit, 1050 Brussels, Belgium — Dissolution-driven convection in partially miscible systems has regained much interest in the context of CO_2 sequestration. A buoyantly unstable density stratification can build up upon dissolution of a species into the host fluid phase, thereby developing convection. Chemical reactions can impact such convection as they affect concentrations and thus the density of the host phase. We theoretically classify the effects of reactions on the convective instability as a function of the contributions to density and diffusion coefficients of the chemical species involved. To do so, we compute the reaction-diffusion density profiles in the host phase and assess their stability with regard to buoyancy-driven convection by a linear stability analysis. The buoyancy-driven instability grows faster when the product of the reaction contributes sufficiently more to density than the initially dissolved reactant. We illustrate this by experimental results showing that reactions accelerate the development of buoyancy-driven fingering during the convective dissolution of CO_2 into aqueous solutions of alkali hydroxides.

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