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Buoyancy-driven instabilities of acid-base fronts CHRISTOPHE ALMARCHA, IRPHE - UMR 6594 - CNRS - Université de Provence - Aix-Marseille Université, France, YASMINA R'HONI, PHILIP M.J. TREVELYAN, ANNE DE WIT, NLPC, Université Libre de Bruxelles, Belgique — Chemical reactions can produce buoyancy-driven motions in solutions by changing the local density in the gravity field. Starting from a stratification of one given miscible reactant solution on top of another miscible one, convective destabilization influenced by the reaction can emerge as a combination of several non-reactive hydrodynamic instabilities, including Rayleigh-Taylor and double diffusive instabilities. In the specific case of reactions between a strong acid and a strong base, we show that all the possible scenarios reduce to the composition of only two asymptotic situations because products generated at the reactive zone are always less dense and slower diffusing than the reactants. Experiments in a vertically orientated Hele-Shaw cell confirm the theoretical predictions and can be quantitatively compared to numerical simulations of a nonlinear reaction-diffusion-convection model.

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