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Buoyancy-driven instabilities induced by chemical reactions in vertical porous media C. ALMARCHA, P.M.J. TREVELYAN, A. DE WIT, Université Libre de Bruxelles — Classical Rayleigh-Taylor or double diffusive instabilities can be triggered by a simple A+B→C chemical reaction when two miscible solutions each containing one reactant are put in contact in the gravity field. A linear stability analysis of the evolving base state profiles is performed using a quasi-steady state approximation. This allows one to classify the various sources of instabilities as a function of the parameters which are the Rayleigh numbers and the ratio of diffusion coefficients of the chemical species. The resulting nonlinear dynamics due to this chemo-hydrodynamic feedback are then systematically analyzed to highlight how the chemical reaction can trigger or modify the hydrodynamical instabilities. It is also shown to what extent the resulting buoyancy-driven instabilities enhance the total reaction rate. Finally, related experiments are also performed in a vertical Hele-Shaw cell with an acid-base reaction.

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