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Asymmetric character of Rayleigh-Taylor and double-diffusive fingers in reactive systems L. LEMAIGRE, M.A. BUDRONI, L.A. RIOLFO, Nonlinear Physical Chemistry Unit, Universite Libre de Bruxelles (ULB), Brussels, Belgium, P. GROSFILS, Center for Nonlinear Phenomena and Complex Systems, Universite Libre de Bruxelles (ULB), Brussels, Belgium, A. DE WIT, Nonlinear Physical Chemistry Unit, Universite Libre de Bruxelles (ULB), Brussels, Belgium

— Buoyancy-driven flows induced by the hydrodynamic Rayleigh-Taylor or double diffusive instabilities develop symmetrically around the initial contact line when two solutions of given solutes with different density are put in contact in the gravity field. If the solutes affecting the density of these solutions are involved in chemical reactions, changes in composition due to the underlying reaction-diffusion processes can modify the density profile in space and time and affect the hydrodynamic patterns. We show both experimentally and numerically that the resulting chemo-hydrodynamic patterns are asymmetric with regard to the initial contact line as fingers develop here upwards and not both up and downwards as in the non reactive situation. In some cases, the dynamical in-situ generation of the product of the reaction can even lead to the co-existence of different convective modes. The experiments are performed using an aqueous solution of an acid put in contact in a Hele-Shaw cell with a miscible aqueous solution of a base. The numerical simulations are made on the basis of a reaction-diffusion-convection model coupling Darcy's law to the evolution equations of the concentrations of the various chemicals involved. Good agreement between experimental results and theory is obtained.

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