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Marangoni flows induced by A + B C reaction fronts with arbitrary diffusion coefficients[1] REDA TIANI, LAURENCE RONGY, Universit libre de Bruxelles — We consider horizontal aqueous solutions in contact with air where three reacting species A, B, and C can affect the surface tension of the solution, thereby driving Marangoni flows. When the two reactants A and B, that are initially separated, are brought into contact, a reaction front producing species C is formed and evolves in time due to diffusion, convection and reaction processes. The resulting dynamics is studied by numerically integrating the incompressible Navier-Stokes equations coupled to reaction-diffusion-convection equations for the three chemical species. For equal initial concentrations of reactants and equal diffusion coefficients, we have explained how chemically-driven Marangoni flows can lead to complex dynamics of the front propagation. Here we extend such results for arbitrary values of the diffusion coefficients and initial concentrations of reactants. We give the general classification of the surface tension profiles as a function of the Marangoni numbers quantifying the effect of each species on the surface tension, the ratio of initial concentrations of reactants and the ratios of diffusion coefficients. Such a classification allows us then to study the resulting structure of the convective rolls as well as the nonlinear dynamics of the reaction front.

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