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Double-diffusive Marangoni convection around exothermic chemical fronts L. RONGY, P. ASSEMAT, A. DE WIT, Nonlinear Physical Chemistry Unit, Universite Libre de Bruxelles (ULB), Brussels, Belgium — We study double diffusive Marangoni flows triggered by concentration and temperature gradients across an exothermic chemical front propagating in horizontal uncovered solution layers. We numerically integrate the incompressible Navier-Stokes equations coupled through the tangential stress balance to evolution equations for the concentration of the autocatalytic product and the temperature. Solutal and thermal Marangoni numbers quantify the effect of the concentration and temperature gradients on the surface tension respectively, while the Lewis number measures the ratio of thermal diffusivity over molecular diffusivity. The asymptotic isothermal dynamics is characterized by a steady fluid vortex traveling at a constant speed with the reactive front, deforming and accelerating it. We analyze here the influence of thermal effects on the dynamics of the system in both cases of cooperative and competitive solutal and thermal effects. In particular, because heat and mass diffuse at different rates, new unsteady double-diffusive dynamics such as oscillations of the concentration field can be observed when the solutal and thermal effects act antagonistically on the surface tension. The influence of the various parameters on the flow field is investigated.

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