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Buoyancy-driven convection around exothermic autocatalytic chemical fronts LAURENCE RONGY, ANNE DE WIT, Universite Libre de Bruxelles, Nonlinear Physical Chemistry Unit, CP231, 1050 Brussels, Belgium — Spatiotemporal distributions of heat and mass across chemical fronts propagating in horizontal solutions can initiate buoyancy-driven convection. The goal of our work is to theoretically investigate the dynamics due to the coupling between exothermic autocatalytic reactions, diffusion, and buoyancy-driven flows. To do so, we numerically integrate the incompressible Stokes equations coupled through buoyancy terms to conservation equations for the concentration of the reaction product and for the temperature. A solutal and a thermal Rayleigh number measure the coupling between reaction-diffusion processes and buoyancy convection. The asymptotic dynamics in the case of an isothermal front is a steady vortex surrounding, deforming, and accelerating the front (L. Rongy, N. Goyal, E. Meiburg and A. De Wit, J. Chem. Phys. 127, 114710, 2007). We address here the influence of thermal effects on the dynamics of the system. We show that exothermic fronts can exhibit new types of dynamics in the presence of convection, particularly when the solutal and thermal effects are antagonistic, leading to temporal oscillations of the concentration, temperature, and velocity fields in a reference frame moving with the front. The influence of the Lewis number measuring the ratio between thermal and molecular diffusivity is investigated.

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