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Hots spots in fingering of exothermic autocatalytic chemical fronts T. GÉRARD, P. GROSFILS, A. DE WIT, Universite Libre de Bruxelles, Belgium, T. TÓTH, D. HORVÁTH, A. TÓTH, Szeged University, Hungary — Across traveling autocatalytic fronts, density differences can result from composition and temperature changes. These density differences lead to buoyancy-driven hydrodynamic instabilities when the heavier solution overlies the lighter one. Using combined experimental and theoretical approaches, we examine the properties of the temperature field around such a buoyantly unstable exothermic autocatalytic front in presence of heat losses. Experimentally, the dynamics of the chlorite-tetrathionate reaction are studied in a Hele-Shaw cell. The concentration field is observed by a color indicator while the two-dimensional thermal field is obtained by an interferometric technique. Because of the heat losses, products are cooled down behind the reaction zone. The interferometric analysis moreover reveals the presence of hot spots, i.e. local areas where the temperature is larger than in a stable front. To understand the properties of the hot spots, we have developed a theoretical model coupling the evolution of the concentration and temperature fields to that of the velocity field. We show that hot spots exist in the presence of buoyancy-induced convection only if heat diffuses faster than mass and/or in presence of heat losses. We quantify the maximum value of temperature obtained in presence of convection as a function of the various parameters of the problem.

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