Surface tension- and buoyancy-driven flows across horizontally propagating chemical fronts

R. Tiani, A. De Wit, L. Rongy

PII: S0001-8686(17)30068-4
DOI: doi:10.1016/j.cis.2017.07.020
Reference: CIS 1805

To appear in: *Advances in Colloid and Interface Science*

Please cite this article as: Tiani R, Wit A. De, Rongy L, Surface tension- and buoyancy-driven flows across horizontally propagating chemical fronts, *Advances in Colloid and Interface Science* (2017), doi:10.1016/j.cis.2017.07.020

Surface tension- and buoyancy-driven flows across horizontally propagating chemical fronts

R. Tiani, A. De Wit and L. Rongy

Nonlinear Physical Chemistry Unit, Faculté des Sciences, Université libre de Bruxelles (ULB), CP231, 1050 Brussels, Belgium.

Abstract

Chemical reactions can interplay with hydrodynamic flows to generate various complex phenomena. Because of their relevance in many research areas, chemically-induced hydrodynamic flows have attracted increasing attention in the last decades. In this context, we propose to give a review of the past and recent theoretical and experimental works which have considered the interaction of such flows with chemical fronts, *i.e.* reactive interfaces, formed between miscible solutions. We focus in particular on the influence of surface tension- (Marangoni) and buoyancy-driven flows on the dynamics of chemical fronts propagating horizontally in the gravity field.

Keywords: Surface tension-driven flows, Marangoni convection, buoyancy-driven flows, chemical fronts, reaction-diffusion-convection systems

1. Introduction

By inducing compositional changes and possible thermal changes of the reactive medium, chemical reactions are likely to modify the physical properties of the solution (density, viscosity, surface tension) which may trigger convection. In that case, the evolution of the system is determined by the interaction between chemical and transport processes, specifically, diffusion and convective motions of the fluid. Such reaction-diffusion-convection (RDC) systems are not only relevant to engineering type processes but also to natural phenomena and environmental issues including air and water pollution, carbon sequestration and climate change. Complex spatio-temporal