Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Double diffusive instabilities of chemical fronts A. ZEBIB, Rutgers University, J. D'HERNONCOURT, A. DE WIT, Universitè Libre de Bruxelles — Gravitational Hele-Shaw fingering of an autocatalytic reaction diffusion interface is investigated theoretically. Dimensional analysis based on reaction diffusion length, time, and velocity scales reveal the dependence on the Lewis number Le, and thermal and concentration Rayleigh numbers R_T and R_c. Linear stability analysis of a planar upward propagating (against the gravitational acceleration) interface results in an eigenvalue problem for each wavenumber k which we solve using a Chebyshev pseudospectral method. A novel light over heavy instability of an endothermic reaction was found when $Le > 1$. It is shown that this instability is equivalent to that of a downward propagating exothermic wave. Nonlinear second-order Crank-Nicolson, finite volume simulations are in agreement with linear theory and also show the docile nature of the interface breakup. A displaced particle argument confirms that this unexpected instability is local, that it is subdued by a region of local stability, and elucidates its dependence on the underlying reaction diffusion mechanism.

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Date submitted: 15 Jul 2005 Electronic form version 1.4