Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Transient buoyancy driven front dynamics in near horizontal tilted tubes. T. SÉON, J. ZNAIEN, J-P. HULIN, D. SALIN, FAST Laboratory, UMR 7608, 91405 Orsay Cedex (France), B. PERRIN, LPA-ENS, UMR 8551, 75231 Paris 5 (France), E.J. HINCH, DAMTP-CMS, CB3-OWA, Cambridge (UK) — The front velocity V_f for interpenetrating light and heavy fluids in a long tube tilted at a small angle α from horizontal is studied as a function of the time t and of α for different Atwood numbers At. Above a critical angle α_c which decreases as At increases ($\alpha_c = 5^o$ for $At = 4 \times 10^{-3}$), the front velocity is always controlled by inertia and constant with time with $V_f = C(Atgd)^{0.5}$ ($C \simeq 0.7$). At lower angles ($\alpha \leq \alpha_c$), the front dynamics is initially inertial and the constant C decreases to 0.5 as $\alpha \to 0$. Then, after a distance x_c diverging to infinity as $\alpha \to \alpha_c$, the front velocity becomes controlled by viscosity and decreases with distance towards a value $V_{f\infty}$ decreasing with α. For an horizontal tube, in the viscous regime, the front velocity decreases to zero as $t^{-0.5}$ ($V_{f\infty} = 0$); the mean concentration profile $C(x,t)$ (reflecting the height of the interface) is self-similar and a function of the reduced variable $x/t^{0.5}$. The variations of V_f with time are well described by a simple equation including the height of the front as a control parameter.

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Date submitted: 31 Jul 2006 Electronic form version 1.4