Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Wavy liquid films in interaction with a strongly confined laminar gas flow: Modeling and direct numerical simulations[1] GEORG F. DIETZE, CHRISTIAN RUYER-QUIL, Laboratoire FAST, UMR 7608, Batiment 502, Campus universitaire, 91405 Orsay — Different technological settings concern the flow of a wavy liquid film in contact with a strongly confined gas flow. Micro-gaps for instance, which are employed for the cooling of electronic equipment, involve a pressure-driven evaporating liquid film flowing co-currently to its own vapor. In packed columns used for distillation, falling liquid films sheared by a counter-current gas flow occur within narrow channels. Surface waves on the liquid-gas interface of these flows play an important role as they intensify scalar transfer and may cause flooding of the channel. However, their accurate prediction by full numerical simulation is associated with a substantial computational cost. We evaluate an alternative approach based on a low-dimensional integral boundary layer formulation applied to both fluid layers. The resulting model captures the long-wave (Yih and Kapitza) instabilities of the flow accurately and allows calculations on long domains at low computational cost. These evince a number of intricate wave-induced flow structures within the film and gas as well as a possible route to the flooding of narrow channels under counter-current gas flow conditions. Comparisons with direct numerical simulations using the VOF-CSF approach as well as experiments are convincing.

[1]GFD acknowledges support from DAAD (Deutscher Akademischer Austauschdienst)

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Date submitted: 18 Jul 2013 Electronic form version 1.4