Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Hydrodynamics and heat transfer of thin films on inclined structured plates KARSTEN LOEFFLER, HONGYI YU, TATIANA GAMBARYAN-ROISMAN, PETER STEPHAN, TU Darmstadt, Chair of Technical Thermodynamics — Thin liquid films flowing down vertical and inclined plates are widely used in industrial applications, e.g. in falling film evaporators for concentrating of sugar solutions. Falling films exhibit very complex wavy patterns, which depend on various parameters. Using structured, in particular, grooved plates is a promising way to enhance the heat transfer rate in thin film evaporators. The influence of the plate topography on the wave motion is still not completely understood. In the present work the evolution of the water film thickness on smooth and structured (longitudinal and sinusoidal grooves and herringbone structures) plates has been experimentally investigated for different inclination angles, Reynolds numbers and at various distances from the inlet. A confocal chromatic sensoring technique was used to measure the film dynamics. Additionally, the temperature distribution at the heated wall has been measured with thermocouples and the liquid-gas interface has been observed with infrared thermography for different heat fluxes. The heat flux has been gradually increased until film rupture occurred. The effect of the wall topography on the film stability has been quantified. It has been found that the wall topography significantly affects the wave pattern, the heat transport and the film stability.

Karsten Loeffler
TU Darmstadt, Chair of Technical Thermodynamics

Date submitted: 30 Jul 2007 Electronic form version 1.4