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Flow and Stability of Evaporating Rivulets on Surfaces with Topography TATIANA GAMBARYAN-ROISMAN, PETER STEPHAN, Chair of Technical Thermodynamics, Darmstadt University of Technology — Surfaces with topography promote rivulet flow patterns, which are characterized by a high cumulative length of contact lines. This property is very advantageous for evaporators and cooling devices, since the local evaporation rate in the vicinity of contact lines (micro region evaporation) is extremely high. The liquid flow in rivulets is subject to different kinds of instabilities, including the kinematic instability and the capillary instability. The instabilities may lead to the development of wavy flow patterns and to film rupture. The effect of the micro region evaporation on the rivulet stability has never been investigated. We develop a model describing the hydrodynamics and heat and mass transfer in flowing rivulets on surfaces with topography under the action of gravity, surface tension, thermocapillarity and the phase change. The contact line behaviour is modelled using the disjoining potential. The perfectly wetting case is described using the usual h^{-3} potential. The partially wetting case is modelled using the integrated Lennard-Jones potential. The developed model is used for investigating the effects of the surface topography, gravity, thermocapillarity and the micro region evaporation on the rivulet stability.

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