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Evaporation near the contact lines of droplets and rivulets on topographically complex surfaces

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Wetting of morphologically complex substrates is omnipresent, since a rare surface is perfectly physically homogeneous. Surface defects, roughness, porosity and/or peculiarities of the upper-layer structure of a surface dictated by the industrial needs often result in the different wetting and evaporation dynamics, when compared to that on a smooth surface. In order to better predict and control the droplet/rivulet behavior, the understanding of physics behind it is crucial.
In the present work, we consider volatile droplets and rivulets deposited on a complex surface. We assume that the contact line is pinned to a wedge-shaped substrate non-uniformity and that the evaporation is governed by the transport of vapor in the ambient gas. We consider the vicinity of the contact line and propose an analytical model to describe the flows in both liquid and gas phases in that region. We determine the critical contact angles, at which the dominant contribution to the flow changes, and propose a simple approximation allowing to calculate them for the known wedge opening angles. We analyze the flow topology and particularly, the emergence of separatrices in both phases for different opening angles of a wedge and different ratios of liquid and gas viscosity.

Hauptautor: KUBOCHKIN, Nikolai (Institute for Technical Thermodynamics, Technische Universität Darmstadt)

Co-Autoren: Prof. GAMBARYAN-ROISMAN, Tatiana (Institut für Technische Thermodynamik, Technische Universität Darmstadt); Prof. AJAEV, Vladimir S. (Southern Methodist University, Department of Mathematics)

Vortragende(r): KUBOCHKIN, Nikolai (Institute for Technical Thermodynamics, Technische Universität Darmstadt)

Sitzung Einordnung: Short Talks