# Influence of wetting and dewetting phenomena on evaporative heat transfer

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## Abstract

Wetting and dewetting phenomena can have a strong influence on the heat transfer performance in many applications such as e.g. nucleate or flow boiling, drop impact onto a superheated wall, or evaporation from porous structures. Close to the dynamically moving contact line separating the three phases liquid/solid/vapour the evaporative heat and fluid flow characteristics often differ a lot from those in the bulk phases.

Here, three examples are presented and discussed: (i) nucleate pool boiling, (ii) drop impingement, (iii) evaporation from a capillary. Experimental and numerical investigations are presented and analyzed with a focus on the specific local heat and fluid transport phenomena. The scales of interest in these investigations range from the nanometer to the millimeter scale. Generic experiments with a specifically designed heater element and high spatial and temporal resolution measurement techniques lead to a detailed insight into the local phenomena. A thermos-hydrodynamic model was developed and implemented into a CFD code for numerical simulations. The model is validated using the experimental data. The numerical results allow zooming into even smaller scales than within the high-resolution experiments, thus enlightening even more details of the local phenomena.

The results prove that advancing and receding contact lines show rather different heat transfer characteristics compared with static contact line situations. Thus, the evaporative heat transfer might be strongly influenced by contact line velocity and apparent contact angle. Vice versa, the heat flux and wall temperature superheat influence the apparent contact angle. The interaction of these parameters will be discussed qualitatively in a more general sense and quantitatively for some typical examples.