Heat Transfer in Binary Falling Films with Liquid-Liquid Phase Transition

Abstract of the PhD Thesis of Dipl.-Ing. Olga Sellmann

At present, there are no publications available that investigate the heat transfer in binary liquid falling films with a liquid-liquid phase transition. The correlations existing for the single-phase films cannot be used to characterize the heat transfer in two-phase falling films since they consider neither the flow characteristics of such films nor the effects of the phase transition like the formation of the new phases and their development along the flow.

This thesis presents the results of experimental examinations regarding the heat transfer in binary liquid films with liquid-liquid phase transition. In the experiments a liquid-liquid phase transition with following phase separation was induced in a binary liquid mixture, that was distributed on a vertical cooled tube, so that a two-phase flow developed in the film downstream. As test mixture the succinonitrile-water system with an upper critical point of miscibility was used.

In the experiments the temperature distribution in binary falling films was assessed under ambient pressure, both for the simgle-phase and the two-phase film while varying the concentration of the test mixture, the mass flow, the entrance temperature of test mixture and cooling liquid, and the length of the cooled tube section. Based on these data, the influence of the phase transition on the heat transfer in binary falling films was determined depending on the entrance conditions. The measurements were conducted according to integral measure method on an especially developed experimental setup.