Condensation heat transfer for horizontal tubes with micro-pin fins

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ABSTRACT (ENG)
In order to improve the heat transfer in condensers, often surface structures are applied to the outside of the condenser tubes. This thesis investigates the condensation heat transfer of so called micro-pin fin structures. These are cylindrical copper pins with a maximum height of 80 µm and diameter of 20 µm, that are standing upright and in irregular assembly on the condenser tube surface.
The experiments show, that the microstructures can effect an improvement of the condensation heat transfer, if the geometric parameters of height, diameter and density are optimized with respect to the condensing fluid and the applied temperature difference. Measurements with four different structures show, that the overall heat transfer coefficient can be increased by more than 200% compared to a flat tube. The efficiency of the microstructures is, however, limited by the condensate film thickness.
The optimization of the structures is facilitated by a theoretical model of the condensation heat transfer. The original model of Webb et al. (1982, 1985) and Rudy und Webb (1983) for condensation on finned tubes was modified by terms that describe the influence of condensate film thickness on the effective height of the microstructures as well as the reduction of heat transfer in a transition zone between fin flank and condensate surface.