



Capillary Flow and Collapse in Wedge-Shaped Channels

By Jörg Klätte

Cuvillier Verlag Jan 2012, 2012. Buch. Book Condition: Neu. 212x147x12 mm. Neuware - The forced, isothermal, and incompressible capillary channel flow has been studied theoretically, experimentally, and numerically in this work using the example of an open wedge-shaped channel with a finite length. The curvature of the interface at the open side of the channel is coupled to the pressure difference between the surrounding gas pressure and liquid pressure along the flow path, and thus, a flow rate limit exists, above which the interface collapses. This work investigates this collapse phenomenon as a function of the channel geometry. The derivation of a one-dimensional differential flow equation is based on the streamline theory. The local pressure loss and both principal mean radii of curvature at the free surface are considered. To approximate the local pressure loss, the fully-developed flow profiles were compared to the three-dimensional numerical flow profiles. The physical understanding of the collapse behavior is generalized with the detection of a second characteristic collapse phenomena. In the inertial limit, the interface chokes at the smallest cross-section. In the viscous limit, the interface collapses at the outlet. A dimensionless number has been introduced, which classifies the inertial and viscous regime. Three...



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