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Two-phase viscous flows in channels with chemically patterned walls VLADIMIR AJAEV, Southern Methodist University, ELIZAVETA GATAPOVA, OLEG A. KABOV, Institute of Thermophysics (Russia) — Recent experimental studies of two-phase channel flows past chemically patterned surface showed that the bubbles of gas phase in the liquid tend to accumulate in the regions of lower wettability. We investigate how the presence of such bubbles affects the flow, in particular the viscous resistance at a given imposed pressure gradient. Two regimes are considered. First, we study the limit of relatively low concentration of bubbles, obtaining expressions for effective slip past a hydrophobic stripe partially covered by bubbles. Then, we consider the regime when bubbles merge, leading to complete coverage of hydrophobic region by the gas phase. In the latter case, the viscous flow is affected by a competition between the slippage effect at the gas-liquid interface and the reduction of the channel flow cross-section. The shape of the gas-liquid interface is found from solving the coupled problems for the flows in two phases.

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