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Pressure drop and void fraction during flow boiling in minichannels at different gravity levels VLADIMIR AJAEV, Southern Methodist University, DAVID BRUTIN, LOUNES TADRIST, Aix-Marseille University (France)
— We use mathematical models of two-phase flow to explain recent experimental data on flow boiling in minichannels under the conditions of hypergravity, normal gravity, and microgravity. The experimental data was obtained during parabolic flights and includes simultaneous measurements of void fraction, pressure drop, and heat transfer coefficient. At higher flow rates, void fraction grows linearly along the channel but with different slopes depending on gravity level. Using the models of motion of confined bubbles, we predict the ratio of the slopes of the void fraction profiles which is in excellent agreement with the experimental measurements. At lower flow rates, the void fraction profiles are concave down and eventually flatten away from the channel entrance. This change in the dynamics is explained by a combination of thermal effects in bubble growth, geometric confinement, and bubble coalescense. The relationship between pressure drop measurement results and flow structure is discussed. Finally, experimentally observed heat transfer enhancement under the conditions of microgravity is explained.

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