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Bubble nucleation in superhydrophobic microchannels due to subcritical heating[1] ADAM COWLEY, DANIEL MAYNES, JULIE CROCKETT, BRIAN IVERSON, Brigham Young University — We report on experiments that investigate the effects of heating on laminar flow in superhydrophobic (SH) microchannels. The parallel plate microchannels (180 μm spacing) consist of two surfaces: a rib/cavity structured SH surface and a smooth glass surface. The back of the SH surface is in contact with an aluminum strip that is heated and a camera is used to image through the glass surface to visualize the flow. Thermocouples embedded in the aluminum obtain the temperature profile along the length of the channel. The friction factor-Reynolds product (fRe) is obtained via pressure drop and volumetric flow rate measurements. Five surface types/configurations are investigated: smooth hydrophilic, smooth hydrophobic, SH with ribs perpendicular to the flow, SH with ribs parallel to the flow, and SH with both ribs parallel to the flow and sparse ribs perpendicular to the flow. Both degassed and air-saturated water are used. When air-saturated water is used, the cavities of the SH surfaces act as nucleation sites and air is desorbed out of the water. Depending on the surface type/configuration, large bubbles can form and result in a large increase in fRe and channel surface temperatures. When degassed water is used no bubble nucleation is observed, however, the air trapped in the cavities of the SH surfaces is quickly absorbed and the surfaces transition to a wetted state.

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Adam Cowley
Brigham Young University

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