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Pressure and Heating Effects on Superhydrophobic Friction Reduction TAE JIN KIM, SUNGYUN HANN, CARLOS HIDROVO, The University of Texas at Austin — Slip in internal flows is known to reduce friction and thus decrease the required pumping power. One method to achieve slip is by roughening the surface to induce Cassie state (a phenomenon in which a liquid rests on top of a rough surface with a gas layer formed underneath). While most work in this area has concentrated on optimizing the surface microtexturing geometry to maximize the friction reduction effects, less attention has been paid to the effects of partially wetted conditions. Our research goal is to control/track the air-water interface location within the roughness elements and study the interface effects on the microchannel friction. The frictional behavior of the flow suggests that (1) the air-water interface resembles closer to a no-slip boundary than a shear-free one, (2) the friction is rather insensitive to the degree of microtexturing wetting, and (3) the fully wetted microtexturing provides lower friction than the non-wetted ones. In accordance to the high frictional nature of the air-water interface, the effective slip length was varied by controlling the location of the air-water interface through heating. Results have shown that the Cassie state can be maintained at higher pressures through heating, but the flow may be pinched if excessive heat is applied to the microchannel.

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