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Laminar Jet Impingement and Hydraulic Jump Behavior on a Horizontal Surface with Anisotropic Slip JOSEPH PRINCE, MICHAEL JOHNSON, JULIE VANDERHOFF, DANIEL MAYNES, Brigham Young University — We present an analytical model that describes the influence anisotropic slip exerts on the thin film and hydraulic jump dynamics of laminar jet impingement on horizontal surfaces. Superhydrophobic surfaces with alternating microscale ribs and cavities exhibit anisotropic slip in the azimuthal direction and thus are described by this model. The thin film dynamics are predicted by an integral momentum based analysis as a function of the jet Reynolds number and for a specified slip length that varies azimuthally. In the analysis the thickness of the thin film at a given radius is assumed to be independent of the azimuthal coordinate. The model shows that the boundary layer grows more slowly parallel to the ribs compared to other directions. A second momentum balance was performed that predicts the radial location of the hydraulic jump as a function of imposed downstream depth. Deviation from the classical no slip case and from the scenario of isotropic slip was determined over a range of possible slip lengths. The results show that the hydraulic jump radius in the direction parallel to the ribs is larger than in the transverse direction and the shape of the hydraulic jump is nearly elliptical. Comparisons between the model results and experimental measurements are also provided.

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