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Slip and Air-Entrainment at Water-Solid Interfaces YINGXI ELAINE ZHU, PRASAD SARANGAPANI, Department of Chemical and Biomolecular Engineering, Univerisity of Notre Dame, ASHIS MUKHOPADHYAY, Wayne State University — A number of recent studies performed with water flow past hydrophobic microchannels have reported the existence of 'slip' at wall and suggested the existence of the interfacial gas layer as the underlying mechanism for the slip motion, yet the details are much disputed. We combine microscopy and advanced laser spectroscopy to directly and non-invasively detect the interfacial gas layer in flowing water past micro/nano-channels whose surface chemistry and gap spacing are varied. We observe that the dimension of the gas layer strongly depends on surface hydrophobicity and flow rates. Surprisingly, we have also observed the slip motion of water over hydrophilic surfaces with a strong dependence on liquid-loading conditions. We propose a mechanistic theory about air-entrainment that can account for our observations to elucidate the origin of the gas formation at water-solid interface and its consequence on slip motion.

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