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Turbulent Flow through a Microchannel with Superhydrophobic Walls KEVIN JEFFS, DANIEL MAYNES, WEBB BRENT, Brigham Young University — A growing amount of research has focused on the reduction of drag in microfluidic transport. One approach is to fabricate micro-ribs and cavities in the channel wall that are then treated with a hydrophobic coating. Such treatment reduces the surface contact area between the flowing liquid and the solid wall, thus yielding walls with no-slip and nearly shear-free regions at the microscale. Most of the previous work has focused on the laminar flow where reductions in the frictional resistance as large as 87% have been observed. Little research, however, has explored the potential drag reduction associated with turbulent flow through such microchannels. Results of an investigation of the turbulent fully developed flow in a parallel plate microchannel with microengineered surfaces will be discussed. A k-ω turbulence modeling scheme is implemented for closure to the turbulent RANS equations. Results are presented for the friction factor as a function of the relevant governing dimensionless parameters. The Reynolds number was varied from 2,000 to 10,000 and compared to previously obtained laminar flow data. Results show, as with the laminar flow case, that as the shear-free region increases the friction factor decreases. The observed reduction, however, was found to be significantly greater in the turbulent flow cases than in the case of laminar flow.

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