

Abstract Submitted
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PIV Characterization of Turbulent Channel Flow with Rib Patterned Superhydrophobic Walls JOSEPH PRINCE, BRADY WOOLFORD, DANIEL MAYNES, BRENT WEBB — We report PIV measurements characterizing turbulent flow in a channel with superhydrophobic surfaces, structured and wetting surfaces, and smooth bottom surfaces. The superhydrophobic and structured surfaces were fabricated with alternating ribs and cavities. Both longitudinal and transverse rib/cavity orientations were considered. The widths of the ribs and cavities were 8 and 32 micrometers, respectively, and the cavity depths were 15 micrometers. PIV measurements were acquired over the Reynolds number range of 4800 – 10000. The smooth bottom wall was used as a basis for comparison. The hydraulic diameter of the channel was nominally 8.2 mm with an aspect ratio of 8.9. A spanwise-averaged velocity profile was obtained at the channel centerline from the PIV data. The time-averaged velocity profiles reveal no discernible time-mean slip velocity at the superhydrophobic wall. However, the different surfaces affect the turbulence intensities, total and turbulent shear stress distributions, turbulence production in the channel, and local friction factors. Superhydrophobic surfaces with the ribs and cavities aligned with the flow show an 11% decrease in the friction factor while the same surfaces aligned in the transverse direction show a modest increase in the friction factor.

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