Abstract Submitted
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**High resolution velocity measurements within a turbulent boundary layer over super-hydrophobic surface**[1] HANGJIAN LING, Johns Hopkins University, SIDDARTH SRINIVASAN, Massachusetts Institute of Technology, JOSEPH KATZ, Johns Hopkins University, GARETH MCKINLEY, Massachusetts Institute of Technology — Using dual view digital holographic microscopy (DHM), high resolution velocity measurements within a turbulent boundary layer (TBL) over a super-hydrophobic surface (SHS) studied its potential application for drag reduction. The 50×152 $mm^2$ (spanwise×streamwise) SHS was created by spray-coating a dispersion of perfluorodecyl polyhedral oligomeric silsesquioxanes (F-POSS) in a poly (methyl methacrylate) binder. A porous base was used for replenishment of entrained air. In water tunnel experiments, the entrainment rate of air from the SHS increased with velocity, but was presumably replenished through the porous wall. Typical reconstructed fields of the 2.6×4.5×2.4 $mm^3$ DHM sample contained more than 34,000 (2$\mu$m) particles. Particle tracking and ensemble averaging gave the mean velocity profiles at a resolution that enabled direct calculation of wall shear stress $\tau_w$ from velocity gradients. Over a smooth wall, the sample covered the viscous, buffer and part of the log layers ( $\nu/u_\tau$ =14 & 5 $\mu$m at 2 & 6 m/s). The $\tau_w$ on the SHS was reduced by 19% and 47% at 2 and 6 m/s, respectively, clearly proving drag reduction in a TBL. The upward shifted velocity profile may facilitate measurements of slip velocity.

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