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Mechanically Robust Superhydrophobic Surfaces for Turbulent Drag Reduction[1] KEVIN GOLOVIN, MATHEW BOBAN, CHARLOTTE XIA, ANISH TUTEJA[2], University of Michigan — Superhydrophobic surfaces (SHS) resist wetting by keeping a thin air layer within their texture. Such surfaces have been shown to reduce skin friction during laminar and transitional flows. However, turbulent boundary layer flows exhibit high shear stresses that damage the fragile microstructure of most SHS, and it is yet unclear to what extent these surfaces can reduce drag. Moreover, the increasing pressure fluctuations and decreasing wall unit length experienced during turbulent flow makes designing mechanically robust SHS with the correct roughness scales a challenge. In this work we evaluate many different SHS in terms of their hydrophobicity, mechanical durability and roughness. Whereas even commercially available SHS lose their superhydrophobic properties after slight mechanical abrasion, our novel coatings survive up to 200x longer. Moreover, we evaluate how the roughness of such surfaces changes with mechanical abrasion, and we design SHS with the correct roughness to display optimal drag reduction in turbulent boundary layer flows.

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