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Direct measurement of turbulent skin-friction reduction on superhydrophobic surfaces[1] HYUNGMIN PARK, GUANGYI SUN, CHANG-JIN "CJ" KIM, University of California, Los Angeles — Recent advances in superhydrophobic (SHPo) surfaces have spurred a great interest in fluid mechanics because their large slip may result in a significant reduction of skin friction in turbulent flows. However, experimental confirmation of the reduction has been sporadic (only internal flows) and equivocal because most times the surface slip was small and the drag measurement indirect. Here we present a direct measurement of the drag on large-slip surfaces in a turbulent boundary-layer flow. The silicon-micromachined sample has a SHPo (microgrates) next to a reference (smooth) surface, each suspended by identical micro flexure beams. Monolithically fabricated in a batch process and sharing all the variations, the two surfaces shift differently only by the difference in the drag. The drag reduction was measured optically (directly) in a turbulent boundary layer in a water tunnel experiment at a moderate Reynolds number ($Re_\tau \sim 250$) over a gas fraction (fraction of the shear-free surface area) of $30\% - 90\%$. Unlike other reports, the drag reduction clearly increased with the gas fraction. More than 50% skin-friction reduction was achieved with 90% gas fraction. During the flow tests, the SHPo surfaces were visually confirmed to contain the air without any loss.

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Chang-Jin "CJ" Kim
University of California, Los Angeles

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