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Hydrostatic and Flow Measurements on Wrinkled Membrane Walls OZGUR OZSUN, KAMIL L. EKINCI, Boston University — In this study, we investigate structural properties of wrinkled silicon nitride (SiN) membranes, under both hydrostatic perturbations and flow conditions, through surface profile measurements. Rectangular SiN membranes with linear dimensions of 15 mm $\times$ 1.5 mm $\times$ 1 μm are fabricated on a 500$-\mu$m-thick silicon substrate using standard lithography techniques. These thin, initially flat, tension-dominated membranes are wrinkled by bending the silicon substrate. The wrinkled membranes are subsequently incorporated as walls into rectangular micro-channels, which allow both hydrostatic and flow measurements. The structural response of the wrinkles to hydrostatic pressure provides a measure of the various energy scales in the problem. Flow experiments show that the elastic properties and the structural undulations on a compliant membrane completely dominate the flow, possibly providing drag reduction. These measurements pave the way for building and using compliant walls for drag reduction in micro-channels.

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