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Laminar Channel Flow Over Superhydrophobic Porous Surfaces

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We have fabricated mesh-like porous superhydrophobic surfaces with solid area fraction ϕ_s, which can maintain intimate contact with both air and water reservoirs on either side. Typical structure has linear dimensions of $1mm \times 1mm \times 200nm$ and pore area of $10\mu m \times 10\mu m$. Recent experiments on such surfaces have shown anomalous hydrodynamic response in oscillating flows [1]. This effect is attributed to a Knudsen layer of gas at the solid-liquid interface. In this study, we investigate laminar channel flow over porous superhydrophobic surfaces. The surfaces are enclosed with PDMS microchannels, where pressure driven flow of DI water is generated. Pressure drop across the microchannels is measured as a function of flow rate. Slip lengths are inferred from the Poiseuille relation as a function of ϕ_s and compared to that of similar standard superhydrophobic surfaces, which lack intimate contact with air reservoir.

[1] http://arxiv.org/abs/1107.5873

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