Abstract Submitted
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**Theory, simulations and experiments for the slip on surfactant-contaminated superhydrophobic gratings in laminar flows**[1] FERNANDO TEMPRANO COLETO, SCOTT SMITH, University of California Santa Barbara, FRANOIS PEAUDECERF, ETH Zrich, JULIEN LANDEL, University of Manchester, FRDRIC GIBOU, PAOLO LUZZATTO-FEGIZ, University of California Santa Barbara — Surfactants have recently been established as a key factor affecting the drag reduction of laminar flows over superhydrophobic surfaces (SHS). Trace amounts of surfactants, unavoidable in practical applications, induce Marangoni forces that can completely negate slip and any associated drag reduction (Peaudecerf et al. PNAS, 2017; Song et al. PRF, 2018). A quantitative theory has recently been developed for two-dimensional flow (Landel et al. JFM, 2020). Here, we present a theory for the practically important case of three-dimensional flow over an SHS comprising long gratings aligned with the flow. The finite length of the gratings must be included in the model in order to capture the relevant surfactant physics. We test our theory by running three-dimensional numerical simulations inclusive of surfactant, and by performing microPIV measurements in microchannel experiments using confocal microscopy. Our theory yields expressions for the slip and drag as a function of ten dimensionless quantities, revealing the most effective routes to optimize the performance of SHS in practice.

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