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Direct numerical simulation of turbulent channel flow over a liquid-infused micro-grooved surface JAEHEE CHANG, Seoul National University, TAEYONG JUNG, LG Eletronics, HAECHEON CHOI, Seoul National University, JOHN KIM, University of California, Los Angeles — Recently a superhydrophobic surface has drawn much attention as a passive device to achieve high drag reduction. Despite the high performance promised at ideal conditions, maintaining the interface in real flow conditions is an intractable problem. A non-wetting surface, known as the slippery liquid-infused porous surface (SLIPS) or the lubricant-impregnated surface (LIS), has shown a potential for drag reduction, as the working fluid slips at the interface but cannot penetrate into the lubricant layer. In the present study, we perform direct numerical simulation of turbulent channel flow over a liquid-infused micro-grooved surface to investigate the effects of this surface on the interfacial slip and drag reduction. The flow rate of water is maintained constant corresponding to $Re_\tau \sim 180$ in a fully developed turbulent channel flow, and the lubricant layer is shear-driven by the turbulent water flow. The lubricant layer is also simulated with the assumption that the interface is flat (i.e. the surface tension effect is neglected). The solid substrate in which the lubricant is infused is modelled as straight ridges using an immersed boundary method. DNS results show that drag reduction by the liquid-infused surface is highly dependent on the viscosity of the lubricant.

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