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Direct numerical simulation of turbulent flows over superhydrophobic surfaces with periodic posts: effect of texture size[1] JONGMIN SEO, Stanford University, RICARDO GARCIA-MAYORAL , University of Cambridge, ALI MANI, Stanford University — Superhydrophobic surfaces submerged in water can produce slip on the wall and thus result in drag reduction by entrapping gas pockets between the roughness elements. This work aims to generate insights into the failure mechanism of such surfaces under turbulent conditions. We perform direct numerical simulations of channels with patterned slip/no-slip boundary conditions, for fixed gas fraction and texture wavelengths, L^+, ranging from 6 to 150 wall units, which include the regime of practical application. The rms pressure at the wall is found to have a fluctuating contribution, caused by the overlying turbulence, and a stationary contribution, caused by the stagnation of flow when encountering downstream solid posts. While the turbulence contribution remains essentially unmodified, the stationary pressure increases with the texture size, and can be responsible for the breakup of the entrapped gas bubbles. We present results revealing the scaling of the induced pressure and the consequent deformations of the air-water interface.

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