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Re-Entrant Structure for Robust Superhydrophobicity and Drag Reduction HONG ZHAO, MOHAMED GAD-EL-HAK, Department of Mechanical and Nuclear Engineering, Virginia Commonwealth University, Richmond, VA 23284, USA — A re-entrant structure is required for superoleophobicity by effectively pinning low-surface-tension liquids from wetting the textures and forming a solid–liquid–air composite interface. In this work, we examine the contribution of a re-entrant structure to the robustness of superhydrophobicity and skin-friction reduction capabilities. Textured surfaces with wavy sidewall pillars provide re-entrant structures and are used as model surfaces. Gibbs energy analysis is conducted to study the pinning sites and wetting stability. The wetting robustness against pressure is characterized by breakthrough pressure, which is obtained by conservation of energy and force balance at the pinning sites. The slip length and slip velocity are evaluated through a shear stress and strain rate correlation, which is obtained using an Anton Paar rheometer. Gibbs energy analysis indicates that the breakthrough pressure provided by the wavy sidewall structure for water is about 18 times of that on the straight sidewall structure. This is mostly due to the energy barrier at the re-entrant structure. When a contact line advances onto and pins at the re-entrant structure, its slip performance degrades due to the increased no-slip fraction on the composite interface, but Cassie–Baxter state still remains.

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