Extreme Hydrophobicity

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Abstract
Since the report of the famous lotus effect in 1997, the science and technology in superhydrophobicity has remarkably progressed, because of the promising applications in a broad region such as energy, environment, biomedicine and anti-icing. However, the applicability the superhydrophobic surfaces in practice is still far from expectation, due to largely the appearance of three types of instability. Firstly, the transition from hydrophobicity to hydrophilicity due to the degradation of the chemistry; secondly, the structural instability of the surface roughness [1]; and thirdly, once transition happens from the desirable Cassie-Baxter wetting state to the unfavorable Wenzel wetting state under disturbance [2], the recovery might physically impossible to automatically happen [3,4]. Extreme hydrophobicity is a new concept proposed by the authors in 2016. Different from the superhydrophobicity that is typically characterized by a high contact angle $\theta > 150°$ and meanwhile low sliding angle $\alpha < 50°$, the extreme hydrophobicity is defined by three new features: (1) the contact angle is very close to 180°; (2) the structure of the material is robust; and (3) the Cassie-Baxter wetting state is monostable. Regarding the last feature [5], it means that even if the liquid is compelled into a Wenzel wetting state under disturbance, the transition from the Wenzel to the Cassie-Baxter wetting state can be repaired spontaneously without any external energy input. This talk will give a brief review about the development process of the concept of the extreme hydrophobicity, including the fundamental theory and experiments. We will also give a perspective about the future academical developments and practical applications of the extreme hydrophobicity and discuss the challenges in this field.

References

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