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Wenzel Wetting on Slippery Rough Surfaces[1] BIRGITT STOGIN, XIANMING DAI, TAK-SING WONG, Pennsylvania State Univ — Liquid repellency is an important surface property used in a wide range of applications including self-cleaning, anti-icing, anti-biofouling, and condensation heat transfer, and is characterized by apparent contact angle (θ^*) and contact angle hysteresis ($\Delta\theta^*$). The Wenzel equation (1936) predicts θ^* of liquids in the Wenzel state [1], and is one of the most fundamental equations in the wetting field. However, droplets in the Wenzel state on conventional rough surfaces exhibit large $\Delta\theta^*$, making it difficult to experimentally verify the model with precision. As a result, precise verification of the Wenzel wetting model has remained an open scientific question for the past 79 years. Here we introduce a new class of liquid-infused surfaces [2] called slippery rough surfaces — surfaces with significantly reduced $\Delta\theta^*$ compared to conventional rough surfaces—and use them to experimentally assess the Wenzel equation with the highest precision to date.

[1] R.N. Wenzel, Ind. Eng. Chem. 28: 988-994 (1936).
[2] T.S. Wong et al., Nature 477: 443 447 (2011).

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