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Intermediate states of wetting on hierarchical superhydrophobic surfaces[1] SEBASTIAN DEHE, Technische Universität Darmstadt, BARUCH ROFMAN, VALERI FRUMKIN, MORAN BERCOVICI, Technion - Israel Institute of Technology, STEFFEN HARDT, Technische Universität Darmstadt — We study the wetting transition on hierarchical superhydrophobic surfaces subjected to external forcing, and show that, in contrast to the common description of an abrupt jump between stable states, such surfaces experience a continuous set of intermediate states. We use two-tier hierarchical surfaces created by the random deposition of nanoparticles over a baseline microstructure, subject them to continuous electrical forcing, and image the light reflections from the gas-liquid interface to visualize the transitions. Using this method, we show that the transition is partially reversible and is limited only by localized Cassie to Wenzel transitions at nano defects in the structure. In addition, we show that even a surface containing many localized wetted regions can still exhibit extremely low contact angle hysteresis, thus remaining useful for many applications. Expanding the classical definition of the Cassie state in the context of hierarchical surfaces, from a single state to a continuum of metastable states ranging from the centimeter to the nanometer scale, is important for a better description of the slip properties of superhydrophobic surfaces, and provides new considerations for their design.

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Sebastian Dehe
Technische Universität Darmstadt

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