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Deceleration-driven wetting transition of "gently" deposited drops on textured hydrophobic surfaces KRIPA VARANASI, HYUKMIN KWON, ADAM PAXSON, MIT, NEELESH PATANKAR, Northwestern University — Many applications of rough superhydrophobic surfaces rely on the presence of droplets in a Cassie state on the substrates. A well established understanding is that if sessile droplets are smaller than a critical size, then the large Laplace pressure induces wetting transition from a Cassie to a Wenzel state, i.e., the liquid impales the roughness grooves. Thus, larger droplets are expected to remain in the Cassie state. In this work we report a surprising wetting transition where even a "gentle" deposition of droplets on rough substrates lead to the transition of larger droplets to the Wenzel state. A hitherto unknown mechanism based on rapid deceleration is identified. It is found that modest amount of energy, during the deposition process, is channeled through rapid deceleration into high water hammer pressure which induces wetting transition. A new "phase" diagram is reported which shows that both large and small droplets can transition to Wenzel states due to the deceleration and Laplace mechanisms, respectively. This novel insight reveals for the first time that the attainment of a Cassie state is more restrictive than previous criteria based on the Laplace pressure transition mechanism.

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