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The role of humidity and pressure in preserving superhydrophobicity for droplet impact[1] HENRY LAMBLEY, THOMAS SCHUTZIUS, DIMOS POULIKAKOS, ETH Zrich — The design of robust superhydrophobic surfaces for impacting water droplets is typically achieved by creating surface structures with capillary (anti-wetting) pressures greater than that of the incoming droplet (dynamic, water hammer). Recent work has focussed on how competition between compression and drainage of air within the surface texture dictates the evolution of the intervening air layer between droplet and substrate and its role in promoting impalement under ambient conditions through local increases in the droplet curvature. However, little consideration has been given to the influence of the intervening air layer composition, and compressibility effects, when departing from ambient conditions on the impact outcome. Here, we explore the limits of the working envelope for robust superhydrophobic surfaces by varying the ambient pressure and water vapour content. By testing rationally engineered materials with both micro and nanoscale features, we are able to provide additional design constraints and propose solutions for future applications of superhydrophobic and icephobic technologies across a broad range of environmental conditions.

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