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On the stabilization of surface nanobubbles DETLEF LOHSE, BRAM BORKENT, University of Twente, MICHAEL BRENNER, Harvard University, HOLGER SCHOENHERR, University of Twente — Recent experiments have convincingly demonstrated the existence of surface nanobubbles on submerged hydrophobic surfaces. However, classical theory dictates that small gaseous bubbles quickly dissolve because their large Laplace pressure causes a diffusive outflux of gas. Here we first present atomic force microscopy (AFM) data on the geometric shape of these surface nanobubbles over more than one decade in magnitude, revealing that the contact angle θ (defined on the gas side) goes to zero for small surface nanobubbles, which leads to a reduction of the Laplace pressure. Based on these data, we then suggest that the surface bubbles are further stabilized by a continuous influx of gas near the contact line, due to the gas attraction towards hydrophobic walls. This influx balances the outflux and allows for a meta-stable equilibrium, which however vanishes in thermodynamic equilibrium.

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