Surface nanobubble stability

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We provide a model for the remarkable stability of surface nanobubbles to bulk dissolution. The key to the solution is that the gas in a nanobubble is of Knudsen type. This leads to the generation of a bulk liquid flow which effectively forces the diffusive gas to remain local. Our model predicts the presence of a vertical water jet immediately above a nanobubble, with an estimated speed of ~ 3.3m/s, in good agreement with our experimental atomic force microscopy measurement of ~ 2.7m/s. In addition, our model also predicts an upper bound for the size of nanobubbles, which is consistent with the available experimental data.