Supporting Information

Supporting data 1. Response of gas micropancakes to ultrasound

We observed that the height of the micropancakes increased while the lateral size decreased following the application of ultrasound (Figure S1). The response of micropancakes to sonication is obviously different from that of nanobubbles and is not related to a temperature effect as it has been observed previously that micropancakes spread laterally at raised temperature. Both the expansion and lateral shrinking indicate that the three-phase contact line of the pancakes was not firmly pinned on the surface. The reason for this property of the micropancakes remains unknown. We also observed that sometimes the pancakes could be transformed to nanobubbles following ultrasound exposure. This is consistent with the instability of micropancakes towards mechanical perturbation. Furthermore, the transformation from micropancake to nanobubble morphology under sonication indicates that the nature of the micropancake is the same as nanobubbles, *i.e.*, they are both interfacial gaseous states.

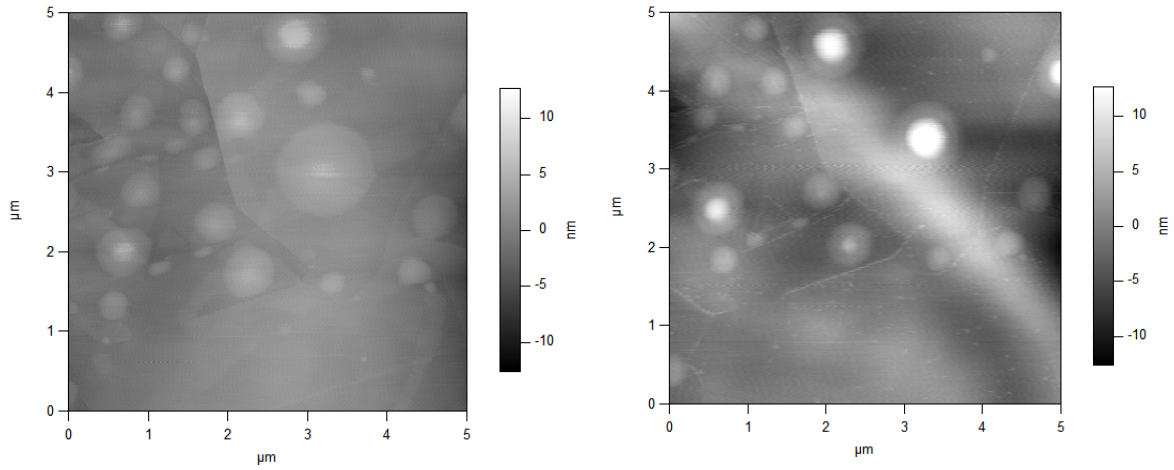

Figure S1. Tapping-mode AFM height images taken in water before and after sonication showing the morphology transformation from micropancake to nanobubble.

Supporting data 2. Large scan area AFM images of oil nanodroplets before and after sonication

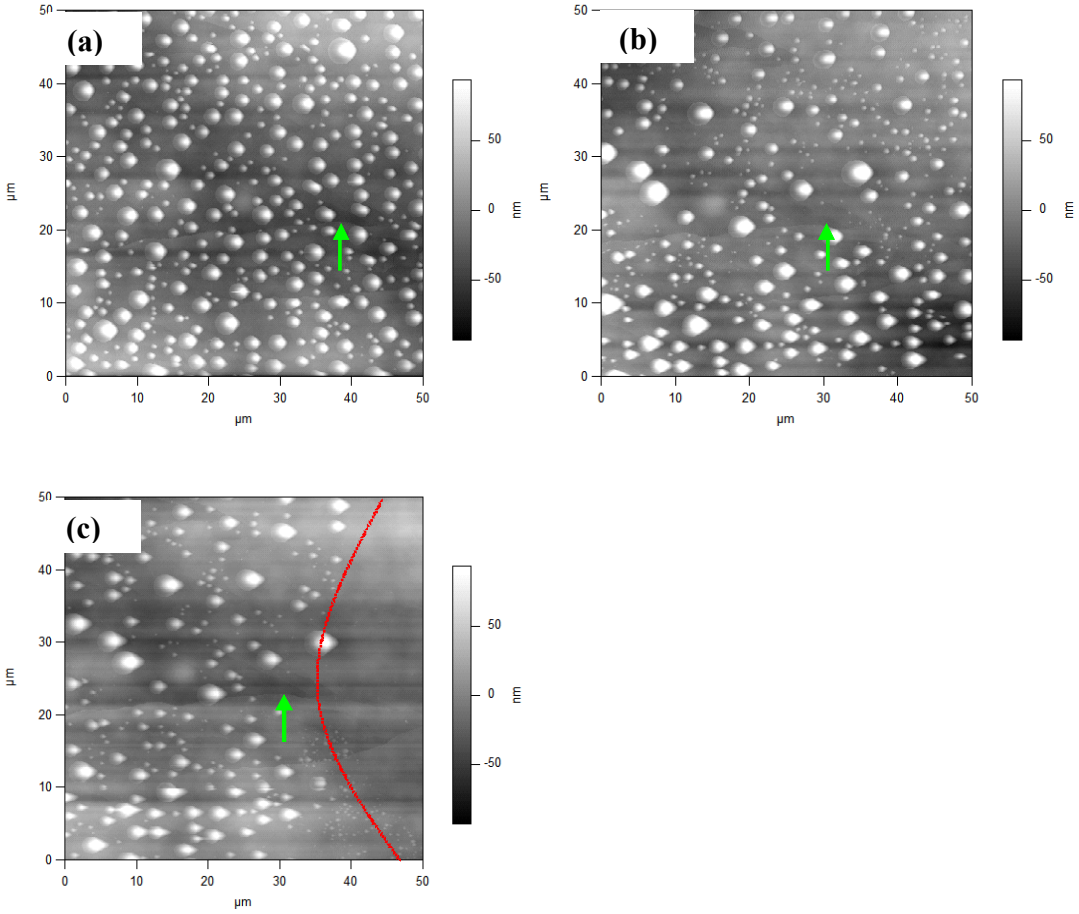

Figure S2. Tapping-mode AFM height images of decane droplets on a HOPG surface taken prior to sonication (a) and after sonication for a period of 20 s (b) and 60 s (c). The images were taken at the same location, as shown by the atomic steps on the HOPG; the green arrows mark the same location on the surface in each image as a reference point. From (a) to (b) there is a large change in the droplet size distribution resulting from dislodgement and coalescence of mobile droplets, and the dissolution of small droplets. From (b) to (c) most droplets were immobile on the surface resulting in little change in their size and location. The area marked in the right of (c) is largely devoid of droplets due to the

formation and detachment of a large cavitation bubble. The large number of small droplets in the lower right section may be due to cavitation induced fragmentation of a larger droplet.