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High Frequency Stable Oscillate boiling FENFANG LI, SILVESTRE ROBERTO GONZALEZ-AVILA, CLAUS DIETER OHL, Nanyang Tech Univ —
We present an unexpected regime of resonant bubble oscillations on a thin metal film submerged in water, which is continuously heated with a focused CW laser. The oscillatory bubble dynamics reveals a remarkably stable frequency of several 100 kHz and is resolved from the side using video recordings at 1 million frames per second. The emitted sound is measured simultaneously and shows higher harmonics. Once the laser is switched on the water in contact with the metal layer is superheated and an explosively expanding cavitation bubble is generated. However, after the collapse a microbubble is nucleated from the bubble remains which displays long lasting oscillations. Generally, pinch-off from of the upper part of the microbubble is observed generating a continuous stream of small gas bubbles rising upwards. The cavitation expansion, collapse, and the jetting of gas bubbles are detected by the hydrophone and are correlated to the high speed video. We find the bubble oscillation frequency is dependent on the bubble size and surface tension. A preliminary model based on Marangoni flow and heat transfer can explain the high flow velocities observed, yet the origin of bubble oscillation is currently not well understood.

Fenfang Li
Nanyang Tech Univ

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