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Abstract

The dynamics of large bubbles in an ultrasonic field

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Ultrasonic standing waves in a liquid cell can be used to trap, oscillate, and manipulate millimeter and centimeter-size gas and vapor bubbles. We have been interested in the response of trapped gas bubbles to oscillatory and static acoustic radiation stresses for the purpose of studying both the nonlinear low-frequency shape oscillatory dynamics as well as the high-frequency capillary waves excitation at the liquid-gas interface. We have found that gas bubbles arc unstable in shape when the amplitude of a stead y acoustic field and the ratio of the bubble diameter to the acoustic wavelength arc sufficient y high. Large amplitude and disordered shape oscillations are excited and remain until the size of the bubble or the acoustic amplitude has **sufficient y decreased. High-ampli tudc bubble** shape oscillations driven by a modulation of the trapping acoustic **field have also been shown to lead to** nonlinear phenomena such as resonance frequency dependence on oscillation amplitude and higher mode shape excitation. The acoustic pressure threshold for the parametric induction of high frequency capillary waves has been determined for millimeter-si~.c air bubbles immersed in water. In addition, flow visualization studies have revealed a strong enhancing effect on the convective flows both outside and within the gas bubbles. This new experimental information on the macroscopic dynamics of single bubbles is generally relevant to the problem of the control of dispersion and heat and mass transfer in systems using two phases in ground-based and low gravity applications. [Research funded by the Microgravity Research Division of NASA].