Measurement of the thickness of the liquid film that separates a cavitation bubble from a solid during its collapse dynamics

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The time evolution of the liquid-film thickness between a single cavitation bubble in water collapsing onto a solid surface is measured. To this end TIR shadowmetry is developed, a technique based on total internal reflection (TIR) and the imaging of shadows of an optical structure on a polished glass surface. The measurements are performed at frame rates up to 480 kHz. Simultaneous high-speed imaging of the shape of a laser-induced bubble at up to 89 kHz allows relating the evolution of the film thickness to the bubble dynamics. We find that there resides a liquid film between the cavitation bubble and the solid during most of its dynamics and provide the time evolution of its thickness. Consequences for mass and heat transfer between bubble interior and solid are discussed.

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