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The dynamics of a single cavitation bubble in a rigid externally driven micro-confinement KONSTANTIN LEONOV, ISKANDER AKHATOV, Skolkovo Institute of Science and Technology — Cavitation in microscopic confinement received some attention recently in the attempt to model free oscillations of the bubbles that pre-exist or appear by nucleation in the trapped liquid. In our study, the dynamics of a spherical bubble in the confined externally driven liquid cell is considered. It is shown that volume confinement strongly affects the manifestation of the classical cavitation Blake threshold. At relatively large liquid cell exposed to a tension exceeding cavitation Blake threshold, the cavitation bubble abruptly expands to a finite radius in contrast with explosive infinite bubble growth in bulk liquid. At liquid cell size smaller than some critical one, the cavitation is completely suppressed by volumetric confinement. The generalized Rayleigh-Plesset equation for the confined bubble is derived in which the liquid cell size is used as a driving parameter. Three possible regimes of bubble dynamics in confined liquid at different types of driving is studied. First, a simple nonlinear growth initiated by relatively weak liquid cell expansion when the cavitation Blake threshold is not reached yet. Second, an abrupt cavitation expansion with oscillatory transient when cavitation Blake threshold is reached. Third, multiple cavitation inception followed by cavitation vanishing at the periodic liquid cell expansion and contraction. In this case, it is also found that for high driving frequency bubble dynamics in the confined liquid resembles the bubble dynamics in an unbounded liquid.

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