Temperature and Pressure in the Nuclei of Homogeneous Cavitation

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On the basis of the theory of nuclei formation of new phases, the homogeneous nucleation process of vapor nuclei in water, ammonia, argon and carbon dioxide is studied. The research is carried out in a temperature interval from the triple point to the critical point and for both negative and positive pressure fields.

For nucleation frequencies $J_1 = 1\ cm^{-3}\ s^{-1}$ and $J_2 = 10^{20}\ cm^{-3}\ s^{-1}$ for a given temperature, values R_1 and R_2 of the bubbles' critical radius and values of the pressure in liquid R_1 and R_2 are calculated. From the data for R_2 and the spinodal parameters, and according to the generalized van der Waals equation, the tensile strength in the presence of a strain is defined.

The homogeneous acoustic cavitation process in a liquid under the action of a powerful ultrasound wave with a pressure amplitude P_b-P_2, where P_b is the pressure on the binodal, is studied. A numerical solution is obtained from the R.P.N.N.P.equation (by Rayleigh, Plesset, Noltingk, Neppiras, and Poritsky) in the case when nuclei with radius R_1 appear in a stretched liquid under the pressure P_1, expand to a value R_m and then collapse into a wave of compression. For water and ammonia the temporal dependence of the bubble radius at different ultrasound oscillation frequencies is obtained. On the basis of these results, the maximum temperature and the maximum pressure of the nuclei during the collapse are determined.