DOI: 10.37102/1992-4429_2025_52_02_05

QUANTITATIVE ASSESSMENT OF CAVITATION BUBBLES ON A LASER HEATING ELEMENT IN A SMALL VOLUME CHAMBER

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Acoustic noises arising from thermal cavitation initiated in the vicinity of the end of an optical fiber immersed in water (a laser heating element) and recorded by a microphone mounted above the surface of a liquid filling a small-volume working chamber are studied. The sound recorded by the microphone includes a series of individual pulses identified as the result of the growth-collapse of cavitation bubbles resulting from the elementary act of boiling water with underfloor heating. In contrast to recording cavitation noise using a hydrophone immersed in an experimental chamber, the method of noise control using a microphone located outside the area of laser exposure is simpler and more reliable and will allow remote monitoring of thermal effects on the material. The paper shows that by means of a microphone located near the volume of short-wave liquid processed by the end of the optical fiber, it is possible to isolate the most energy-carrying pulses in cavitation noise and, based on their quantitative analysis, control the degree of heating of the medium. This will make it possible to control the energy modes of laser operation during other types of laser treatment, for example, cavitation cleaning, hardening, quenching or sanitation of technical surfaces, and automate the management of the duration of radiation exposure based on quantitative indicators.

Keywords: steam bubbles, laser radiation, heating, boiling, sound pulse, acoustic vibrations, cavitation, small volume chamber, microphone

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Recommended citation:

Lebedev M.S., Tagil'cev A.A., Chudnovskij V.M. QUANTITATIVE ASSESSMENT OF CAVITATION BUBBLES ON A LASER HEATING ELEMENT IN A SMALL VOLUME CHAMBER. UNDERWATER INVESTIGATIONS AND ROBOTICS. 2025. No. 2 (52). P. 53–58. DOI: 10.37102/1992-4429_2025_51_01_05. EDN: RANCUB.

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