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Fragmentation of a liquid tin droplet by a short laser pulse SERGEY GRIGORYEV, VASILY ZHAKHOVSKY, SERGEY DYACHKOV, Dukhov Research Institute of Automatics, BOGDAN LAKATOSH, Moscow Institute of Physics and Technology, MIKHAIL KRIVOKORYTOV, VYACHESLAV MEDVEDEV, Institute for Spectroscopy of RAS — Fragmentation mechanisms of a micrometer-sized liquid tin droplet irradiated by a short laser pulse are studied. Our experiments show either symmetric or asymmetric expansion of the droplet depending on laser pulse intensity. To reveal the underline processes we perform simulations complying with the experiments using the smoothed particle hydrodynamics. It is demonstrated that, as a result of fast laser energy deposition, a strong shock wave followed by a tensile wave is formed and propagates from the frontal side to the rear side of droplet. Convergence of such waves inside the droplet induces cavitation nearby the center, which causes the droplet to expand symmetrically. Reflection of a shock wave from the rear side of droplet may lead to spallation producing a thin layer moving in the laser pulse direction, which results in the asymmetrical expansion. The calculated laser intensity threshold for the rear-side spallation is higher than a threshold required for the central cavitation. The corresponding expansion velocities and thresholds agree well with the experimental results in both regimes of droplet expansion.

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