One- to two-dimensional front crossover in laser-induced shock-waves modeling

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Laser induced shock-waves (SWs) have widespread area of applications nowadays. To most important of them belong laser ablation to liquids and laser shock-wave peening, where SWs are main drivers of physical and technical effect. Single femtosecond laser pulse action upon thick aluminium target is considered. SW generated after laser heating propagates in the target, firstly as planar wave and afterwards as hemispherical wave. Hydrodynamical simulations were made with different equations of state and different numerical methods to find and calibrate optimal hydrodynamic model and numerical algorythm for the phenomenon modeling. Attenuation of SWs is also considered and effects of ideal gas equation of state versus Mie–Grüneisen approach are analyzed. Results are compared to molecular dynamic simulations and experiment.