A numerical model of shock wave propagation from a powerful high-pressure pulsed discharge in a gas-discharge chamber

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The radial propagation of a shock wave in a cylindrical high-pressure discharge chamber filled with hydrogen has been studied by numerical simulation. The simulation was performed for conditions of a powerful electrical breakdown with a current rise rate of $\approx 10^{11}$ A/s. A system of equations of gas dynamics for a compressible inviscid medium was used for the mathematical description of gas dynamics [1], and a finite-difference scheme was used for the numerical solution, taking into account various models of energy release [2]. Based on comparison with a wide range of experimental data [3], it is shown that the model qualitatively reproduces the key processes: the evolution of the shock wave and the pressure build-up on the chamber wall. The qualitative coincidence of the calculated and experimental curves confirms the applicability of the numerical method used to describe hydrodynamic fields. It is established that the accuracy of the simulation critically depends on the initial gas pressure and the adequacy of the mathematical model of the disturbance source.

[1] Fletcher C A 1991 *Computational Techniques for Fluid Dynamics* 2nd ed (Berlin, Heidelberg: Springer-Verlag)

[2] Triaskin J V, Budin A V, Pinchuk M E, Tryaskin N V and Bogomaz A A 2025 *Bulletin of the Russian Academy of Sciences: Physics* **89** S259–S263 ISSN 1062-8738

[3] Rutberg P G, Bogomaz A A, Pinchuk M E, Budin A V, Leks A G and Pozubenkov A A 2011 *Physics of Plasmas* **18** 122702