Method for determining of Jones–Wilkins–Lee equation parameters using the cylinder test results

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The paper presents a method for determining the parameters of the Jones–Wilkins–Lee equation of state (EOS) for detonation products of explosives using the results of the cylinder-test experiment. Three types of approximation functions are used to fit the experimental data and the optimal one with a minimum error value is selected. The search for the EOS parameters in this technique is carried out using the optimization method in three-dimensional space (R_1, R_2, ω) with the determination of remaining parameters (A, B, C) from the linear equations, which, in comparison with optimization in six-dimensional space $(A, B, C, R_1, R_2, \omega)$, has a faster convergence. The method ensures the realization of physical restrictions on the EOS parameters. To verify the EOS parameters, mathematical modeling of test problems was carried out with determined and reference EOS parameters, e.g., [1]. Mathematical modeling is based on solving the system of continuous medium mechanic equations in Euler coordinates to describe gas-dynamic flows of detonation products and in Lagrangian coordinates to describe elastic-plastic flows in the material of a cylindrical tube. The results are in good agreement with the experimental data.

[1] Lee E, Hornig H and Kury J 1968 Adiabatic expansion of high explosive detonation products Report UCRL-50422 Univ. of California, Lawrence Radiation Laboratory Livermore, CA