AN EXAMPLE OF OPTIMIZATION OF THE BLOCK CHARGE USING NUMERICAL MODELING

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Abstract: To select the block charge for a given barrel setup, it is nesessary to optimize a few of its properties, including the size of propellant grains, thickness of the polymer film coating the grain surface, density, configuration, size and strength of the block as well as loading density. This work involves a lot of firings, because any change of the block properties results in changing of the maximum pressure. Application of numerical modeling provides with opportunity to fulfill this work more effectively, significantly reducing the number of firings. This paper considers an example of the block optimization in a 14.5-millimeter laboratory barrel setup using a numerical model of internal ballistics. The first step is the testing of the input parameters of the model by means of comparison of calculation results with a few firings at the blocks fabricated from single-base propellant VU coated by 3% polyvinyl butyral. The second step is the parametric analysis which demonstrates significant increase of the muzzle velocity with increasing the loading density and changing the all-round mode of the block burning by the butt one. The block properties have been determined under which the calculated increment of the muzzle velocity relative to the common charge of loose-packed density exceeds 200 m/s, or 18%, at the same maximum pressure.

Keywords: internal ballistics; single-base propellant; block charge; loading density; muzzle velocity

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