THEORETICAL ANALYSIS OF THE METHOD OF TESTS OF SOLID EXPLOSIVES FOR SENSITIVITY TO MECHANICAL IMPACT — DESTRUCTIVE SHELL

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Abstract: A theoretical analysis of the original test method for determining the level of sensitivity of solid explosives to mechanical stress, called Destructive Shell (DS), was carried out. It belongs to the number of nonimpact test methods when an explosive charge compressed to high pressure is suddenly released from it and freely scattered around. It is argued that in the process of high-speed movement, the fragments of destruction are compressed by the parts of the test device with simultaneous physical and mechanical interaction with them as well as with each other through heat exchange contacts and chemical reactions. The situation is generally similar to that which arises in the process of destruction of an explosive charge upon mechanical impact. Therefore, to analyze the DS method, the mathematical procedure for calculating the parameters of flows and temperatures of dissipative heating of the destroyed charge substance, previously developed for calculating an explosion upon impact, was used. The data obtained made it possible to clarify the formulations of the two main mechanisms of initiation of solid explosives by the DS method, namely, viscous-plastic and frictional heating.

Keywords: destruction; initiation; explosion; sensitivity; explosives; impact

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Figure Captions

Figure 1 Time change of the parameters of the explosive and loading system: *1* — velocity of the contact surface of the punch w; *2* — total energy E_0; *3* — potential energy E_p; *4* — thermal energy E_t; *5* — kinetic energy E_k; and *6* — charge strength of explosive σ

Figure 2 Parameters of the explosive charge depending on time: *1* — pressure P; *2* — thickness h; *3* – hot spot temperature T; *4* — axial compression velocity w; *5* — velocity of the center of mass of the loading system v; and *6* — relative concentration of explosion products η

Figure 3 Dependences of the flow parameters in the mixtures of HMX-A (0.1) 70/30 (*a*) and HMX-A (7) 80/20 (*b*) on time of charge destruction (A stands for Aluminum): *1* — pressure P; *2* — thickness h; *3* — axial compression velocity w; *4* — temperature of hot spot T; *5* — temperature of hot spot for the inert analog of HMX in the mixture; *6* — temperature of hot spot in the absence of chemical interaction between the components of the mixture; and *7* — decay products of the mixture η

Table Captions

Table 1 Charge destruction parameters during HMX initiation

Table 2 Parameters of destruction and of explosion initiation of charges from a mixture of HMX with aluminum

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