CIRCULAR CAVITY IN A CLOSED LAYER OF SOLID EXPLOSIVE: COLLAPSE ON IMPACT AND INITIATION OF EXPLOSION

A. V. Dubovik

N. N. Semenov Federal Research Center for Chemical Physics of the Russian Academy of Science, 4 Kosygin Str., Moscow 19991, Russian Federation

Abstract: The dynamics of drop-weight machine impact on thin layer of solid explosives placed in a closed gap between the impactor and the anvil is considered. There is a gas cavity in the middle of the layer. Cavity collapses if the impact pressure exceeds the limit set of the layer material. The problem of cavity collapse and explosion initiation is reduced to the numerical integration of equations system of the viscoplastic flow of the layer, the impact mechanics, and heat transfer between the gas and the walls of the cavity, taking into account the reaction of thermal decomposition of explosives. The obtained calculation results confirm the previously made conclusions about the necessary role of gas in the rise of viscoplastic heating to ignition of the cavity walls which allow one to determine a number of critical conditions for the initiation of an explosion.

Keywords: solid explosives; thin layer; gas cavity; impact; plastic deformation; heat transfer; heating; explosion

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Figure Caption

Dependencies on time of the parameters of air cavity collapse: *1* — radius of the cavity; *2* — thickness of the high explosive (HE) layer; *3* — speed of the striker; *4* — impact pressure; *5* — temperature of the viscoplastic heating; *6* — the same heated from the air into the cavity; *7* — gas temperature; *8* — depth of HE decomposition; *9* — friction heating; $\theta = (T - T_0)/T_x$, $T_x = P_x/(\rho_0 c_0) = 999$ K, $P_x = 1.99$ GPa

Table Caption

Parameters of the collapse of cavities in the HE layer with $2R = 10$ mm, $a_0 = 0.5$ mm, and $h_0 = 1$ mm upon impact with a load of $M = 10$ kg at a speed of $V_0 = 3.13$ m/s ($H_0 = 0.5$ m and $E_0 = 49$ J)

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Contributor

Dubovik Alexander V. (b. 1938) — Doctor of Science in physics and mathematics, professor, leading research scientist, N. N. Semenov Federal Research Center for Chemical Physics of the Russian Academy of Sciences, 4 Kosygin Str., Moscow 119991, Russian Federation; a-dubovik@mail.ru