Mathematical modeling of ignition of high explosives

Pomykalov E.V.[1,@], **Kovalev Yu.M.**[1] **and Yalovets A.P.**[1]

[1] South Ural State University, Lenin Avenue 76, Chelyabinsk, 454080, Russia

[@] pomykalovev@susu.ru

The paper presents a mathematical model of the possible appearance of hot spots in a thin layer of explosives due to the operation of the dry friction force. This mode of interaction is realized in the case of an adiabatic shift when the steel impactor slides along the explosive surface. As a result of the friction force, their impactor–explosive contact boundary heats up, and the heat generated at the contact boundary spreads into the material of the impactor and the explosive under study. To determine the proportion of the heat flux propagating into the material under study [1] and the temperature of the contact surface, a combination of an expression is used to calculate the surface temperature of a body under the influence of a given heat flux [2] and the condition for equal temperatures on the contact surface.

The paper shows that the transition from dry friction to viscous friction is possible only when melting a certain final layer of the material under study. In this case, it is possible to heat the explosive surface above the melting point, which may eventually create conditions that lead to ignition of the molten explosive layer.

The conducted test calculations show that the developed mathematical model adequately describes the ignition of explosives due to the operation of the dry friction force and can be used to analyze the appearance of hot spots in a thin explosive layer in the case of adiabatic shear during sliding at low speeds of a steel impactor on the explosive surface.

[1] Landau L D and Lifshitz E M 1988 *Theoretical physics. In: Hydrodynamics, vol. 6* (Moscow: Nauka)

[2] Amosov A P 1996 *Journal of Samara State Technical University, Ser. Physical and Mathematical Sciences* **4** 208–235