ON THE NATURE OF DISTURBANCES AS A REASON OF DOUBLE-BASE PROPELLANTS PULSATING COMBUSTION

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Abstract: Theory of "spot-pulsed combustion mode" (SPC) phenomenon assumes two-dimensional disturbances as the cause of its appearance. An analysis of origination of combustion front disturbances has been performed for a particular case of double-base propellants. The theory of SPC considers a material as a single-component system and does not take into account the fact of the presence of nonvolatile component (nitrocellulose) and liquid volatile constituents — nitroglycerin and dinitrotoluen in the propellant. Consideration of a double-base propellant as a multicomponent system follows the formation of local zones of active evaporation and boiling of propellant liquid components on the charge surface to be a governing mechanism of disturbances onset. It is thus assumed that hotspots arise in places of local boiling of liquid components of a propellant. As a result, a certain volume of microporous nitrocellulose is created, which then rapidly burns out. The model experiment, demonstrating the pulsating mode of burning of gel containing volatile liquid and nonvolatile polymer has been described. In a general case of solid energetic medium, structural and/or kinetic irregularities of the charge surface can be a reason of combustion front disturbances.

Keywords: combustion; double-base propellant; hotspot-pulsed combustion

References

1. Marshakov, V. N., and B. V. Novozhilov. 2015. Teoreticheskie modeli ochagovo-pul'siruyushchego goreniya porokha i eksperiment [Theoretical models of hotspot-pulsed combustion of double-base propellants and experiment]. *Goren. Vzryv (Mosk.) — Combustion and Explosion* 8(2):121–128.
2. Beljaev, A. F., V. K. Bobolev, A. I. Korotkov, A. A. Sulimov, and S. V. Chuiko. 1973. Perekhod goreniya kondensirovannykh system vo vzryv [Transition of condensed system combustion into explosion]. Moscow: Nauka. 293 p.
3. Zarko, V. E., *et al.* 1977. Isparenie letuchikh i dispergirovanie pri gorenii nitroglitserinovogo porokha [Evaporation of volatile and dispersion at nitroglicerin propellants combustion]. *Gorenie condensirovannykh system*. Chernogolovka: JIChPh. 66–69.
4. Zenin, A. A., and S. V. Finyakov. 2009. Modified double-base propellants: Combustion wave parameters and burning rate response functions]. *Russ. J. Chem. Phys.* 3(3):448–457.

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