PREDICTION OF ACCELERATION ABILITY OF MIXTURES CONTAINING HIGH EXPLOSIVES AND ALUMINUM HYDRIDE

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Abstract: From the results of calculations, it follows that the addition of aluminum (Al) and aluminum hydride (AlH_3) significantly increases the potential energy content of HMX. This parameter is higher in the case of Al-containing mixtures. However, the compositions with AlH_3 form a considerable number of moles of gaseous products in distinction to the mixtures with Al. The acceleration ability (AA) of aluminized compositions was measured with the use of the method known as M-40 (acceleration of a steel plate from the end of a charge inside the thick-walled steel shell). Furthermore, the AA values were calculated for the systems containing Al and AlH_3. The results of studies demonstrated the possibility of increasing AA of high explosive (HE) by adding both Al and AlH_3. In the case of HMX (HE with negative oxygen balance (OB)), the AlH_3-containing compositions are inferior to the Al-containing ones in AA. The greatest increase in AA with the addition of AlH_3 should be expected in the case of HE with positive OB (such as bis(trinitroethyl)nitramine), the compositions with AlH_3 therewith should be superior to the Al-containing systems in AA.

Keywords: high explosive; acceleration ability; aluminum; aluminum hydride; nanocomposite

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Figure Captions

Figure 1 The potential energy store of the HMX-based compositions depending on the concentration of the additive: *1* — Al; and *2* — AlH_3. The experimental values of the heat of explosion for the mixtures containing the additive: *1* — Al(0.1); *2* — Al(7); and *3* — Al(15)

Figure 2 The volumetric values of the potential energy store (*a*) and the mole number of the gaseous products of explosion (*b*) for the HMX-based compositions depending on the concentration of the additive: *1* — Al; and *2* — AlH_3

Figure 3 The maximum value of the acceleration ability of the compositions based on the explosive (*1* — HMX; and *2* — bis(trinitroethyl)nitramine (BTNEN)) depending on the concentration of the additive Al (solid lines) and AlH_3 (dashed lines)

Figure 4 The acceleration ability of the compositions based on HMX (*a*) and BTNEN (*b*), depending on the concentration of the additive: *1* — nanocomposite with Al(0.1); mechanical mixtures with the additive: *2* — Al(0.1), *3* — Al(7), *4* — Al(15), *5* — AlH_3(7), and *6* — AlH_3(15). Signs — experimental values of the acceleration ability for the mixtures containing the additives

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