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Development of standards of chemical stability of filled nitrocellulose compositions

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“Vulcan-2005M” measuring-calculating complex.

Abstract

Works on a determination of standards of chemical stability of the filled nitrocellulose compositions depending on a content and a type of filler (octogen, hexogen, aprol, dazin) were carried out.

The study of the kinetic patterns of decomposition of composite compositions was carried out under conditions of forced aging using the measuring and computing complex “Vulkan-2005M”. The work of the “Vulkan-2005M” is based on the measurement of the vapor pressure of the decomposition of substances in a closed reaction chamber of primary converters in isothermal mode with the registration of the measurement results on a computer. The pressure in the reaction chambers is measured by a direct method using semiconductor strain gauge pressure modules. The signal from the measuring bridges of the strain gauge modules is transmitted to the instrument normalization amplifiers and then to a 24-bit analog-to-digital converter, from which the measurement data is transmitted to a computer for subsequent processing. The duration of the analysis was selected from the condition of achieving an excess pressure of 220 mm Hg (29 kPa), which on average corresponds to the pressure created at 1% decomposition of 1 g of gunpowder or explosives (assuming that for almost all explosives, the volume of products released during decomposition is about 700 cm³/g, and the volume of the reaction chamber is 28 cm³).

On the basis of a mathematical model of thermal decomposition kinetics, using the Arrhenius equation, forecasts of the duration of preservation of the operational properties of the cellulose nitrate–filler compositions were calculated, which showed a satisfactory coincidence of the forecast results with the known experimental data.

The norms of chemical resistance of the compositions, depending on the content and type of filler, are established, which do not exceed 20 kPa.

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