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Crystallization of Cl-20 using an ultrasonic nebulizer

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Abstract

At present, the cyclic nitramines are the basic components in the development of mixed solid rocket fuels (CPTTs). They are distinguished by high density and enthalpy of formation in combination with low sensitivity to mechanical influences in comparison with nitrate-ethereal components.

Among cyclic nitramines in recent years, special attention is being paid to developers of CPTT by 2,4,6,8,10,12-hexanitro-2,4,6,8,10,12-hexaazaisowurtzitane, commonly known as CL-20. The physicochemical and explosive properties of this compound directly depend on the polymorphic composition, as well as on the shape, size and morphology of the crystals. A set of these characteristics is laid in the crystallization stage of CL-20, which makes it one of the key in the synthesis of nitramine.

The results of crystallization of CL-20 with the use of an ultrasonic nebulizer are presented, which makes it possible to obtain crystals of a high-energy compound of spherical shape and an average size of 10-40 μm.

The influence of a number of technological parameters, such as the power of ultrasonic vibrations, the type of solvent, and the concentration and rate of supply of the working solution, on the size and morphology of the crystals formed is shown.

The polymorphic composition of the product contains a mixture of α- and β-polymorphs and depends on the type of solvent have been found. The proportion of crystals larger than 50 μm did not exceed 2%, which indicates the promise of this method for obtaining fine and ultrafine CL-20 fraction without an additional stage of classification.

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