INVESTIGATION INTO 2,4-DINITROANISOLE – PENTAERYTHRITROL TETRANITRATE MIXED COMPOSITIONS

A. N. Maloyaroslavtsev, A. V. Sarafannikov, A. I. Akhmetzyanov, A. Yu. Tarasov, K. A. Gaisina

FSUE «RFNC – VNIITF named after Academ. E. I. Zababakhin», Snezhinsk, Russia

Currently, one of the challenging problems is finding binders that enhance the operating characteristics of cast mixed HEs without degrading their processing characteristics. One of such binders is 2,4-dinitroanisole (DNAN), an energy material that is used as a fusible component in cast mixed HEs with reduced sensitivity to external factors [1, 2]. DNAN is widely used in explosive compositions in the countries of the NATO alliance [3–6].

The paper presents the feasibility of using DNAN as a fusible matrix in two-component fusible mixtures with other HEs, for example, with pentaerythritrol tetranitrate (PETN), which presumably will enhance energy characteristics and at the same time reduce sensitivity to external factors. The paper presents the results of investigation into PETN/DNAN mixtures with different mole ratios of components. It also provides fusibility and heating diagrams based on melting temperatures (TM) and intensive decomposition temperatures (TID) determined by the differential scanning calorimetry method (DSC).

In the considered compositions with DNAN concentrations ranging from 20 to 90%, the first endothermic peak corresponds to melting of DNAN in the composition, while the second peak corresponds to PETN melting.

The analysis of thermal properties has shown that no eutectic mixture is formed, but the components reveal a reciprocal influence on their melting temperatures. This dependence is shown in Fig. 1. The DSC curves of PETN/DNAN alloys show one or two exothermal peaks (Fig. 2) pertaining to decomposition of each component in the mixture.

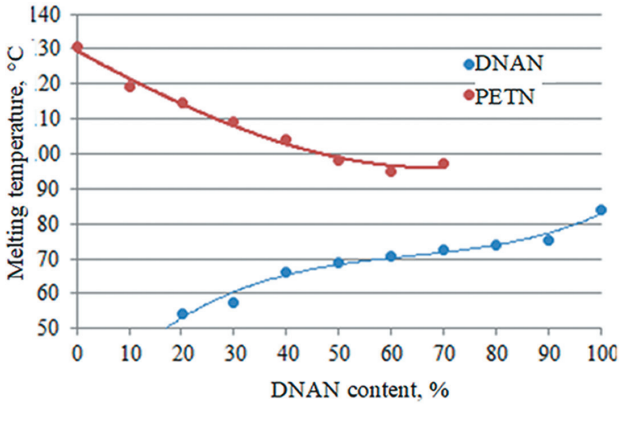

Fig. 1. TM of PETN/DNAN alloys vs. DNAN content in the mixture

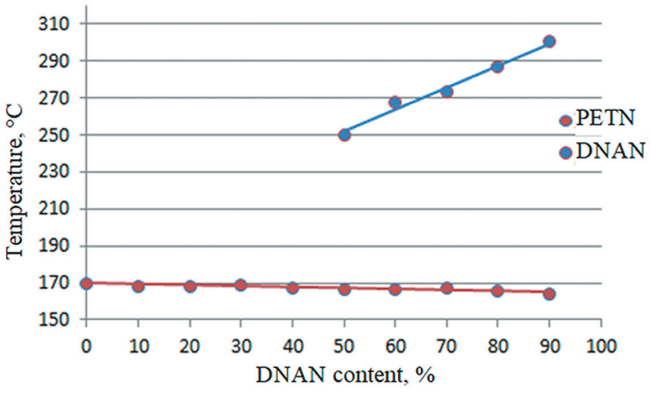

Fig. 2. TID of PETN/DNAN alloys vs. DNAN content in the mixture

The temperature of intensive PETN decomposition appears to be independent of DNAN concentration in the alloy, since TID difference doesn't exceed ≈5°C. We can also observe an increase in ΔT (the difference between TID and TM) of the most sensitive component (PETN); the dependence of ΔT on DNAN concentration in the mixture is shown in Fig. 3.

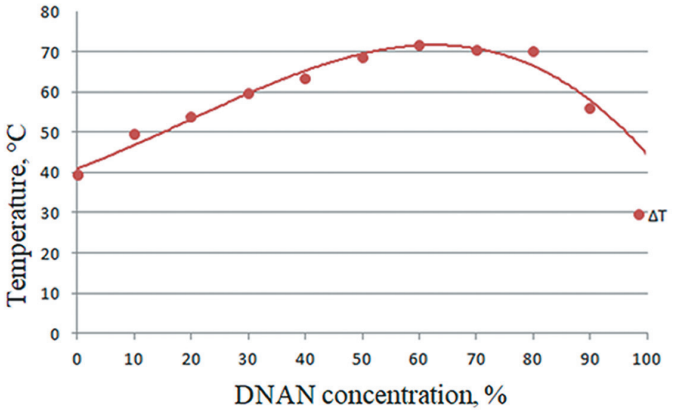

Fig. 3. ΔT vs. DNAN concentration in the mixture

In the course of our studies, the reciprocal influence of components on their melting temperatures in PETN/DNAN mixtures has been observed, while no eutectic mixture has been formed. The melting temperature of PETN in the mixture decreases by 48°C, with the temperature of intensive decomposition remaining approximately constant. The obtained results suggest that it is feasible to manufacture and process cast fusible mixtures using the existing equipment. In the meanwhile Meanwile, the DNAN polymorphism and the absence of an eutectic mixture in the process of heating the compositions under study limit their applicability in mixed HEs and require further studies.

References

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