INVESTIGATION OF THE POSSIBILITY OF CURING PLASTIC EXPLOSIVE COMPOSITIONS

L.G. Sukhova, G.P. Kutsenko, Candidate of Technical Sciences, A.S. Gladkov, S.P. Luneev, O.V. Sosnin, E.A. Prokudina, E.A. Gladkova, A.O. Lobaev
JSK «GosNII «Kristall», E-mail: kristall@niikristall.ru

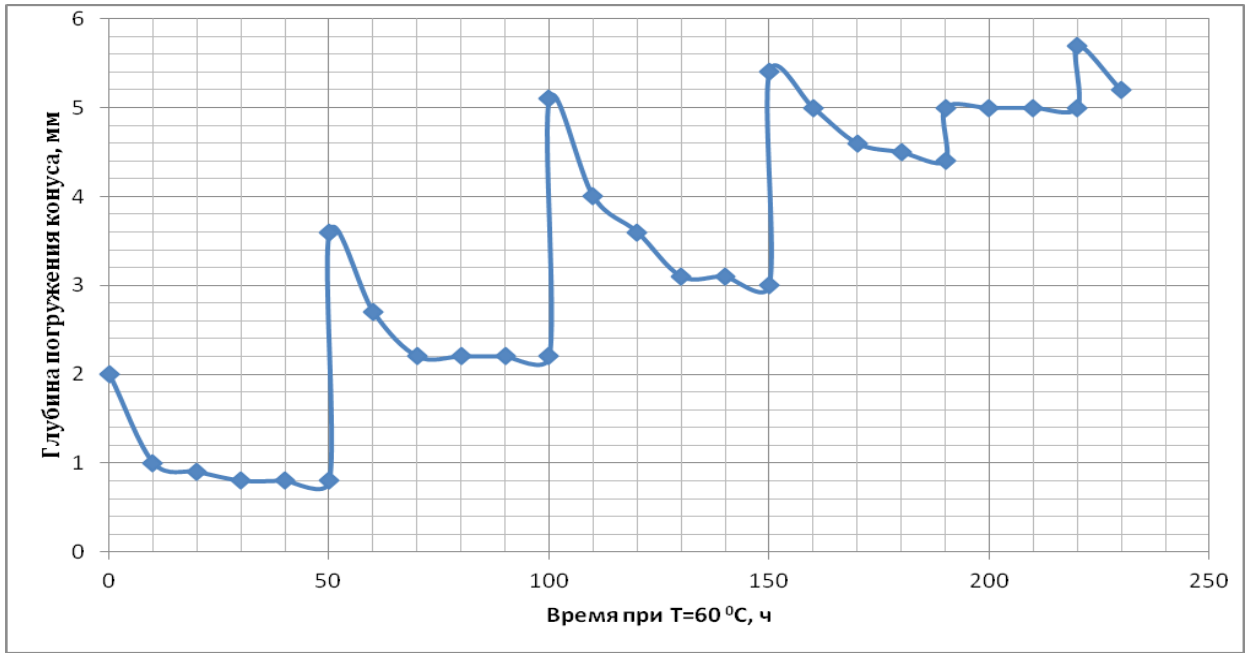
Plastic bonded explosives (PBX) are used in many ammunitions, mainly where filling other types of explosives is difficult. They found the most application at filling of channels detonation distributors, as additional detonators in fusing devices, anti-tank mines and in engineering ammunition.

Having satisfactory adhesion, PBX well kept in products and does not require special fastening methods.

Disadvantages of PBX is the ability to change shape under intensive and prolonged vibration or impact loads, as well as structured, that leads to internal stresses in the mass of explosives, mainly in the surface layer of the charge. Structuring is not irreversible, rolling or manual kneading seamlessly easily destroys the induced bonds in the mass of the composition.

To reduce the degree of structuring we have conducted experiments on multiple thermostatting the sample of composition at 60 °C for a long time and next its rolling every 50 hours of thermostatting.

After each thermostatting and each rolling, the plasticity of the composition on the penetrometer was determined. The test results are shown in Figure 1, where shows the dependence of the penetration index (i.e. the depth of immersion of the cone) from the number of cycles thermostatting and rolling.



Time at T=60 °C, h
Depth of immersion of the cone, mm

Figure 1: dependence of the penetration index from thermostatting time

From the diagram shows that after each thermostatting the toughness of the composition is increasing, but the subsequent rolling sharply increases the plasticity of the composition, and the composition becomes more plastic than it was after the previous cycle. After 3 cycles of plasticity reaches a maximum and then practically does not change.

Experience has shown that one, two-time thermostatting of the composition with subsequent rolling slows the process of structuring up to 4-6 months, but does not completely exclude.

Delete the structuring, increase strength and give the products from PBX of solid (hard-lined) form can by curing. Traditionally, rubbers are cured using sulfur cured.

However, the use of sulfur cured for low-molecular-weight of butadiene rubber based on PBX of led to some negative phenomena. First of all for cured it was required to introduce into the composition in two to three times more cured agents compared to that recommended for cured of rubber compounds. In addition, thanks to the presence of cured agents, the PBX has become much more hard-lined that complicates the filling process. Cured agents were selected so that cured was carried out at a temperature

not exceeding 100 °C. Experiments have shown that during thermostatting in the air medium, the curing process ended within 10 to 15 hours. If the curing took place water vapour medium, the process ended through 1 to 1.5 hours, probably due to the better heat transfer. However, aging in a water vapor medium is technologically inconvenient, especially if large products are to be thermostated.

The disadvantage of sulfuric cured was also that PBX after cured loses both and plastic and elastic properties, becoming hard and brittle.

Therefore, it was suggested cured PBX using quinoline ether EQ-1. The results of experiments on the use of quinoline ether EQ-1 as cured agent are given in table 1.

Table 1 – curing of PBX

Curing process	Curing time, hour			Result
	water vapor	air		
		80 ^{0}C	90 ^{0}C	
Sulfury	1,0 – 1,5	–	10 – 15	Solid sample, brittle
Quinoline ether EQ-1: – 1 % – 0,7 %	 – –	 3 – 5 3 – 5	 1,0 1,0 – 1,5	Durable sample, slightly elastic

Introduction quinoline ether into PBX increased the plasticity of the composition is probably the quinoline ether also performs the function of surfactant in this composition. For curing was sufficient to introduce 7-10 parts of quinoline ether on 100 parts of rubber. At the same time, the most important is that the curing was completed in the air medium at a temperature of 90 °C in about 1 hour. Curing is possible at 80 °C, but the time increases to 3 - 5 hours. Completion of curing was determined using penetrometer. The viability of PBX containing the quinoline ether is not completely defined, but is several months.

The composition cured using quinoline ether had a durable solid system with a small elasticity, in which cracks formation and integrity failure is impossible. Curing also increases to the bonding durability of PBX with body of the detail in which it is placed. Cured plastic explosive composition can be used for filling products with special severe operating conditions.