TATB PERFORMANCE AND SENSITIVITY

Paul E. Kramer

DEVELOPMENT DIVISION

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Normal Process Development
Endeavor No. 106

MASTER

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ABSTRACT

Plans for cylinder and wedge tests with pure TATB were delayed by a series of puzzling density reports. Investigation of the density problem revealed that nominal density pressings (95 - 96 percent TMD) of pure TATB can absorb appreciable amounts of water.

One wedge test was conducted with a sample which had absorbed water.

An attempt to determine why gap test results differ for machined-to-shape and pressed-to-shape charges was inconclusive.

DISCUSSION

Wedge tests on TATB have previously been confined to RX-03-BB, but emphasis on pure TATB applications has stimulated interest in obtaining wedge test data for the HE with no binder. Pressed-to-shape parts for gap tests had indicated a nominal density of 1.86 to 1.87 g/cm³ for most lots of pure TATB and 1.86 g/cm³ seemed to be quite common for machined parts shipped to LLL, so a request was submitted for wedge test samples at 1.86 g/cm³.

When the parts were received, the reported densities (dry-wet procedure) were about 1.86 g/cm³ but it was noted that the billet density was only 1.84 g/cm³.

One half of the billet remained and a check showed a value of 1.84 while repeated measurements of the wedges still indicated 1.86. Some peripheral machining scraps were tested and all showed densities between 1.85 and 1.86 g/cm³. Further investigation revealed that the pieces readily absorbed appreciable amounts of water. This not only increased their density; the fact that the wet weighing followed the dry weighing caused an excessively high calculated density. Since the effect of water absorption on average density is dependent upon the ratio of surface area to volume, the density figures for the billet and half-billet were sure to be the most accurate, and indeed, density calculations made using weight and dimensions agreed well with the dry-wet results for the half-billet.

It was found that a 100 g part at 96% of TMD could easily absorb 0.4 g of water during a few minutes of submersion. This means that about 10% of its original void space was filled, and it is likely that the absorption was close to 100% near the surface. A pressed-to-shape TATB pellet, which might have been expected to have a relatively impervious skin, also absorbed water readily. However, a pressed-to-shape pellet of RX-03-BB at 98% of TMD showed no water absorption during a 30 minute submersion.

The effects of absorbed water in TATB have not been investigated thoroughly, but it is certainly conceivable that both physical properties and compatibility could be adversely affected, and it is very likely that filling voids with water would negate the increase in shock sensitivity obtained by using binderless TATB.

It is not presently known if drying TATB pieces which have absorbed water can yield a satisfactory product. Until this question is answered, all machining of pure TATB at Pantex will be done (remotely) with no coolant. Further, dry-wet densities will be taken only on large billets. The billet density will be used for machined parts which are not amenable to dimensional density determination.

Whereas it was previously thought that isostatic pressing yielded TATB parts with densities of 1.86 to 1.87 g/cm³, it now seems likely that values of 1.84 to 1.85 g/cm³ are more representative. It is also evident that repressing yields less density improvement than with RX-03-BB.

One wedge test for pure TATB was assembled and fired before the water absorption problem became evident. It is known that the tested part had ample opportunity to absorb water. It is also known that when a part sits in a rather dry bay for several days, as this one did, that it can release an appreciable amount of its absorbed water. However, no measurements of this effect or its significance have been made. There is no indication of how representative of dry TATB the test results are. Dry pieces from the remaining half-billet will be tested soon.

Wedge Test Results for TATB Containing
Unknown Quantity of Water

($\rho_0 \sim 1.84 \text{ g/cm}^3$)
(Detonation Velocity: 7.4 to 7.6 km/s)

<u>Transmitted Pressure (GPa)</u>	<u>Distance To Detonation (mm)</u>	<u>Time To Detonation (μs)</u>
12.9	3.0	0.54 - 0.55

Cylinder test parts of 51 mm diameter were made from a typical Pantex lot of TATB and will be fired to provide a performance standard for TATB. An identical shot will be fired at LLL. Parts for a 25 mm test have also been fabricated to see if pure TATB can perform adequately at that diameter. Parts (51 mm) have also been prepared from a Cordova lot containing approximately 5% extractable impurities to see what effect those unknown impurities have on energy output. (No effect on gap sensitivity was observed.)

Gap tests with RX-03-BB have consistently shown machined samples to be more sensitive than those which are pressed to shape. One theory attributes this phenomenon to the existence of a high density "skin" on the pressed parts. A group of normal 25.4 mm long samples was pressed using LLL Blend 9, already tested using machined parts. Another group of pieces about 3 mm longer was pressed. One end was faced off each long piece to produce a length of 25.4 mm. During testing, the machined end was oriented toward the LX-04 donor.

The difference in results for the two groups was insignificant (0.06 mm). The expected difference for a normal machined group at the same density would be about 0.4 mm. Thus, it does not appear that a "skin effect" is responsible for the lower sensitivity of pressed-to-shape gap test parts.