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# RECYCLE PROCESS FOR TATB PBX PARTS

A. Gordon Osborn
Thomas L. Stallings
Herbert D. Johnson

DEVELOPMENT DIVISION

DECEMBER 1978

*Process Development*

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# RECYCLE PROCESS FOR TATB PBX PARTS

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## ABSTRACT

A process was developed for recycling scrap TATB PBX parts into reusable PBX. Pressed densities of two lots of RX-03-BB formulated from scrap parts were found to be slightly above normal and physical strengths were adequate.

## INTRODUCTION

TATB PBX scrap is generated in two forms, flakes from fine semigranular machine cuttings, and solid parts. The solid parts are pretested physical property specimens, unused machining parts or reject pressings. During production the estimated reclaimable material will be 50% machine cuttings, and 50% in the form of pressed pieces. Previous development work on recycling TATB PBX scrap has involved only machine cuttings. This form of scrap is more easily recycled since the small flakes lend themselves to immediate reprocessing without additional grinding or dissolving steps which are required with larger solid pieces.

A method was developed to recover the larger solid scrap parts by dissolving the parts in a solvent. Only the Kel-F is dissolved, while the insoluable TATB particles remain in the slurry. Thus, in a single step, solid parts can be reduced to a form suitable for immediate regranulation. Two lots of RX-03-BB were regranulated from dissolved parts. For one lot a modification of the Pantex procedure was used in the 30-litre reactor, while for the other larger lot, a modification of the Holston processing method was used in the 300-gallon kettle. The rate of solution of the scrap parts, the particle size distribution of the reclaimed TATB and physical properties of the reclaimed material were measured. These results are presented in Table I and Figs. 1, 2 and 3. Also, included for comparison are data from recycled machining scrap, a lot of RX-03-BB regranulated from machine cuttings, No. 7027-145-01(*1*), and average physical properties of eight standard lots of RX-03-BB(*2*), made from virgin TATB.

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*(1) A. Gordon Osborn, Thomas L. Stallings and Herbert D. Johnson, Recycling TATB PBX, MHSMP-78-3 (February 1978).*

*(2) A. Gordon Osborn, Thomas L. Stallings and Herbert D. Johnson, TATB PBX Development (Particle Size), MHSMP-77-18D (March 1977).*

Table I. Reclaimed TATB PBX Physical Properties

| Identification No. | Lot Size (kg) | Bulk Density | Pressed Density | % TMD | Tensile Stress (MPa) | Tensile Strain (%) | Compression Maximum Stress (MPa) | Compression Maximum Strain (%) | Compression Ult. Strain (%) | Particle Size <44 μm (%) | Particle Size <20 μm (%) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7279-145-01 | 3.5 | 1.1 | 1.905 | 98.0 | 8.2 | 0.13 | 23.7 | 1.0 | 1.1 | 72.2 | 39.3 | Solid Parts |
| 8224-145-03 | 173.0 | 1.0 | 1.906 | 98.1 | 8.7 | 0.21 | 24.9 | 1.2 | 1.4 | 71.0 | 46.9 | Solid Parts |
| 7027-145-01[a] | 120.0 | 1.0 | 1.911 | 98.3 | 13.2 | 0.30 | 26.6 | 1.5 | 1.9 | 69.9 | 47.3 | Machining Scrap |
| RX-03-BB[b] | 3360.0 | 0.9 | 1.901 | 97.8 | 10.1 | 0.35 | 24.5 | 2.4 | 7.5 | 40.7 | 21.8 | New TATB |

[a] *MHSMP-78-3*

[b] *Average of eight lots made from virgin TATB (MHSMP-77-18D)*

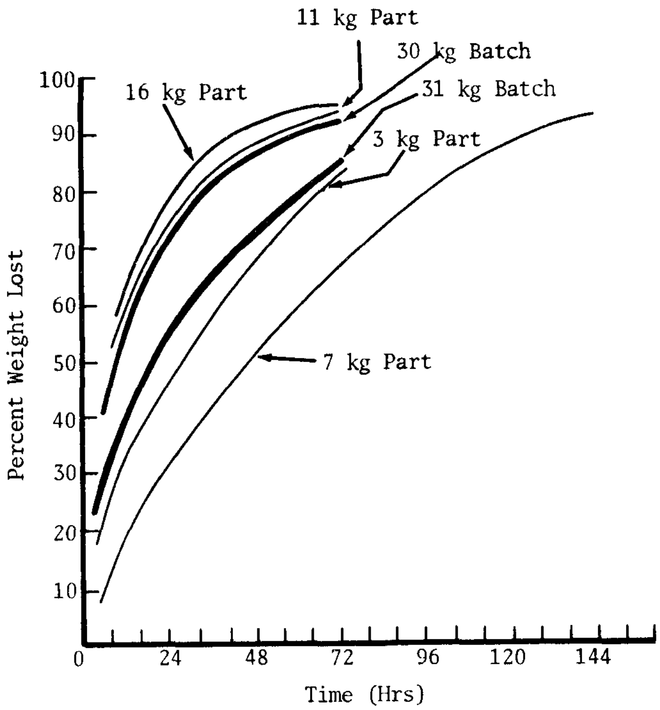


Fig. 1. Dissolving Rate (Economy Mill)

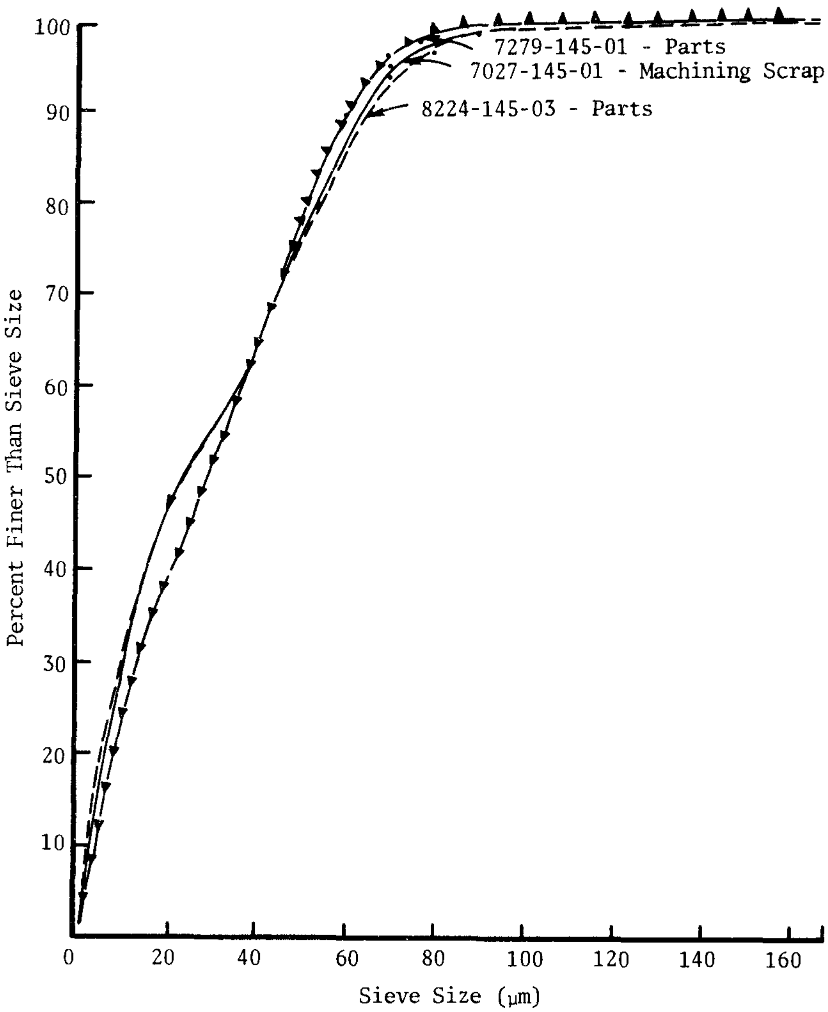


Fig. 2. Cumulative Distribution Reclaimed TATB

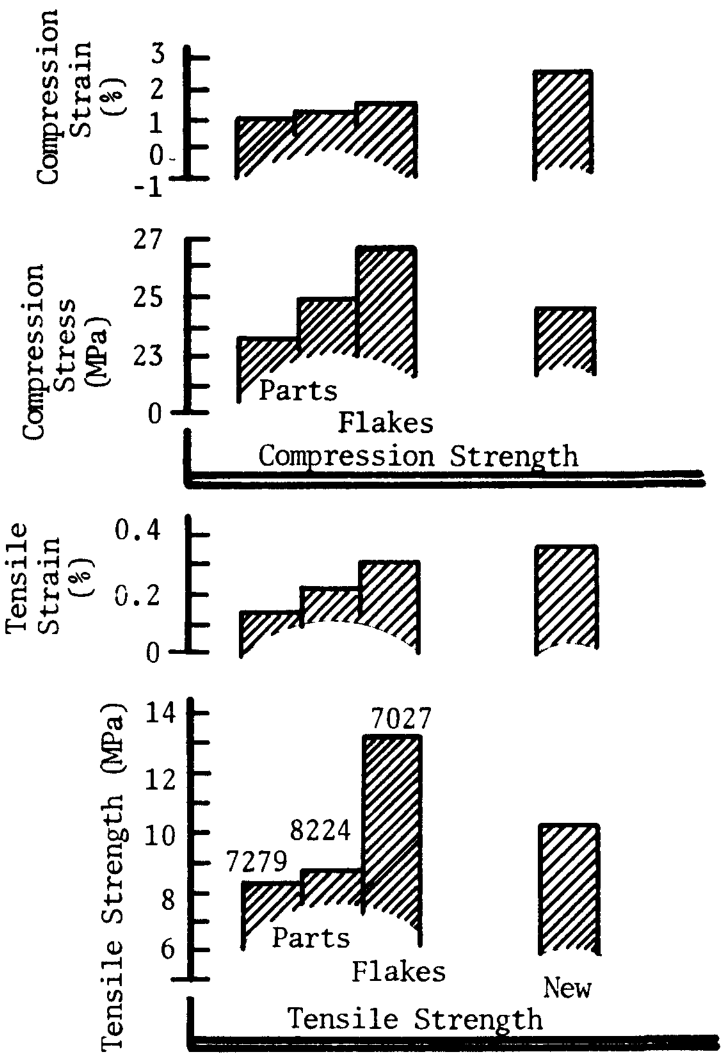


Fig. 3. Evaluation of Reclaimed RX-03-BB

## SOLUTION OF SCRAP PARTS

The scrap parts were dissolved in an Economy Pebble Mill. The mill was modified by removing the ceramic balls and adding solvent. The rotating motion of the mill continuously abraded and dissolved the TATB parts. Approximately 19 litres (5 gallons) of ethyl acetate was mixed with approximately 32 kg (70 pounds) of TATB scrap. Mill rotation was continuous at 20 rpm. The mill size is 0.53 m in diameter by 0.71 m long with a sealed side opening of 0.19 m by 0.29 m. Fig. 1 shows the approximate solution rate for various size pieces including two batches of miscellaneous parts. These results were obtained by stopping the mill daily to estimate the weight of the parts remaining undissolved. As shown in Fig. 1, there is wide variation in the rates of solution. Generally, between 55 and 75% of a given batch of material is dissolved in a 24-hour period.

## REGRANULATION-PANTEX PROCEDURE

Scrap dissolved in the Economy Mill was regranulated into a small lot of RX-03-BB using a modification of the standard Pantex procedure. The RX-03-BB was first dissolved in ethyl acetate in the mill, regranulated in the 100-gallon kettle and dried to remove the ethyl acetate. A small 3.5 kg batch (No. 7279-145-01) was granulated by the Pantex process in the 30-litre reactor to yield material for pressing and testing. This slurry procedure employes a 133 g/litre RX-03-BB/water ratio, using an MIBK and NBA solvent system and applying heat and an air sweep to remove the solvent and form the granules.

## REGRANULATION-HOLSTON PROCEDURE

Lot No. 8224-145-03 is a 173 kg blend of two batches regranulated in the 300-gallon kettle by the Holston processing method. The Holston and Pantex processing methods for making TATB PBX differ as to solvent system and method to achieve granulation. The solvent used by Holston is ethyl acetate, which has a relatively high water solubility. A slurry is formed at a low water level with the TATB and the lacquer, then the granules are formed by adding sufficient water to extract the solvent thus causing granule formation. The solvent is then stripped by distillation. Scrap RX-03-BB dissolved in ethyl acetate in the mill is thus suitable for immediate reprocessing by the Holston method. Incorporated into both the Pantex and Holston procedures is a clean-up step. All recycled material, after solution in a solvent and before regranulation, is strained through a grid to remove foreign inclusions which may have inadvertently become incorporated into the material.

## PARTICLE SIZE

The TATB particle size data obtained from the two lots regranulated from solid parts are shown in Fig. 2. Also included are results of a lot reported previously(*1*), which was regranulated from machine cuttings. As shown from the cumulative distribution plot, there is very little difference in the particle size distribution from TATB extracted from scrap parts or machine cuttings. However, the recycling processes for both types of material reduce the TATB particle size considerably compared to virgin TATB.

## PRESSABILITY

As shown in Table I, pressed densities are well within the normally expected range for pressings used for physical properties specimens. Though the reclaimed material may have densities slightly higher than normal RX-03-BB, the density variations are minimal and do not reveal differences that may be attributed to the use of recycled RX-03-BB or differences in TATB particle size distribution.

## PHYSICAL STRENGTH

Tensile and compression strengths of the four lots of RX-03-BB listed in Table I are graphically displayed in Fig. 3. Both tensile and compression stress and strain levels exhibit the same trends. The small lot made in the 30-litre reactor has lower stress and strain than the larger lot made by the Holston procedure. Of the recycled group in Fig. 3, the lot made from machine cuttings or flakes has the highest values. However, the physical strengths of all of the recycled lots are adequate.

## CONCLUSIONS

The feasibility of recycling and recovering TATB PBX has been successfully demonstrated. Scrap parts can be dissolved, regranulated and yield adequate physical properties. Also, the feasibility of recycling flakes produced by machining has been demonstrated and previously reported(*1*).

The recovery of solid parts posed more of a problem than the machine cuttings or flakes since the size of solid parts must be reduced. Dissolving was chosen over grinding for size reduction. A very strong grinder would be required since RX-03-BB is a very tough material. Also additional machining would be required to saw parts to a size which would fit into the jaws of a grinder. The ground parts would ultimately be dissolved in a solvent and then regranulated.

By using a dissolving chamber, scrap parts are placed directly in a solvent chamber and prepared for regranulation in a single step, with very little labor involved. The only limit to the size of a part or the quantity of material dissolved is the size of the solution vessel and the opening into the vessel.

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