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TATB PBX Formulations

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DEVELOPMENT DIVISION

OCTOBER - DECEMBER 1975

Normal Process Development
Endeavor No. 106

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ABSTRACT

Preliminary process development to establish a procedure for recycling RX-03-BB from machine cuttings was begun. An acetone precipitation process followed by pelletizing with TF Freon in the 30-litre reactor appears to yield a PBX with acceptable physical properties.

Process development work on a large scale in the 300-gallon kettle was continued. LLL B8 was made in a single large 340 kg batch and subsequently reworked to improve tensile properties. LLL B9 was made in 5 sub-batches and blended into a 490 kg lot. It is being evaluated for physical properties.

A 45.4 kg batch containing 5% Kel-F 800, RX-03-AU, which is similar to LASL's X-0290 formulation has been tested.

DISCUSSION

The limited availability and the high cost of TATB powder makes it desirable to reclaim all material possible. Therefore, a program to develop a processing technique which will yield satisfactory physical properties using recycled material was initiated.

Three of the four batches made in the 30-litre reactor listed in the first part of Table I were made using recycled RX-03-BB machine cuttings. The tensile and compression curves are shown in Figs. 1 and 2, and Figs. 3 and 4 contain photographs of broken test specimens. Batch No. 5300-04 gives an indication of the physical properties of recycled material, processed by the standard slurry process. As shown, tensile properties are exceptional; however, compression strain is low and breakage occurs between granule boundaries, which is not desirable. For batches 5302 and 5304-03, recycled machine cuttings were mixed with acetone to dissolve the Kel-F and subsequently precipitated into water. Batch 5302 was carried one step further, i.e. a small amount of TF Freon was added for pelletization. Material as precipitated from the acetone is quite dusty after drying, while the pelletization eliminates the dust and simplifies handling. Physical properties of both these batches were similar and reasonably good. Apparently the additional pelletization step does not degrade physical properties. Breakage, as shown, is uniform across the specimens. The other 30-litre reactor batch, No. 5293, used new TATB (LLL B6) and was made by the slurry process using TF Freon as the solvent for the lacquer instead of the MIBK/NBA combination which is normally used. Based on the low strain obtained on the compression test, the TF Freon appears to offer no real advantage as a solvent for the slurry process.

Batch 5240, formulated from LLL B8 TATB, was an attempt to produce a large 340 kg lot of RX-03-BB in a single batch in the 300-gallon kettle. This large scale experiment utilized a wetting agent and a different

slurry procedure for producing large LLL blends. Tensile properties were low as shown in Fig. 5 and the batch was subsequently reworked by the standard process using smaller batch sizes before blending into the large lot, No. 5300-02. Compression data are shown in Fig. 6 with broken specimens shown in Fig. 7.

LLL B9 batch, No. 5315-04, was made in 98.1 kg sub-batches. Difficulty was encountered while making the 18.1 kg pressing for physical properties—the cycle was interrupted—therefore, another pressing (3.4 kg) was made. The physical properties results (Figs. 8 and 9) indicate that the interrupted cycle on the 18.1 kg pressing did not affect the properties and that there is little difference in properties for specimens made from the different size pressings. Only one each broken specimen for the tensile and compression tests is shown in Fig. 10 since they are representative of both size pressings.

A 45.4 kg formulation of RX-03-AU was reported made last quarter. This is a 5% Kel-F 800 formulation similar to the LASL X-0290 formulation. Stress-strain curves of the RX-03-AU are shown in Figs. 11 and 12 and broken specimens are shown in Fig. 13.

FUTURE WORK; COMMENTS; CONCLUSIONS

Considering all of the large LLL PBX blends, the successive trend has been for a continual improvement in physical properties. An area which is being investigated is the procedure for blending the large lots. An experimental program has begun on a small scale to establish actual blending limits for the wet blending process.

TATB PBX can be recycled by the acetone precipitation process to yield a material with adequate physical properties. This program will be enlarged to evaluate other solvents for pelletizing the material and scaled to include large 45 kg batches in the 300-gallon kettle.

Table I. RX-03-BB TATB/7.5% Kel-F 800 PBX - Physical Strength

Batch No.	Description	Vessel	Batch Wt. (kg)	Pressing Wt. (kg)	Physical Properties					
					Compression[c]			Tensile[d]		
					(psi)	(MPa)	Strain	(psi)	(MPa)	Strain
5293	Slurry Process with TF Freon LLL B6 TATB (3.6 kg Batch)	30 Litre	3.6	3.4	3530	24.34	1.14	1167	8.04	0.17
5300-04	Standard Slurry Process Recycled PBX (2 ea 1.8 kg Batches)	30 Litre	1.8	3.4	3919	27.02	1.04	1500[a]	10.30[a]	0.23
5304-03	Acetone Precipitation Recycled PBX (2 ea 1.8 kg Batches)	30 Litre	1.8	3.4	3585	24.72	4.63	1385[a]	9.55[a]	0.18
5302	Acetone/TF Freon Pelletizing Recycled PBX (3.6 kg Batch)	30 Litre	3.6	3.4	3534	24.36	4.53	1342	9.25	0.16
5240	LLL B8	300 Gal	340.0	3.4	2497	17.20	5.45	720	4.96	0.09
5300-02	LLL B8 Reworked	300 Gal	77.7	18.1	2563	17.67	6.60	1187	8.19	0.28
5315-04	LLL B9 - Off Cycle Pressing	300 Gal	98.1	18.1	2684	18.50	6.85	1078	7.40	0.18
5315-04	LLL B9	300 Gal	98.1	3.4	2645	18.24	7.50	1035[b]	7.13[b]	0.18
5246	RX-03-AU (5% Kel-F 800)	300 Gal	45.4	3.4	2362	16.29	4.70	978	6.74	0.20

[a] *Test Terminated - Breakage in End Cap - Actual Strength Equal to or Greater Than Shown.*

[b] *Breakage at the beginning of the Radius Section.*

[c] *Compression - 0.001 mm/sec constant crosshead speed.*

[d] *Tensile - 0.002 mm/sec constant crosshead speed.*

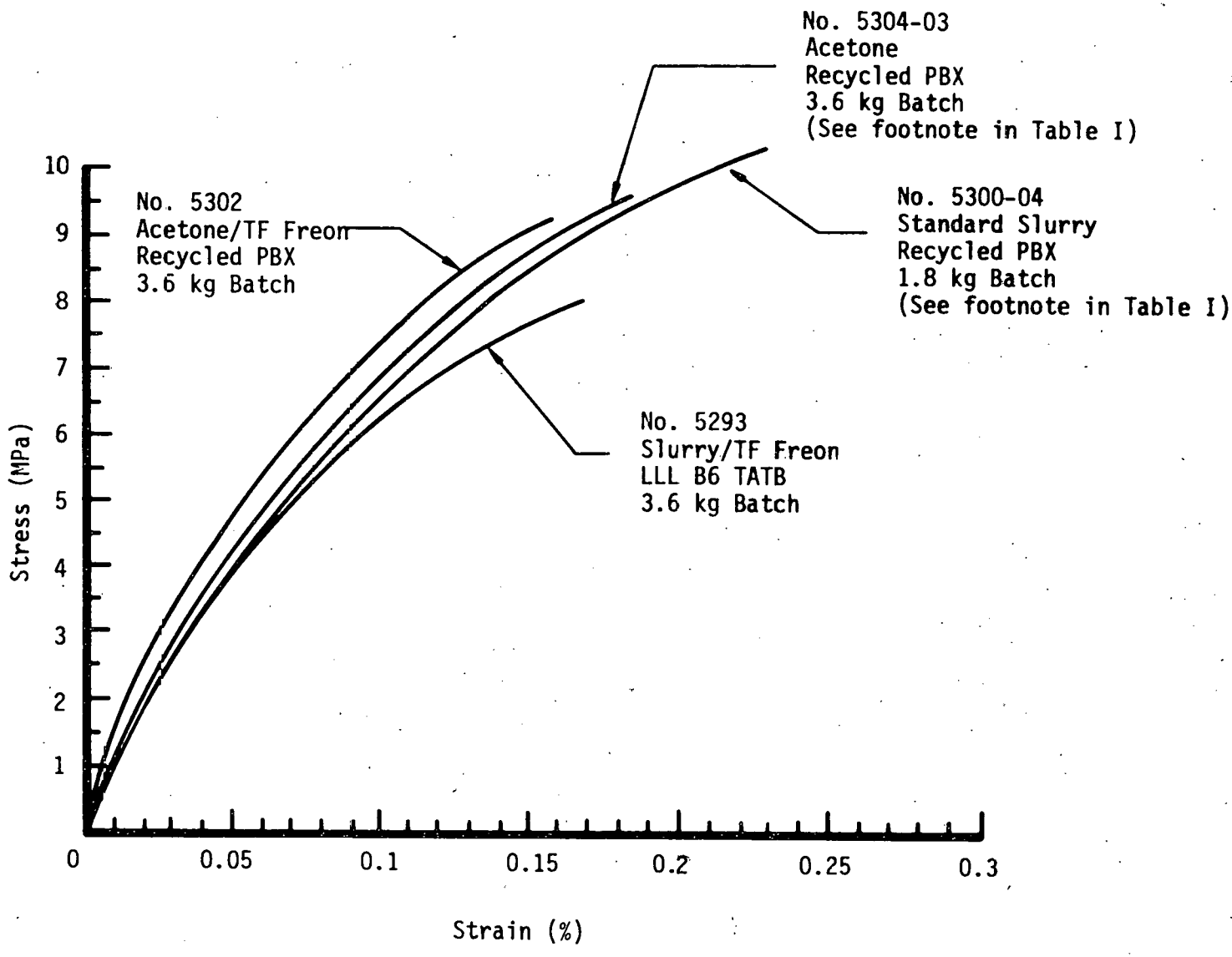


Fig. 1. Tensile Test - RX-03-BB, 30-Litre Reactor

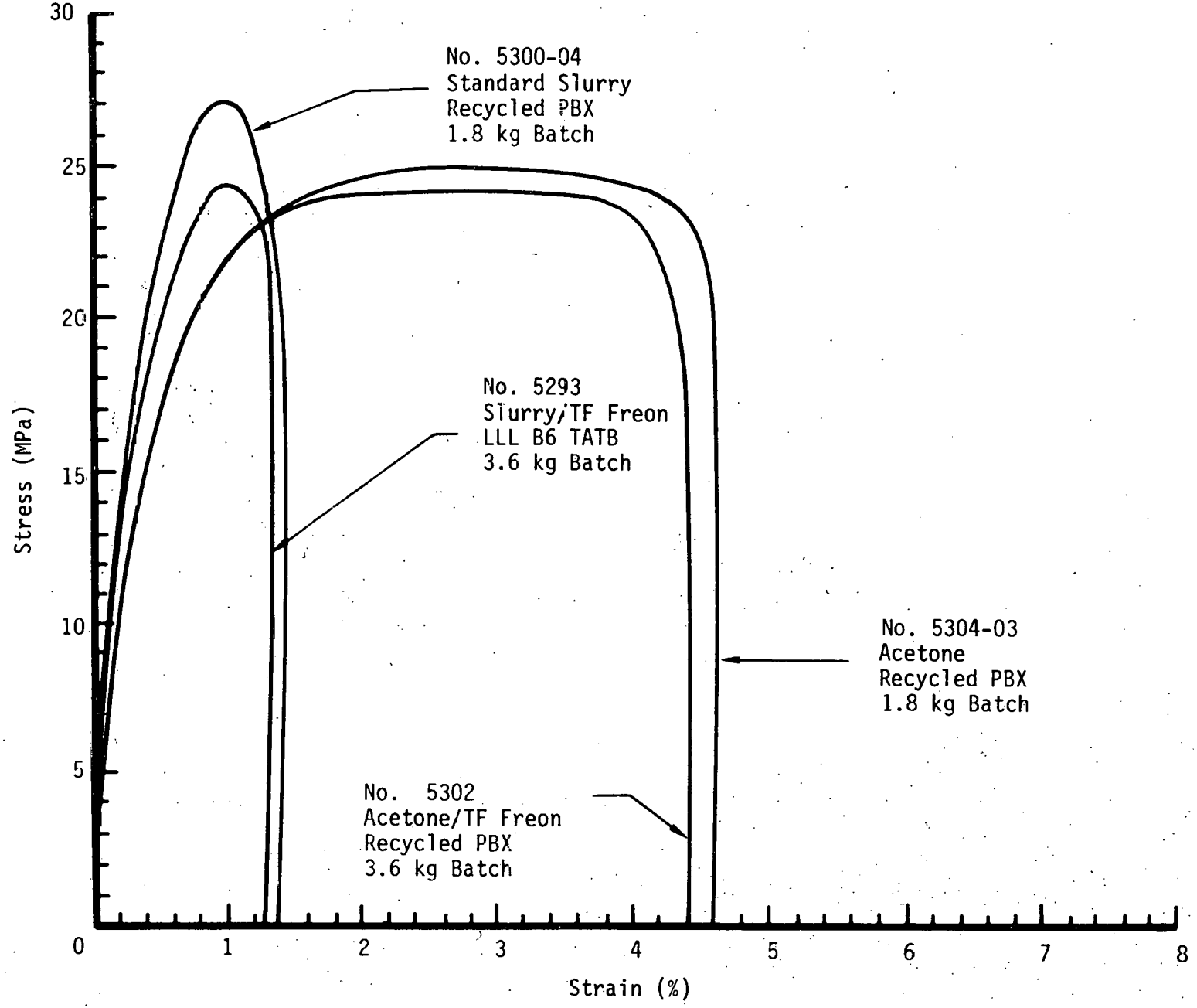


Fig. 2. Tensile Test - RX-03-BB, 30-Litre Reactor

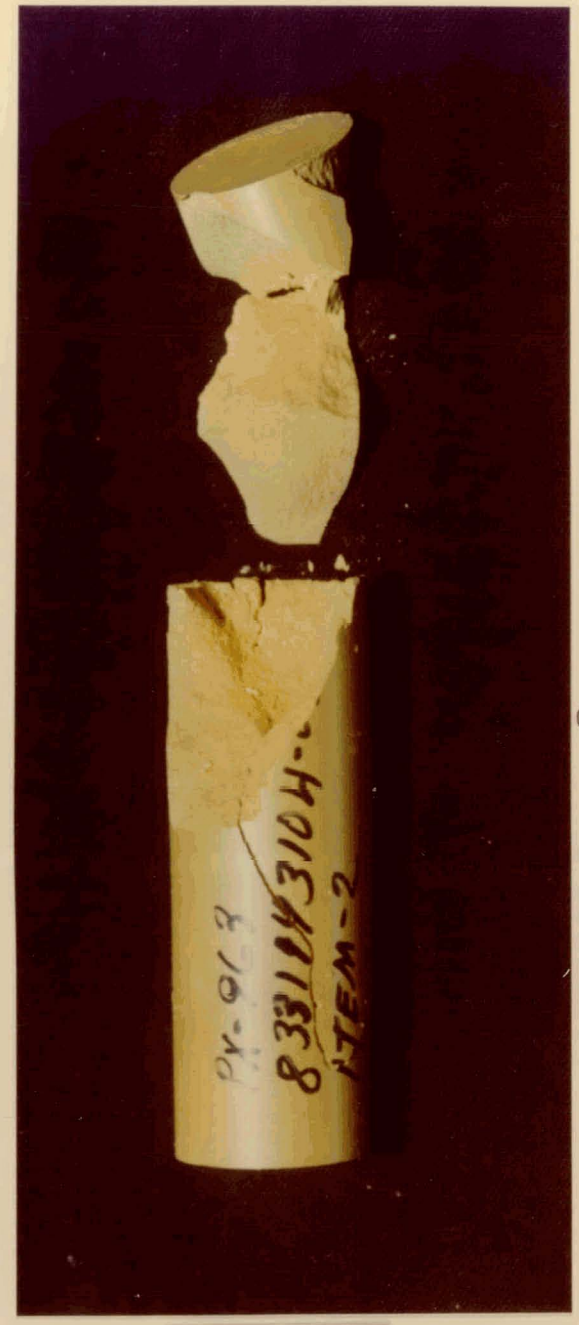
Compression

Tensile

No. 5293 - Slurry/
TF Freon LLL B6 TATB -
3.6 kg Batch

No. 5300-04 Standard
Slurry Process Recycled
PBX - 1.8 kg Batch

Fig. 3. RX-03-BB Broken Test Specimens (30-Litre Reactor)



Compression

Tensile

No. 5304-03 Acetone - Recycled PBX - 1.8 kg Batch

No. 5302 Acetone/TF Freon - Recycled PBX - 3.6 kg Batch

Fig. 4. RX-03-BB Broken Test Specimens (30-Litre Reactor)

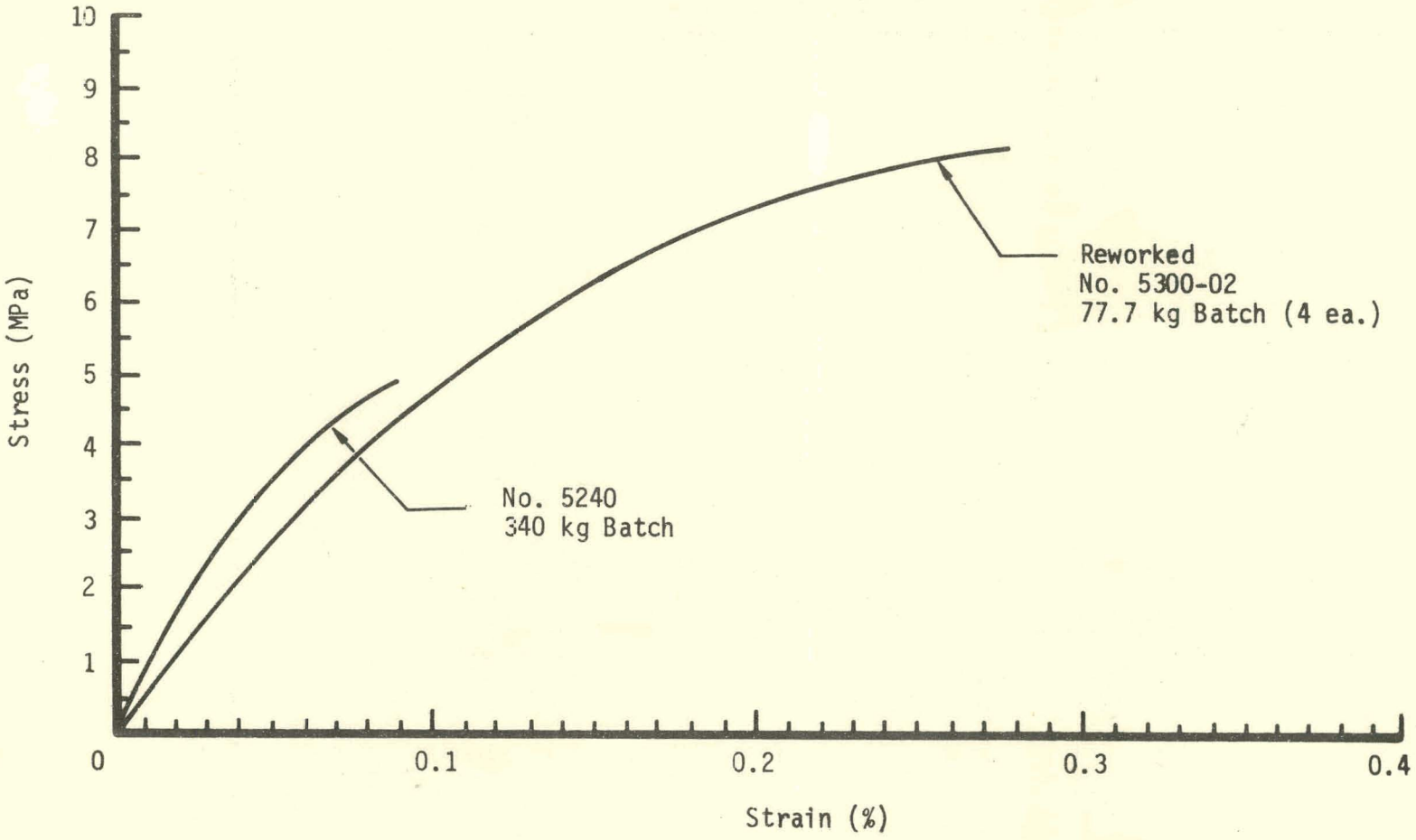


Fig. 5. Tensile Test - LLL, B8, RX-03-BB

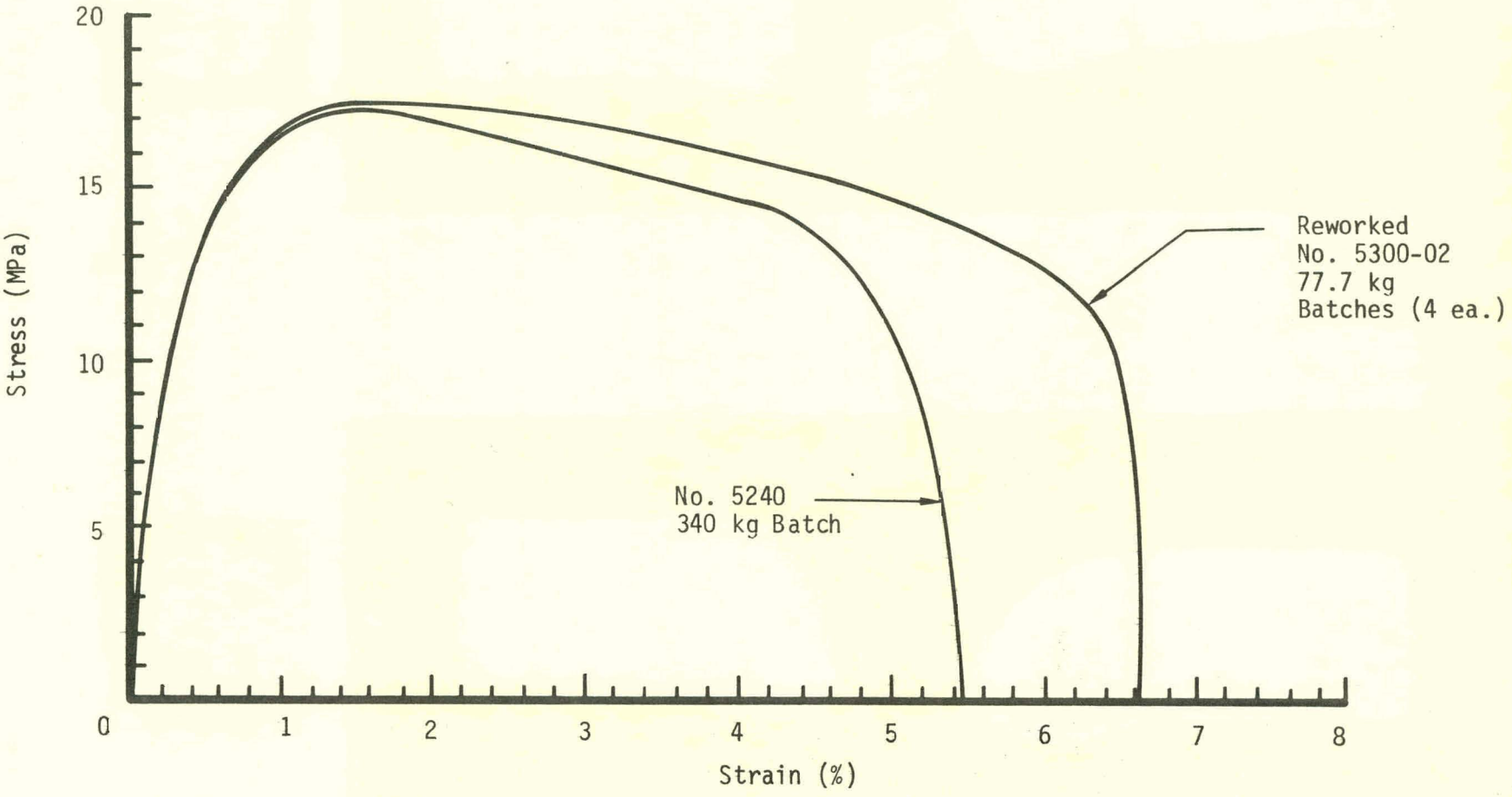
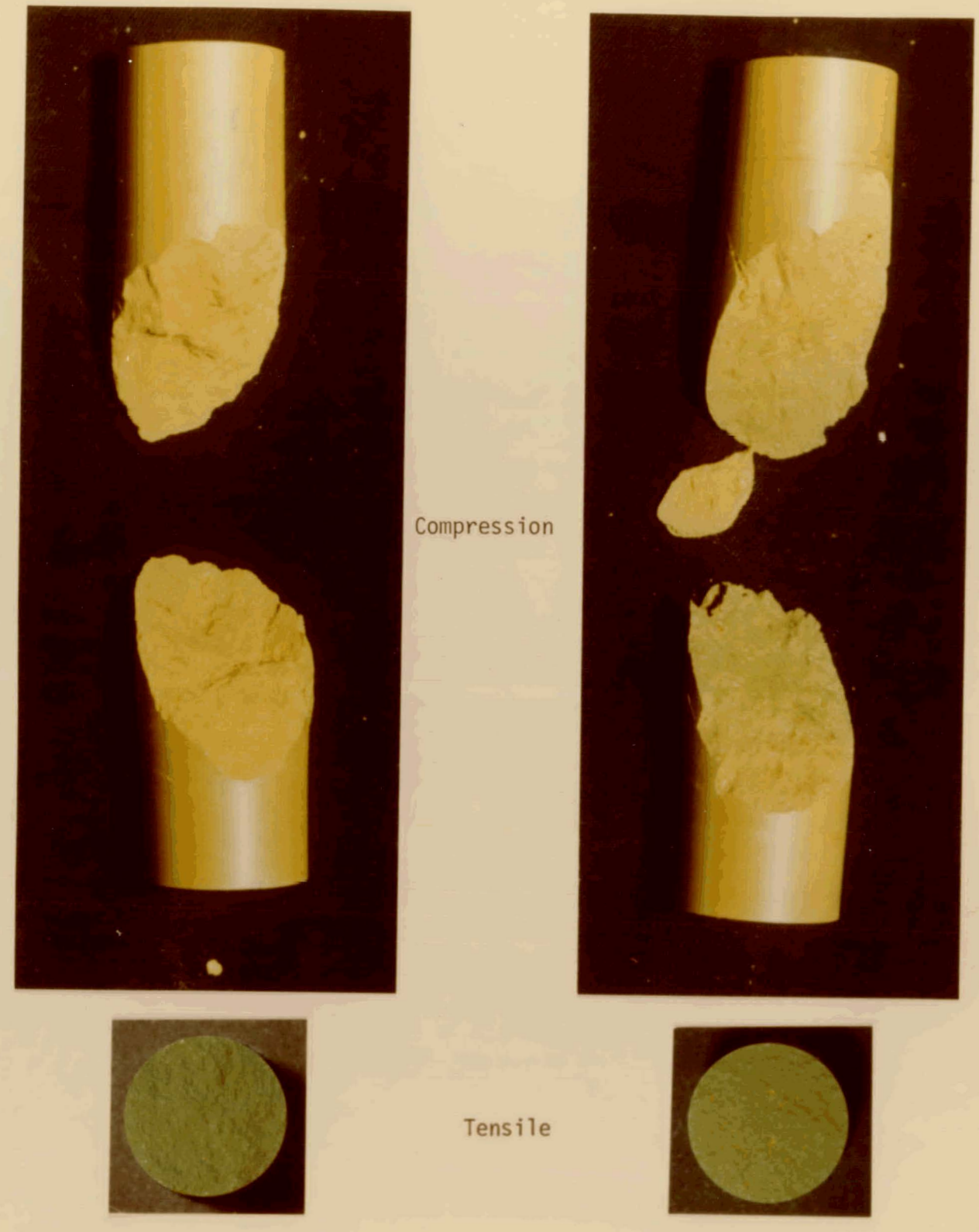


Fig. 6. Compression Test - LLL B8, RX-03-BB



No. 5240 - 340 kg Batch

No. 5300-02, Reworked - 77.7 kg Batch

Fig. 7. RX-03-BB Broken Test Specimens (LLL B8)

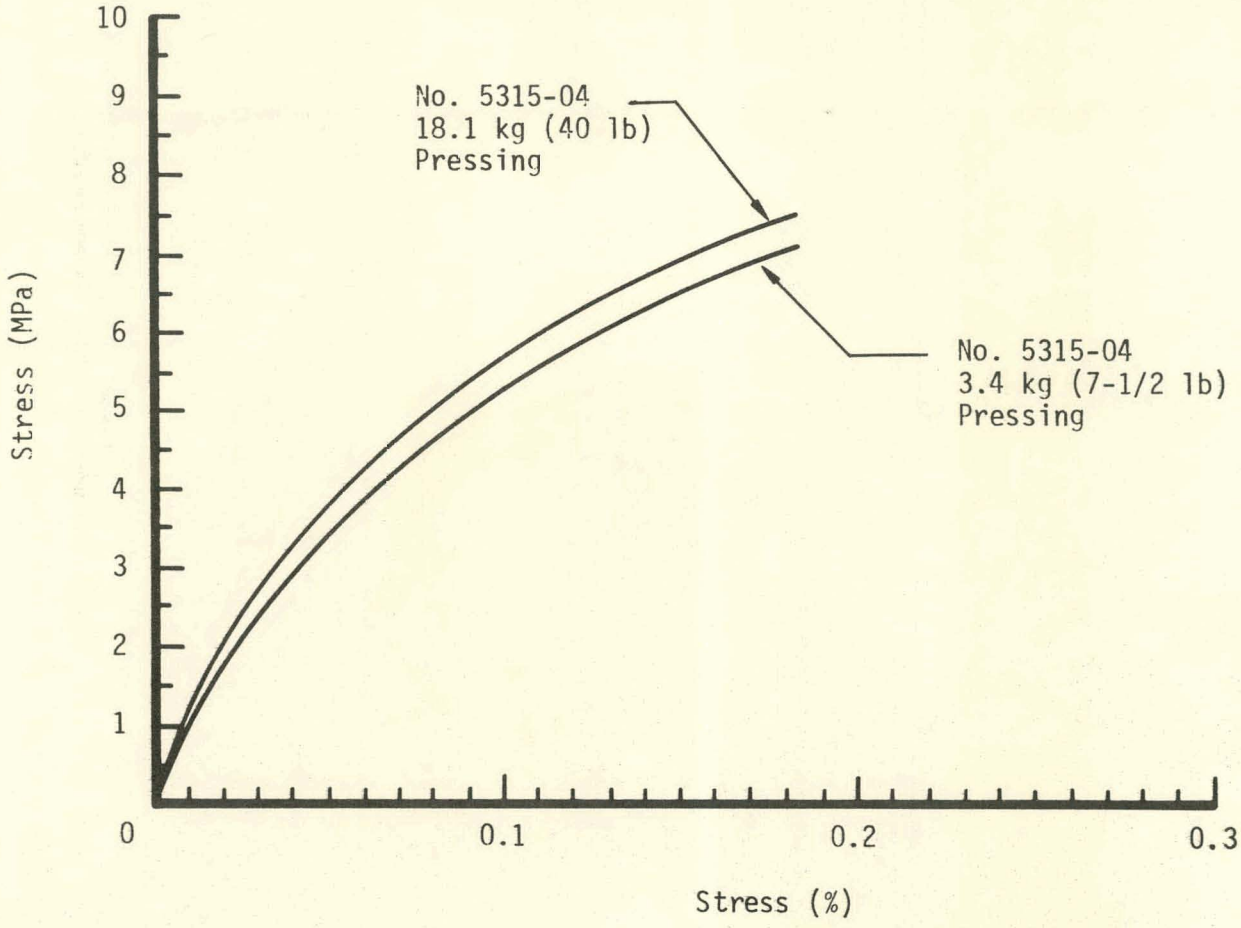


Fig. 8. Tensile Test - LLL B9, RX-03-BB

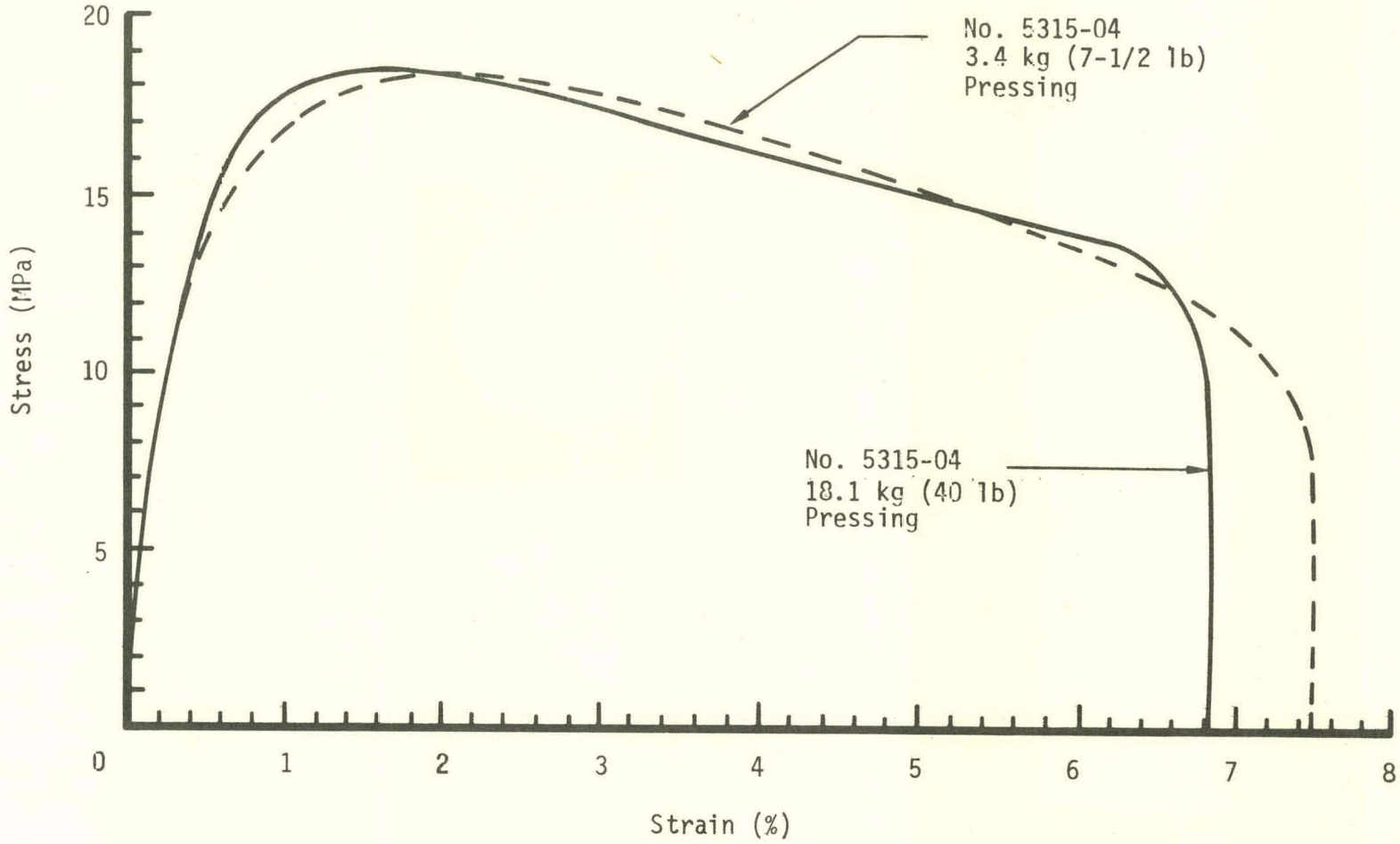


Fig. 9. Compression Test - LLL B9, RX-03-BB

Compression

Tensile

No. 5315-04 - 3.4 kg (7-1/2 lb) Pressing

Fig. 10. RX-03-BB Broken Test Specimens LLL B9

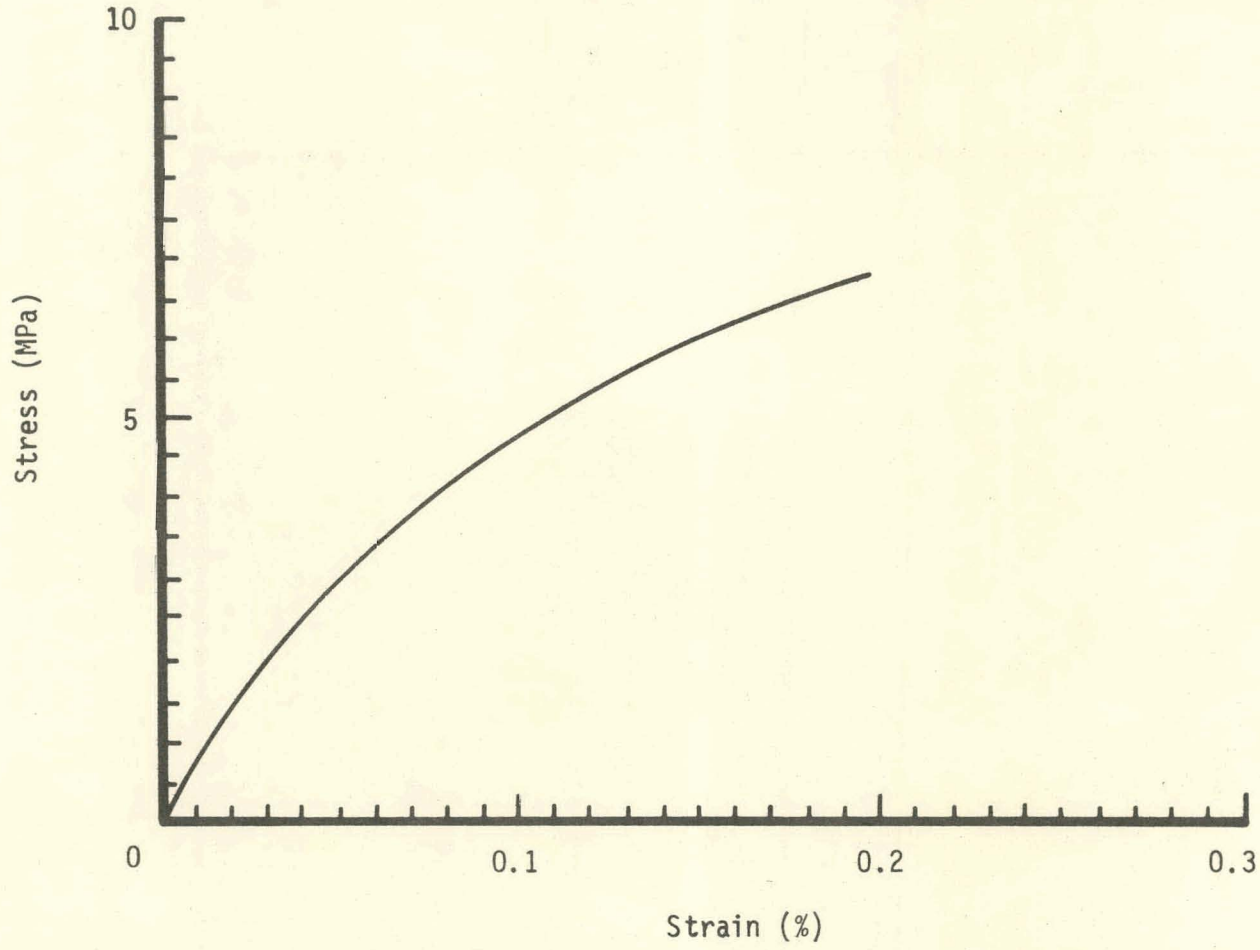


Fig. 11. Tensile Tests - RX-03-AU, 5% Kel-F 800, No. 5246

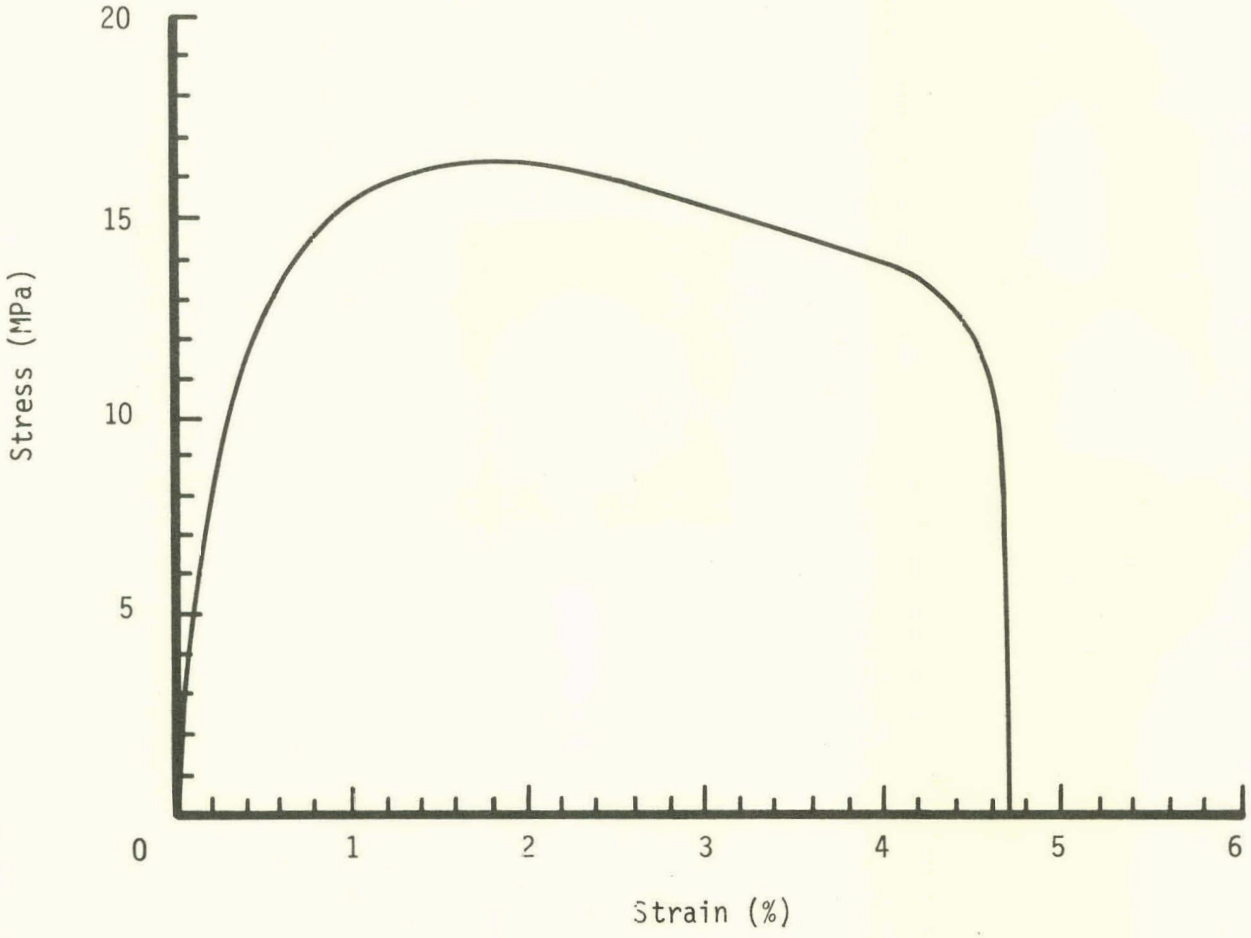
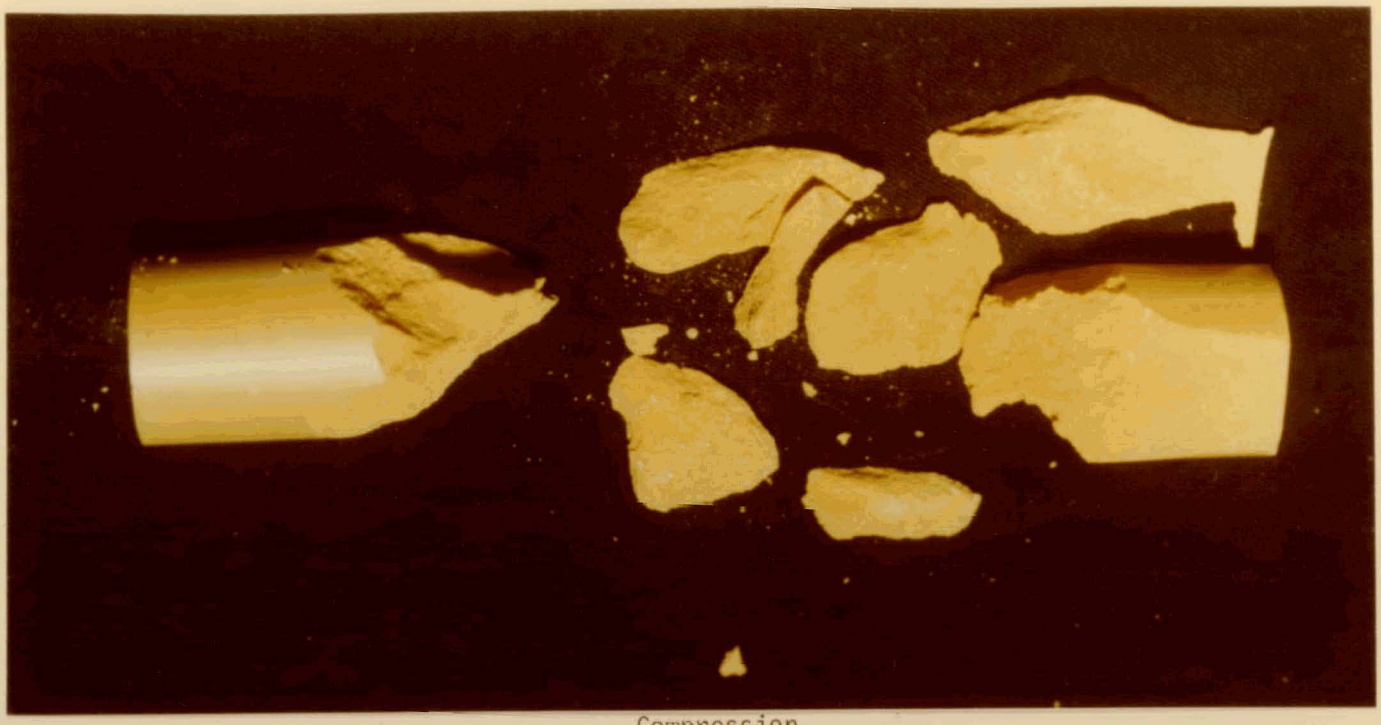
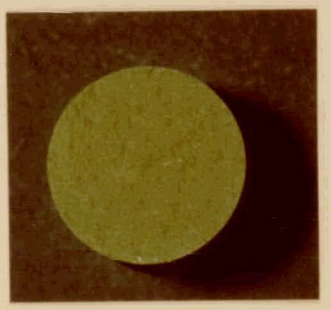


Fig. 12. Compression Tests - RX-03-AU, 5% Kel-F 800, No. 5246



Compression



Tensile

Fig. 13. RX-03-AU 5% Kel-F 800 Broken Test Specimens (No. 5246)