RDX/SYLGARD EXTRUDABLE
EXPLOSIVE DEVELOPMENT

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Process Development
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ABSTRACT

RDX precipitated in the Micronizer was evaluated for use in the RDX extrudable X-0208. Several different RDX crystal types were surveyed and the micronized RDX crystal appeared to have adequate sensitivity and was chosen for further evaluation.

INTRODUCTION

The LASL explosive X-0208 is an 80%/20% RDX/Sylgard extrudable composition. The firing performance criterion established by LASL is detonability and propagation in a 1.65 mm (0.065 inch) channel. Most conventional RDX crystal types do not make a sufficiently sensitive extrudable to propagate in a 1.65 mm channel; therefore, RDX must be processed in some manner to attain an adequate level of sensitivity.

EXPERIMENTAL PROCEDURE

The goal of this phase of the RDX/Sylgard extrudable development was to make the preliminary selection of

an RDX crystal which will propagate in a 1.65 mm (0.065 inch) channel.

Several types of RDX crystals were tested. In order to obtain the appropriate texture or consistency of the composition, conventional, as received, Class E RDX was also mixed into the extrudable in different proportions.

Small 50 or 100 g samples of the 80%/20% RDX/Sylgard were prepared by hand blending the Sylgard and RDX followed by milling, usually 15 passes, on the small laboratory 3-roll mill. To evaluate sensitivity, samples of the extrudable were then hand-loaded into small plastic test fire blocks as illustrated in Fig. 1. Denting of the witness plate was used to verify propagation.

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Fig. 1. X-0208 Test Fixture

EXPERIMENTAL DATA

Five RDX crystal types were surveyed. They were (1) as received Class E RDX, (2) RDX ground in the Colloid mill, (3) RDX precipitated in the Micronizer, (4) RDX precipitated from acetone into water, and (5) into TF Freon. Also mixtures of the various RDX crystal types were made with the Class E RDX in an attempt to control the consistency of the extrudable. The firing data along with material identification and description are summarized in Table I. Included is a notation of the texture or consistency of the extrudable. Figs. 2 and 3 contain photomicrographs of the various RDX crystal types. The Fisher Sub-Sieve Sizer surface area is listed under the identification on the photographs.

DISCUSSION

The channels failed to propagate using Class E RDX. Adding RDX which was precipitated from acetone into water, and RDX which had been ground in the Colloid mill improved sensitivity in most cases; however, in Table I, failures are noted for these materials (Batches 6239-02, 6365-01 and 6365-02). In these cases the extrudable was too stiff for proper filling of the channels which is the probable cause for the failure.

RDX precipitated from acetone into Freon did not produce a sensitive crystal and its evaluation was discontinued after the initial test.

The most promising RDX was produced by crystallization from acetone into

Table I

RDX/Sylgard No.	RDX No.	Type RDX	Ratio (%)	Extrudable Texture	Firing	
					(1.40 mm) 0.055-inch	(1.65 mm) 0.065-inch
6240-322-01	445-8	Class E	100	Soft	NO GO	NO GO
6239-322-01	6239-1054-01	Precipitation from Acetone into Freon	100	Soft	NO GO	NO GO
6239-322-02	6239-105C-01	Precipitation from Acetone into Water	100	Stiff	NO GO	NO GO
6244-322-01	445-8	Class E	50	Medium	NO GO	GO
	6244-105C-01	Precipitated from Acetone into Water	50			
6364-322-01	445-8	Class E	50	Medium	GO	GO
	6244-105C-01	Precipitated from Acetone into Water	50			
6240-322-02	3277-105G-01	Ground Colloid mill	100	Stiff	NO GO	GO
6365-322-02	3277-105G-01	Ground Colloid Mill	100	Stiff	No Test	NO GO
6240-322-03	445-8	Class E	50	Medium Stiff	NO GO	GO
	3277-105G-01	Ground Colloid Mill	50			
6365-322-01	445-8	Class E	50	Medium Stiff	No Test	NO GO
	3277-105G-01	Ground Colloid Mill	50			
6365-322-04	1323-105M-01	Micronized	100	Stiff	GO	GO
6365-322-03	445-8	Class E	50	Medium	GO	GO
	1323-105M-01	Micronized	50			
7060-322-02	7056-105M-01	Micronized	100	Stiff	NO GO	GO
7060-322-01	445-8	Class E	50	Soft	NO GO	NO GO
	7056-105M-01	Micronized	50			
7070-322-01	445-8	Class E	25	Medium	NO GO	GO
	7055-105M-01	Micronized	75			
7070-322-02	445-8	Class E	25	Medium	GO	GO
	7069-105M-01	Micronized	75			

water. This was accomplished initially by hand mixing followed by micronization. For the Micronizer precipitation process, air was injected into the precipitation chamber creating controlled turbulence for the mixing of the water and acetone solution.

An aged sample of micronized RDX was retrieved from storage and fired successfully as Batch Nos. 6365-03 and 6365-04. Three 2.3 kg batches of RDX were precipitated in the Micronizer and small samples were mixed and milled to make the extrudable. Micronized RDX and mixtures of 75% and 50% micronized RDX with Class E RDX were used. From preliminary indications, as shown from the data in Table I, the 75%/25% micronized/Class E RDX mixture has acceptable handling characteristics and a workable consistency with

sustained firing in the 1.65 mm track.

CONCLUSIONS AND FUTURE WORK

Precipitation of RDX in the Micronizer is a semicontinuous reproducible process. All fluids are filtered, flow rates are precisely controlled and chamber turbulence is reproducible. Preliminary testing of an extrudable explosive made from a mixture of 75%/25% micronized/class E RDX indicates that consistency and texture are acceptable and that the firing criteria are satisfied. More batches of micronized RDX will be precipitated and tested to establish reliability and confidence in the material. Three additional 2.3 kg RDX batches have been micronized and samples made into extrudable explosives which are awaiting test firing.

Class E RDX
Lot 445-8
 $S_O^G = 215 \text{ m}^2/\text{kg}$

RDX Recrystallized
From Acetone Into Water
 $S_O^G = 1385 \text{ m}^2/\text{kg}$

RDX Recrystallized
From Acetone Into TF Freon
 $S_O^G = 810 \text{ m}^2/\text{kg}$

RDX Ground on Colloid Mill
Lot 3277-105G-01
 $S_O^G = 595 \text{ m}^2/\text{kg}$

Fig. 2. RDX Photomicrographs (Magnification $\sim 400X$)

1323-105M-01
 $S_O^G = 1330 \text{ m}^2/\text{kg}$

Lot 7055-105M-01
 $S_O^G = 1070 \text{ m}^2/\text{kg}$

Lot 7056-105M-01
 $S_O^G = 1070 \text{ m}^2/\text{kg}$

Lot 7069-105M-01
 $S_O^G = 1145 \text{ m}^2/\text{kg}$

Fig. 3. Micronized RDX Photomicrographs (Magnification $\sim 400X$)