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Inter-Office Correspondence

From LOCATION : Research Department - Mound Laboratory

CC :

DATE : August 26, 1965

MOUND LABORATORY-MONSANTO
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SUBJECT : TR-167 - Visit to Los Alamos Scientific Laboratory - August 9-11, 1965

REFERENCE :

TO : Dr. G. Richard Grove

The writer and Dr. H. R. McGraw visited LASL GMX-7, TD Site, to discuss the results of the CATS (Comprehensive Appraisal of TriPEON Stabilization) and to attend a PETN Specification meeting.

The results of the CATS Program were discussed with the following GMX-7 personnel: W. H. Meyers, G. S. Price, L. A. Carlson, R. H. Rochester and R. J. Peterson. Spike presented test firing data and the writer, surface area data. You will recall that the purpose of this program was to determine the effect of TriPEON on the firing performance and surface area of PETN after elevated temperature storage. Test conditions are shown below:

Nominal Initial Surface Area, cm^2/g	SE-1 Gold BW, Inch	Amount Additive, %	Temperature, °F
3,000	0.0015 x 0.040	0,1,2,3,5	130, 160, 190
6,000	0.0015 x 0.040	0,1,2,3,5	130, 160, 190
12,000	0.0007 x 0.020	0,1,2,3,5	130, 160, 190
16,000	0.0007 x 0.015	0,1,2,3,5	130, 160, 190

Time at Temperature, Days: (190°F) 0.5, 1.25, 7, 15
(160°F) 3, 7, 20, 60
(130°F) 10, 30, 90, 360

The most important aspects of the test firing results were that Δt_m values were lower for products containing TriPEON; in many cases negative Δt_m values were attained with TriPEON batches. No additional improvement was afforded in most cases by quantities larger than 1% TriPEON. Voltage threshold data were erratic and generally inconsequential. Generalizations drawn from surface area data were that:

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1) surface area decreased with increasing time and temperature;

2) relative surface area deterioration was greatest with fine particle size products;

3) TriPEON batches were more stable dimensionally than batches without additive;

4) TriPEON in quantities greater than 1% did not improve dimensional stability;

5) surface area deterioration was greatest during the first heating period - only slight changes occurred thereafter.

LASL personnel were generally pleased with the results of the experiment but wish now that they had stuck to their original plans to use lesser quantities of TriPEON (0.25 and 0.5%).

Informal discussions were held with Loren Carlson and Bob Peterson. Loren described his two "cut-back" tests for 1E30 detonators. (These are described in detail in the May and June issues of "Excerpt from GMX-7 Monthly Progress Report"). Briefly, they consist of determining t_m of various particle size products at different well lengths or firing voltages. They are called "cut-back" tests because the curves (t_m vs well length; t_m vs voltage) go through a minimum t_m's then cut-back. He was using PETN with nominal surface areas of 5,500, 8,000 and 11,000 cm^2/g with and without TriPEON. At a selected well-length of 0.10 inches and a potential of 2200 volts the 8,000 cm^2/g with 1% TriPEON performs best, i.e. the t_m continues to decrease considerably with decreasing well-length and voltage before cutting back. Actually, the 11,000 cm^2/g material performed better in the well-length studies but the t_m cut back rapidly just below the prescribed 2200 volts in the other test. Because of the results of these tests, it appears that LASL will use 8,000 cm^2/g PETN with 1% TriPEON in their 1E30 design.

Clarence Courtright, the Explosives Safety Engineer at S Site, showed us an interesting documentary film titled "Electrostatic Ignition of X-248 Rocket Motors". Subject of the film was the investigation by Cornell Aeronautical Laboratory of Buffalo, N. Y. of the inadvertent ignition in two separate incidences of the rocket used as a third stage of a Delta vehicle. The one incident occurred at Tulsa, Oklahoma where no one was injured; the other occurred at Cape Kennedy where a total of seven persons were injured, three fatally. In the latter incident the technicians, following routine checking of the system, dropped a polyethylene tent, used as a dust cover, over the rocket motor. An explosion occurred. The Cornell group discovered that the explosion started at a squib containing lead styphnate. The squib was surrounded by fiberglass with a 10^9 ohm resistance - a rather good insulator. However, they soon found that the electrostatic potential attained by dropping the plastic sheet from its pinned-up (working) position over the rocket body was 75,000 volts. At that potential the insulating material was actually a conductor and a detonation ensued. In the Tulsa incident, the unit was to be raised onto the second stage with a crane when one of the workers noticed a few flecks of dirt on a plexiglass window of the rocket. He wiped these off with a workman's glove. This act generated enough electrostatic charge to detonate the same type of squib. Both incidences were repeated by the Cornell group with exact replicas of the original models. These inadvertent detonations suggest to the writer the use of detonators containing explosives which are less sensitive to electrical shock - perhaps PETN or RDX.

The following attended a PETN Specifications meeting:

W. H. Meyers	-	LASL GMX-7
A. D. Van Vessem	-	LASL GMX-7
L. A. Carlson	-	LASL GMX-7
J. R. Stroud	-	LRL
N. Schneider	-	LRL
H. R. McGraw	-	Mound
G. W. Leadingham	-	Mound
W. R. Schurman	-	Mound
L. D. Haws	-	Mound

(The absence of Sandia representation is noteworthy. They are apparently writing their own PETN Specifications). It was resolved that Mound will continue to buy duPont PETN per military specification MIL-P-387A, Class 3. In the past, duPont has been reluctant to supply nitrogen content and vacuum stability test results. Although these tests are part of that specification, they have usually been waived with LASL's approval. Mound's Special Purchases Group will be asked to review these requirements with the manufacturer. Furthermore, Mound's Analytical Section will investigate the feasibility of performing these two tests at Mound in the event that duPont will not comply. It was further resolved that Mound will implement a Product Acceptance Test on each incoming lot of PETN. This test will be conducted, in general, as follows: Samples from each lot or drum of PETN will be processed by a standard recrystallization procedure. Surface area of the product will be measured and the product tested in SE-1 detonators. Limits will be set up on surface area, t_T, t_m and Δt_m. To establish these limits, samples of historical PETN lots will be tested; these lots contain both "good" and "bad" PETN according to old 1E26 data. If the incoming lot meets these requirements, it will be used for processing a number of PETN products, namely -

Type 1	-	4,000 cm^2/g
Type 2	-	4,000 cm^2/g with TriPEON
Type 3	-	12,000 cm^2/g
Type 4	-	12,000 cm^2/g with TriPEON
Type 5	-	16,000 cm^2/g
Type 6	-	16,000 cm^2/g with TriPEON

The Specification will provide some processing latitude since it will describe the process of the above types only in general terms such as batch size, solvents, order of addition and certain temperature limits. Each process <u>will</u>, however, be tightly controlled by a Mound Manual referenced to the Specification. This resolution came about in order that changes can more efficiently be made in the event that problems arise which can be corrected by altering one or more processing parameters slightly. The writer understands that the Manual can be changed by the Mound Production Engineer; changes in the Specification require LASL and/or LRL approval.

Walt Meyers is still looking for a high temperature detonator or more correctly, a solid secondary explosive with the brisence, sensitivity, etc. of PETN but with a higher melting point. HMX has been mentioned in the past but one of its polymorphic forms is very sensitive to initiation. RDX, with a melting point of 204°C looks promising and Mound's Detonator Development Group has been investigating the use of same in a low priority program.

Bob Spaulding was informed of my studies on heating PETN in the presence of siliceous adsorbents with resultant hydrolysis product formation. He was very much interested and encouraged continuation of these studies. We discussed the British procedure of "stabilizing" PETN without TriPEON by subjecting PETN to a 300 hours/100°C environment prior to loading into detonators. This causes a drastic decrease in surface area (about 50% change). But, as the CATS results show, surface area decreases almost asymptotically with time after prolonged heating. He is reluctent to employ such procedures before we know if chemical as well as physical changes occur during those drastic conditions. I assured him that Mound Explosives Research would continue decomposition studies.

Informal discussions were also held with John Tucker, Don Baker, Dick Rochester and Boyd Horton.

Lowell D. Haws

Lowell D. Haws

LDH:db

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