

AD-A080 318

AIR FORCE PACKAGING EVALUATION AGENCY WRIGHT-PATTERSON--ETC F/B 13/4
EVALUATION OF EXPANDED BEAD POLYETHYLENE FOAM CUSHIONING FOR PA--ETC(U)
NOV 79 R V BROWN
PTPT-79-9

UNCLASSIFIED

NL

1 of 1
AD-A080318



END
DATE
FILMED
3-80
ENC

Approved for Public Release
Distribution Unlimited

12
14
PTP [redacted] 79-9
AFPEA PROJECT NO. 77-P7-49

LEVEL

DA080318

10

RICHARD V. BROWN
Mechanical Engineering Technician
Autovon 787-4519
Commercial (513)257-4519

Final report

6

EVALUATION OF EXPANDED BEAD
POLYETHYLENE FOAM CUSHIONING FOR PACKAGING

DDC
RECEIVED
FEB 6 1980
A

DDC FILE COPY

HQ AFALD/PTP
Air Force Packaging Evaluation Agency
Wright-Patterson AFB OH 45433

11

Nov 79

1220

80 2 4 033
403519

RB

NOTICE

When government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related government procurement operation, the United States Government thereby incurs no responsibility whatsoever; and the fact that the government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto. This report is not to be used in whole or in part for advertising or sales purposes.

ABSTRACT

Expanded Bead Molded Polyethylene Foam Cushioning Material was evaluated for its static and dynamic characteristics. It was determined that the material meets the compression set and compressive strength requirements of Type I material of PPP-C-1752A, "Cushioning Material, Packaging, Unicellular Polyethylene Foam, Flexible." The material provides slightly better dynamic cushioning in the optimum cushioning static stress range than conventional polyethylene sheet stock materials. Application of molded polyethylene should prove to be cost effective when used in lieu of built-up cushion packs or container structures which are formed by laminating together pieces of polyethylene sheet stock.

PREPARED BY:

RICHARD V. BROWN, Mechanical Eng. Tech.
Materials Engineering Division
AF Packaging Evaluation Agency

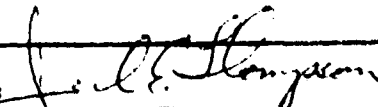
REVIEWED BY:

MATTHEW A. VENETOS
Chief, Material Engineering Division
AF Packaging Evaluation Agency

PUBLICATION DATE:

28 NOV 1979

APPROVED BY:


JACK E. THOMPSON
Director, Air Force Packaging
Evaluation Agency

INTRODUCTION

At the present time, polyethylene foam is being used for cushioning and blocking and bracing of various items in containers. In some Air Force transportation packaging order (TPO) packs polyethylene foam sections are frequently cemented together in various thicknesses and then cut to the shapes desired. Either because of poor bonding or repeated use, these sections sometimes separate and are lost. In the case of the TPO pack for the LN-15 Inertial Measurement Unit (IMU), it was found that the top polyethylene pad in the inner container became uncemented (see Fig 1 and 2) making it impossible to remove the item from its container without tilting the container

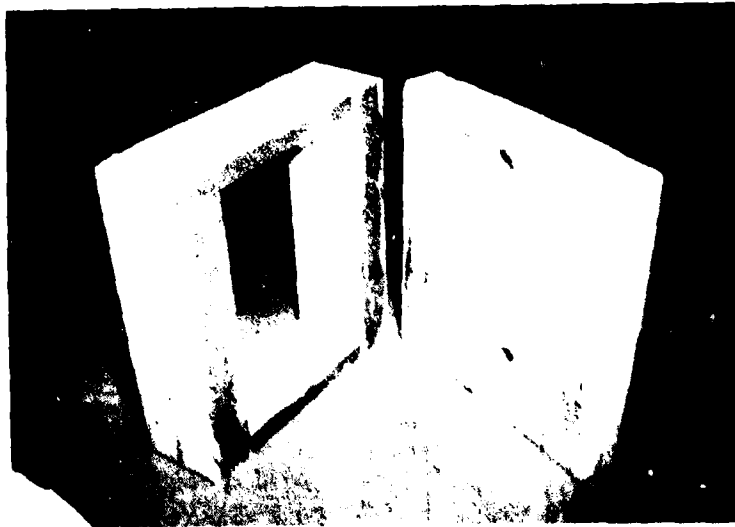


Figure 1. Cement bond failure in the top pad of an LN-15 pack.

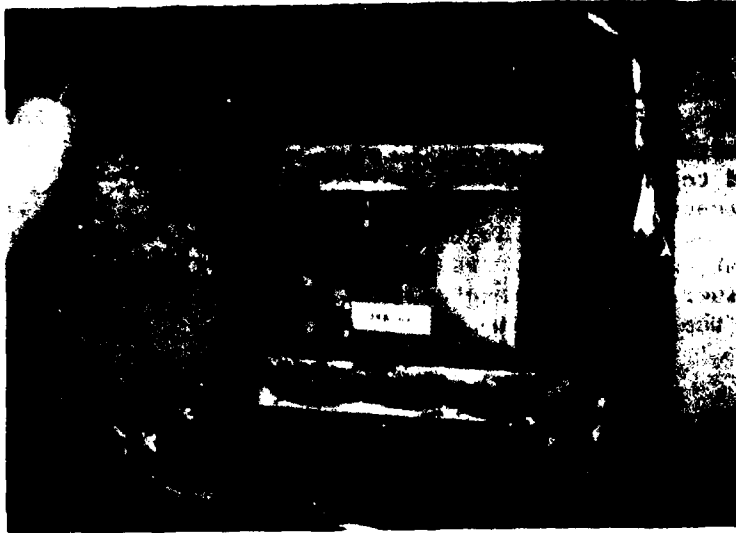


Figure 2. LN-15 difficult to remove because of bond failure of the polyethylene pad

upside down at an angle and sliding the item out. If this is not done carefully, damage can result to this fragile and expensive item. A possible solution to this and other packaging problems would be to use molded pieces of polyethylene.

At the present time a molded polyethylene material, tradename EPERAN, is manufactured only in Japan. However, there are plans to manufacture EPERAN IN THE United States if sufficient market volume can be developed.

The Kaneka America Corporation has furnished this Agency with considerable technical data on "EPERAN" including graphs and tables of performance data. English translations of this data can be obtained from AFALD/PTPT, WPAFB OH 45433.

OBJECTIVE

The objective of this study was to evaluate the static and dynamic characteristics of 2.0 lb/ft^3 (0.034 gm/cm^3) density EPERAN (expanded bead polyethylene foam) and determine its potential use as a cushioning and/or blocking and bracing material in package designs for DOD equipment.

MATERIAL DESCRIPTION

"EPERAN", a foam polyethylene first developed by Kanegafuchi Chemical, is formed by the internal molding of polyethylene beads. It can be produced in practically any desired shape (see Fig. 3) by a completely automatic molding process. The material is white in color, odorless, clean, and has a "spongy" feel to it. Some of the advantages claimed for EPERAN are:

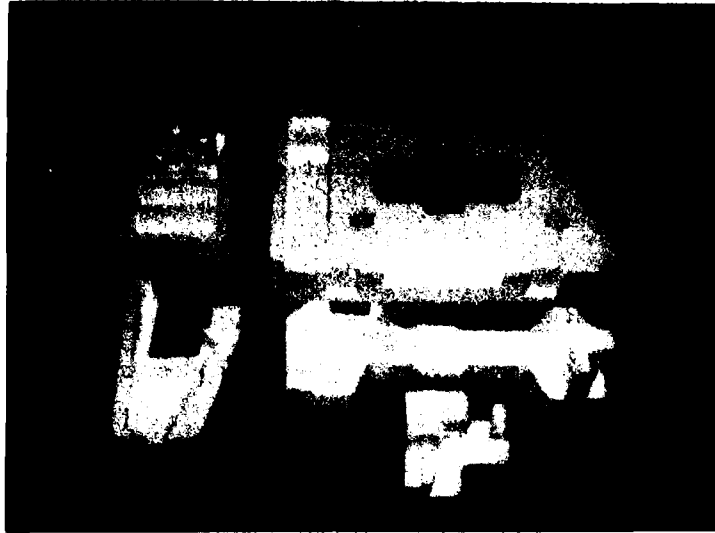


Figure 3. Various Shapes of Molded Eperan

1. Moldable to practically any shape.
2. Can be cut, and cemented if necessary.
3. Consistent properties.
4. Can be produced in variable densities.
5. Outstanding shock absorbent characteristics which decline little as a result of repeated impact.
6. Oil, chemical, and weather resistant.
7. Good surface protection - soft and pliable.
8. Does not produce black smoke or toxic gases when burned.
9. Eperan can be obtained in various densities ranging from 1 lb/ft³ (0.016 gm/cm³) to 6 lb/ft³ (0.096 gm/cm³) by varying the amount of expansion of the polyethylene beads. The standard material densities available are 2.0 lb/ft³ (0.034 gm/cm³) and 5 lb/ft³ (0.08 gm/cm³) obtained through bead expansion of 27 and 15 fold respectively. The data from the manufacturer on static and dynamic characteristics primarily dealt with the 2.0 lb/ft³ material. The material evaluated in this study was also limited to that density.

TEST SPECIMENS

The molded polyethylene foam material provided was in sheet thicknesses of 1, 1.6, 2, 2.4 and 3 inches (2.45, 4, 5.06, 6, and 7.62 cm

respectively). Samples of molded corner pads were also furnished. Those pads, measuring 0.79 inch (2 cm) in thickness, were tested in completed pack configurations.

TEST EQUIPMENT AND INSTRUMENTATION

The following equipment and instrumentation were used to conduct the tests:

Equipment

"Hardigg" Cushion Tester, Model No. 3

Drop Tester, Model 125 DTP, Gaynes Engineering Company

Instron Tensile/Compression Tester, Model TTC

Instrumentation

Accelerometer, + 100 G, Type A5A-100-350, Statham Instruments

Power Supply, Model RM-6, Sensotec Inc.

Accelerometers (3 ea), Model 2233E, Endevco Corp.

Charge Amplifiers (3 ea), Model 26514C, Endevco Corp.

Power Supply, Model 2622C, Endevco Corp.

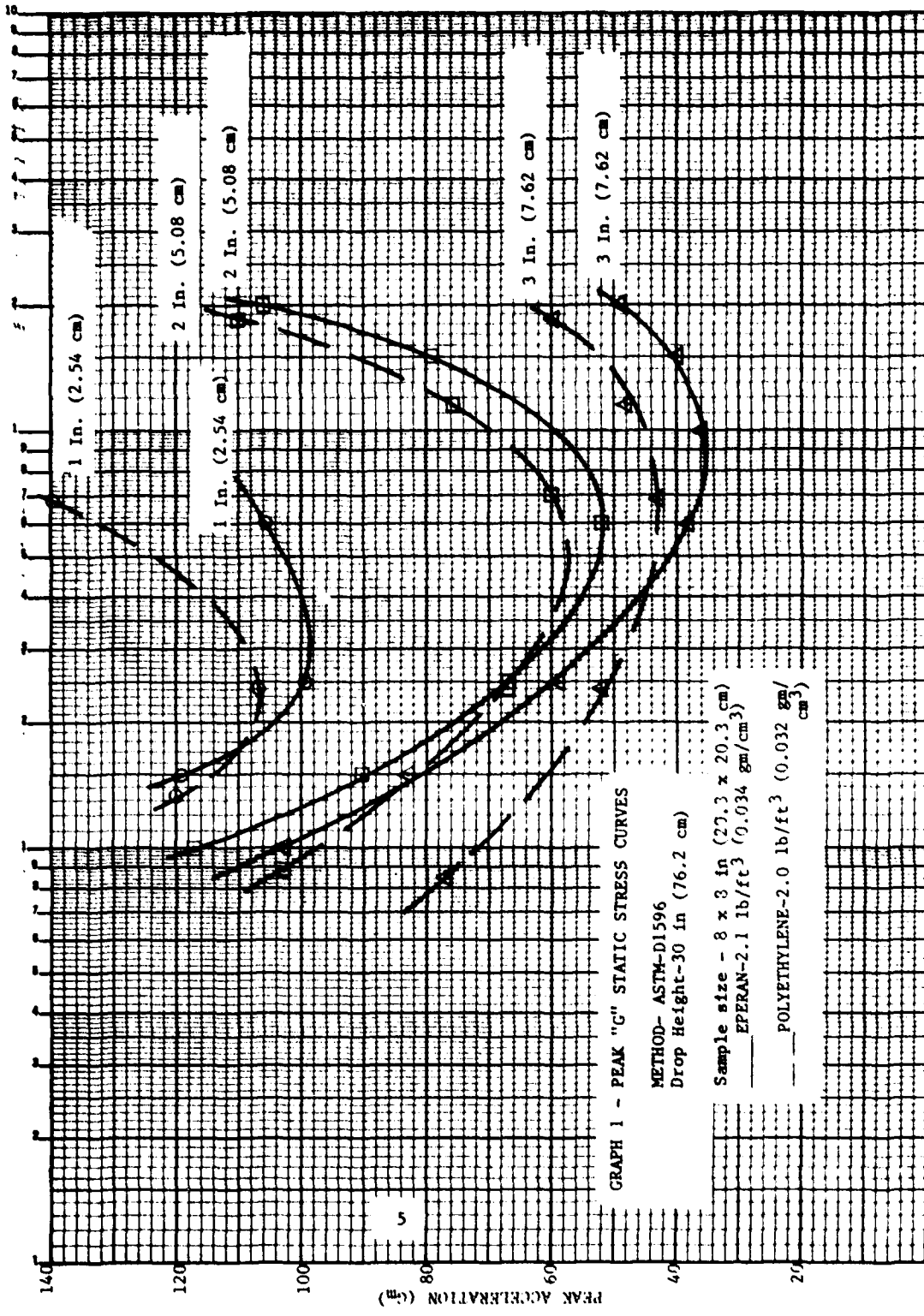
"Storage" Oscilloscope, Type 565B, Tektronix

TEST PROCEDURE

Dynamic Cushioning Test

Peak G - static stress curves (Graph 1) were developed in accordance with ASTM-D1596, "Shock Absorbing Characteristics of Package Cushioning Materials". Three 8" by 8" samples of each thickness, 1, 2, and 3 inch, were conditioned at 72°F, 50% RH for at least 24 hours. The density of each sample was calculated prior to conducting the impact test. A drop height of 30 inches was used. Five drops were made on each sample at intervals of at least one minute between drops to allow for specimen recovery. The first recorded peak "G" on each sample was ignored but the remaining four values were averaged. Then the averages of the three samples were combined to determine a static point for plotting. The same samples were used throughout the tests required to establish a complete curve.

The same procedure was used to develop Peak G - static stress curves (Graph 2) for the 1.6 and 2.4 inch thicknesses of material at a drop height of 23.6 inches (60 cm).



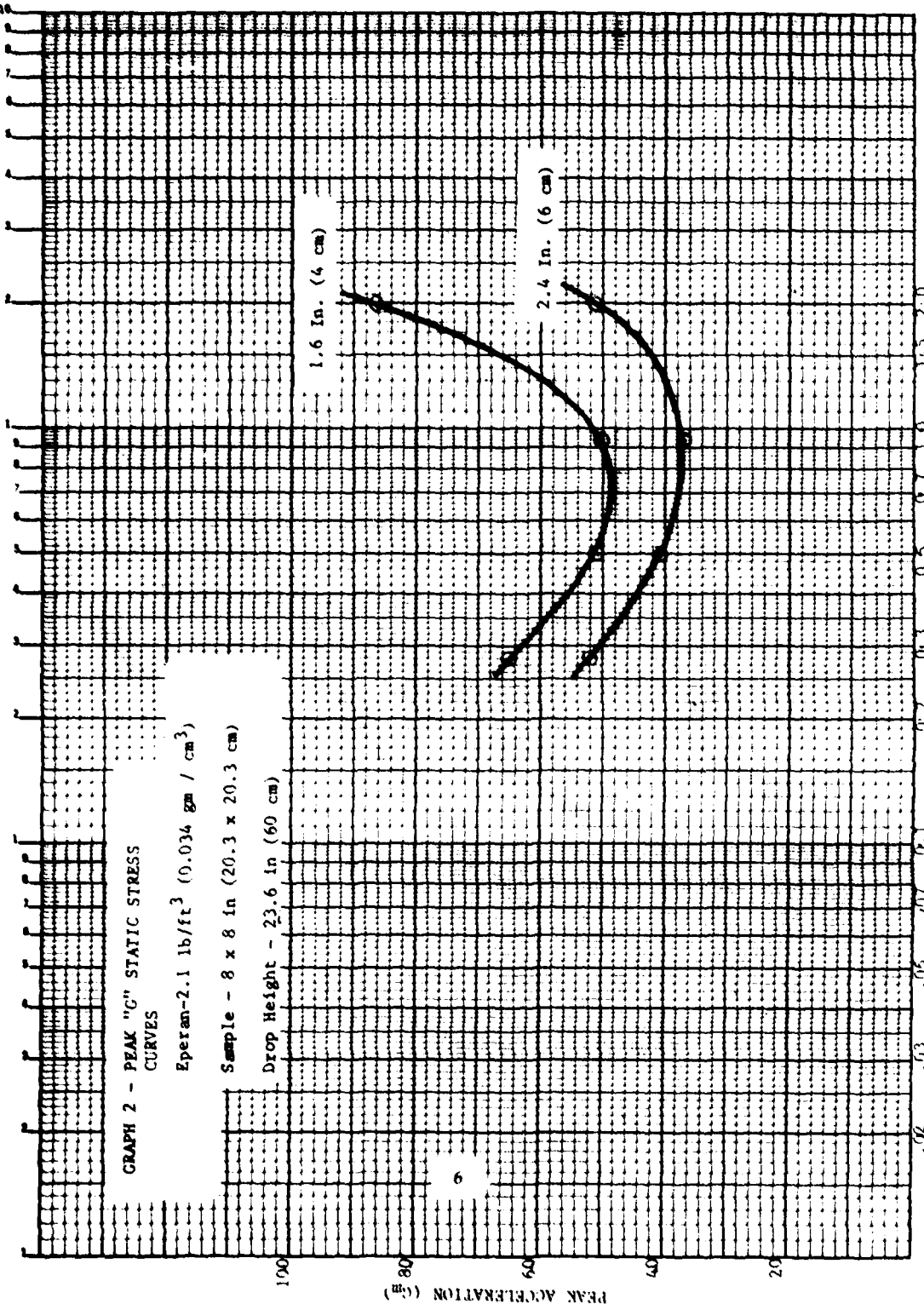
0.02 0.03 0.05 0.07 0.1 0.2 0.3 0.5 0.7 1.0 1.5 2.0
 STATIC STRESS W/A (psi)

GRAPH 2 - PEAK "G" STATIC STRESS CURVES

Eperan-2.1 lb/ft³ (0.034 gm / cm³)

Sample - 8 x 8 in (20.3 x 20.3 cm)

Drop Height - 23.6 in (60 cm)



STATIC STRESS W/A (psi)

PEAK ACCELERATION (G)

Completed Pack Tests (corner pads)

Two sets of molded corner pads were tested in a completed pack configurations to determine their dynamic cushioning performance. A set of eight molded corner pads, 0.79 inch (2 cm) thick with a base area of 7.4 in² (48 cm²), was placed on the corners of a rectangular shaped wood test load (see fig. 4) with dimensions of 17 x 11 x 9 inches (43.2 x 27.9 x 22.9 cm) and weight of 13.5 lbs (6.13 kg). The cushioned load was placed in a single wall domestic grade fiberboard container. The container flaps were closed with 3-inch wide tape (PPP-T-60D, Type III, class 1). The test load was instrumented with three triaxially mounted accelerometers placed at the center of gravity of the load.

The drop tests were conducted in accordance with Fed. Test Method Std. No. 101B, Method 5007 except for the order of drop. A total of 30 drops were made, 5 drops on each face. The drops alternated between opposite faces until 10 drops had been conducted. This test sequence was repeated on the other 2 sets of opposite faces. The Peak G values were displayed on the oscilloscope. The drop tests were conducted from heights of 15.7 inches (40 cm) and 19.7 inches (50 cm) using one set of corner pads. At the completion of these drops, the container was dropped from a height of 19.7 inches (50 cm) on corners and edges. The load weight stressed the corner pads to 0.46 lb/in² (0.03 kg/cm²), the optimum cushioning point of the dynamic Peak G vs. Static Stress curve for the material. The weight of the load was increased to 25 lbs (11.35 kg) and the flat face drops repeated using new corner pads. This weight stressed the corner pads to 0.84 lb/in² (0.06 kg/cm²).

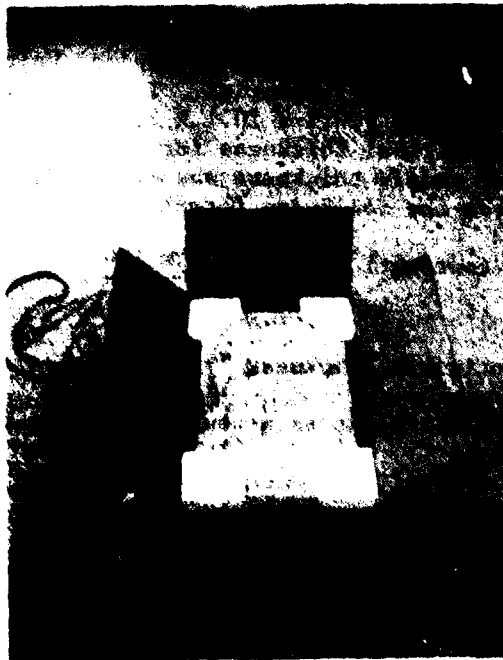


Figure 4. Molded Corner Pads

Corner pads fabricated "in-house" were also evaluated. The pads, of both 1.6 inch and 2.4 inch (4 and 6 cm) thick EPERAN, were cut and glued from flat sheet stock. The dynamic performance of these corner pads were compared with the predicted performance based on the Peak G versus Static Stress curves developed using the ASTM-D1596 test method. The area of each face of pads was approximately 6.8 in² (43.9 cm²). The 25 lb (11.35 kg) load used for drop testing stressed the material to 0.92 lb/in² (0.064 kg/cm²).

Each set of corner pads was subjected to the same test procedure of 30 drops as described previously and also dropped on all eight corners and twelve edges. An additional drop sequence of an impact on four corners and two edges was also made.

Static Compressive Stress-Strain Curve

The stress-strain data (Graph 3) was developed using the method described in MIL-HDBK-304A "Military Standardization Handbook, Package Cushioning Design". Three samples, 4 x 4 x 2 inches (10.2 x 10.2 x 5.1 cm) were conditioned at least 48 hours at 72°F, 50% RH. The samples were then compression cycled 10 times, 65% of their original thickness at a 10 inches per minute loading rate. One hour after cycling, the thickness of each sample was measured under a preload of 0.025 lb/in² (0.002 kg/cm²) and then a load-deflection curve was generated at a one inch (2.5 cm) per minute loading rate. This data was then converted to a stress-strain curve. The data developed on three samples was averaged to produce Graph 3.

Compression Set

The compression set of the material was determined in accordance with PPP-C-1752A, "Cushioning Material, Packaging, Unicellular Polyethylene Foam, Flexible", for type I material. Three samples were cut to dimensions of 4 x 4 x 1 inch (10.1 x 10.1 x 2.5 cm). Each sample was compressed 35% of its original thickness for 1 hour. One hour after removing the load, the sample thickness was measured. The compression set was determined from the following formula:

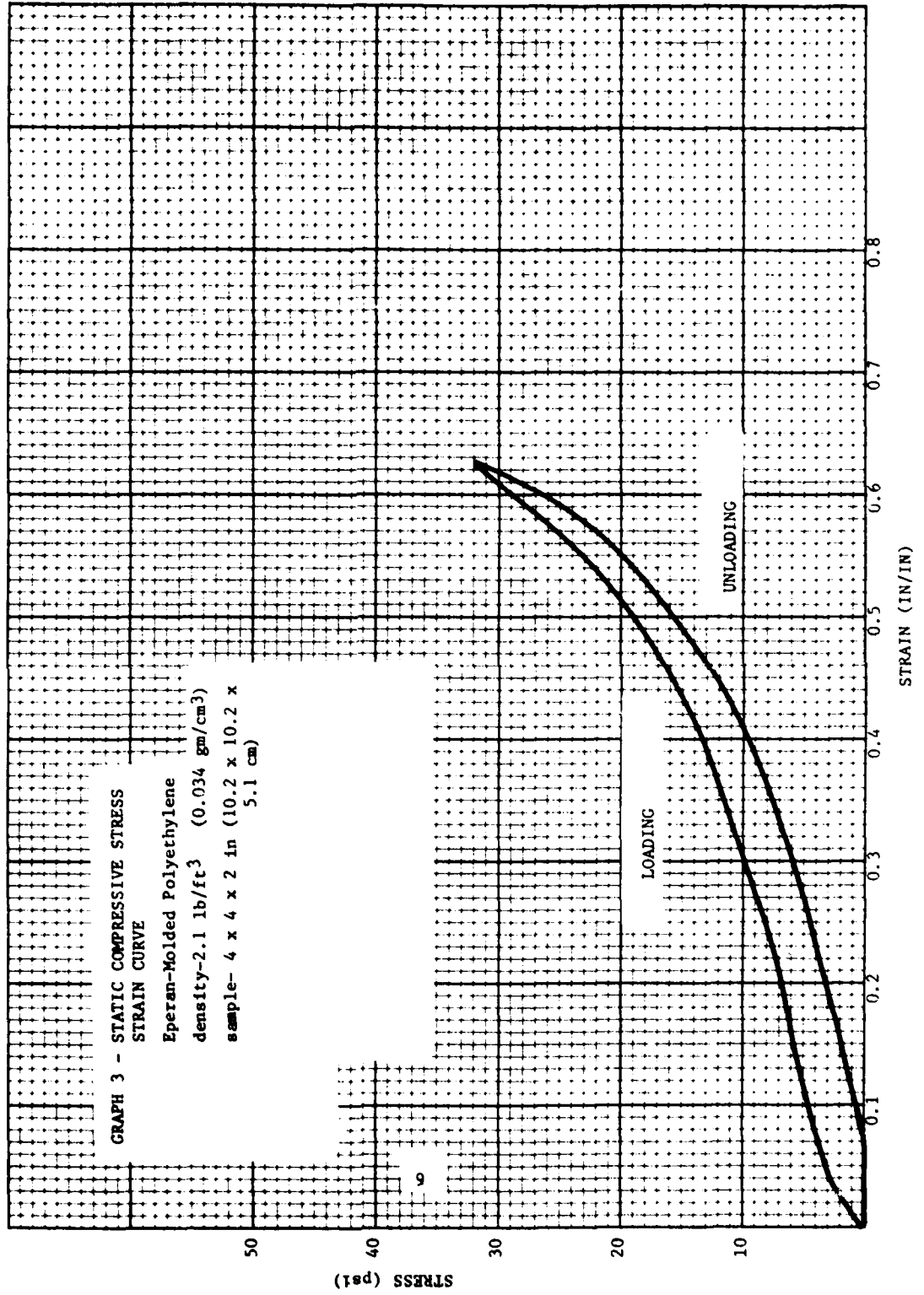
$$\text{compression set (percent)} = \frac{(t_o - t_f) \times 100}{t_o}$$

Where: t_o = original thickness

t_f = final thickness measured one hour after load removal

ORDERING PAPER NO. 14800-10
PRACTICE PAPER NO. 14877-10
CROSS SECTION-TENSILE TO 1 INCH

MADE IN USA



Compressive Strength

The compressive strength of the material was determined in accordance with PPP-C-1752A for type I material. Three specimens 4 x 4 x 1 inch (10.1 x 10.1 x 2.5 cm) were compressed 10% of their original thickness at a rate of 0.5 inch (1.3 cm) per minute. The load was read at 10% compression and this value converted to pounds per square inch.

Temperature Effects (dynamic)

To observe the effects of temperature on the dynamic characteristics of EPERAN, the following tests were conducted. Two and three inch (5.1 and 7.6 cm) thick samples 8 x 8 inches (20.3 x 20.3 cm) were tested using the same method as used to develop the peak G vs. static stress curves. Only one static stress point was evaluated (0.6 lb/in² (0.042 kg/cm²)). A drop height of 30 inches (76.2 cm) was maintained for all drops. Five drops were conducted on each sample at 72°O, -20°OF, 72°OF, 120°OF and 72°OF in that order, using the same procedure as described above.

RESULTS

Dynamic Impact Test

The results of the dynamic tests are presented in Graph 1. The curves indicate that, the EPERAN material provides lower peak G values than the 2.0 lb/ft³ (0.034 gm/cm³) polyethylene in the optimum cushioning static stress range. The data for the 2.0 lb/ft³ (0.032 gm/cm³) polyethylene material was taken from MIL-HDBK-304A.

A comparison of the Peak G vs static stress data developed by this Agency with that developed by the manufacturer indicated some differences. The differences may be due to variations in the test methods or slight material variations. The comparisons were made at the 23.6 inch (60 cm) and 29.5 inch (75 cm) drop heights. A curve developed for 1.6-inch (4.1 cm) thick material at a drop height of 23.6 inches (60 cm) indicated that this Agency's data was 20% higher than the Japanese data in the optimum cushioning static stress range.

Completed Pack Test (Corner Pads)

The results of all corner pad testing in the completed pack configuration at drop heights of 15.7, 19.7, and 23.6 inches (40, 50, and 60 cm) indicated that the manufacturer developed peak G-static vs. stress curves could safely be used for designing corner pads.

The drop tests conducted, on the molded corner pads 0.79 inch (2 cm) thick, at drop heights of 15.7 and 19.7 inches (40 and 50 cm) indicated that they would hold up very well. A second corner drop on one corner is the most hazardous situation because of the container's corner being crushed on the first drop. The relatively thin material does allow the design "C" level to be exceeded on the second drop. The thicker material corner pads did experience some increase in G level on the second corner drop but did not exceed the design value.

The results of the drop tests using the "in-house" fabricated corner pads of 1.6 and 2.4 inch (4 and 6 cm) thicknesses correlated very well with the dynamic curves developed by this Agency for a 23.6 inch (60 cm) drop height. The pads held up well for the number of drops (45) made on them.

Static Compressive Stress-Strain Curve

The stress-strain curve (average of 3 samples) is presented in Graph 3. As indicated by the "unloading" curve the material exhibited good recovery after 62.5% compression. Also, as indicated by the "loading" curve, deformation of 2% or less occurs when the material is loaded to its optimum static stress range of .3 psi (.02 kg/cm²) to 1.5 psi (.11 kg/cm²).

Compression Set

Specification PPP-C-1752A for uncellular polyethylene foam allows for a maximum set of 10% of the original thickness. Eperan has an average set of 3%, which indicates excellent recoverability.

Compressive Strength

PPP-C-1752A allows for an 8 lb/in² (0.056 kg/cm²) maximum compressive strength. The average compression strength for the Eperan material was 6.7 lb/in² (0.47 kg/cm²).

Temperature Effects (Dynamic Cushioning)

The following table presents the results of the temperature tests for 2 and 3-inch (5.1 and 7.6 cm) thick samples:

Temp.		2 in (5.1 cm) sample	3 in (7.6 cm) sample
(°F)	(°C)	Avg. Peak Gs	Avg. Peak Gs
72	22.2	52.7	38.3
-20	-28.9	57.0	46.7
72	22.2	55.3	39.7
120	48.9	58.7	39.5
72	22.2	56.2	39.2

In general, the results indicate that the effects of temperature extremes on dynamic cushioning performance are minimal. The only change of any significance occurred at -20°F for the 3 in (7.6 cm) thick material.

The results for the 1.6 and 2.4-inch (4 and 6 cm) thick samples are shown in the following table:

<u>Temp.</u>		<u>1.6 in (4 cm) sample</u>	<u>2.4 in (6 cm) sample</u>
<u>(°F)</u>	<u>(°C)</u>	<u>(Avg. Peak Gs)</u>	<u>(Avg. Peak Gs)</u>
72	22.2	63.0	44.5
-60	-51.1	69.2	51.2
72	22.2	67.2	46.7

The average peak G values for both samples thicknesses increased a little over 6 Gs. Some of the increase may have been due to repeated impacts. The material did not crack or show any signs of degradation due to the effects of temperature.

DISCUSSION

Dynamic Characteristics

The results of the dynamic tests indicate that the cushioning properties of Eperan are equal to or better than 2 lb/ft³ (0.032 gm/cm³) polyethylene sheet stock material when used in the optimum cushioning static stress range. The ability to mold the material in a variety of forms and shapes enhances its potential applications as both a cushioning and container material.

CONCLUSIONS

From the data collected in this study it is concluded that:

1. Molded polyethylene has a potential use as a cushioning and/or a blocking and bracing material in package designs.
2. The molded polyethylene material will provide superior cushioning performance in the higher static stress ranges associated with most applications of polyethylene materials.
3. The greatest potential benefit with this material appears to be in those applications which require the use of built-up cushion pads or container structures formed by laminating together pieces of polyethylene sheet stock. Where volume production is required, the substitution of molded polyethylene in these applications should prove to be cost effective through the reduction of labor requirements.

DISTRIBUTION LIST

	<u>COPIES</u>
HQ USAF/LETT WASH DC 20330	1
Aviation Supply Office Attn: TEP-A Philadelphia PA 19111	1
Commander US Army Natick R&D Ctr/DRXNM-EP Natick MA 01760	1
NWC-Earle Colts Neck NJ 07722	1
DESC/DESC-T 1507 Wilmington Pike Dayton OH 45444	1
JPMT Aberdeen Proving Ground MD 21005	2
ADTC/SD3P Eglin AFB FL 32542	1
WR-ALC/DSP Robins AFB GS 31098	1
OO-ALC/DSTC Hill AFB UT 84406	1
OC-ALC/DSPA Tinker AFB OK 73145	2
SA-ALC/DSP Kelly AFB TX 78241	1
SM-ALC/DSP McClellan AFB CA 95652	1
Tobyhanna Army Depot/DRXTO-TP-S Tobyhanna PA 18466	1
HQ AFSC/LGT Andrews AFB DC 20334	1

DISTRIBUTION LIST (Cont'd)

	<u>COPIES</u>
AFALD/PT	1
AFLC/LOZPP	1
AFALD/PTP Library	20
DDC-TC (Accessions Division) Alexandria VA 22314	12
DLSIE/DRXMC-D US Army Logistics Management Attn: Mr. Malcolm Alley Fort Lee VA 23801	2
AGMC/DMTP Newark AFS OH 43055	1
USA Natick Labs (DRDNA-EPS) Natick MA 01760	1
NAVSUPSYSCMD (SUP-0321A) Wash DC 20376	5
USA Armament Research & Development Command Attn: DRDAR-LCU-TP Dover NJ 07801	1

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER RTPT Report No. 79-9 ✓	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Evaluation of Expanded Bead Polyethylene Foam Cushioning For Packaging	5. TYPE OF REPORT & PERIOD COVERED Final	
7. AUTHOR(s) Richard V. Brown	6. PERFORMING ORG. REPORT NUMBER AFPEA Project No. 77-P7-49 ✓	
9. PERFORMING ORGANIZATION NAME AND ADDRESS AFALD/PTPT Wright-Patterson AFB OH 45433	8. CONTRACT OR GRANT NUMBER(s)	
11. CONTROLLING OFFICE NAME AND ADDRESS AFALD/PTP Wright-Patterson AFB OH 45433	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS	
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	12. REPORT DATE November 1979	13. NUMBER OF PAGES 18
	15. SECURITY CLASS. (of this report)	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for Public Release Distribution Unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Molded Polyethylene, Cushioning material, Creep Test, Compression Set, Dynamic Properties.		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Expanded Bead Molded Polyethylene Foam Cushioning Material was evaluated for its static and dynamic characteristics. It was determined that the material meets the compression set and compressive strength requirements of Type I material of PPP-C-1752A, "Cushioning Material, Packaging, Unicellular Polyethylene Foam, Flexible." The material provides slightly better dynamic cushioning in the optimum cushioning static stress range than conventional polyethylene sheet stock materials. Application of molded polyethylene should (Cont'd)		

FORM 1473
1 JAN 73

EDITION OF 1 NOV 68 IS OBSOLETE

UNCLASSIFIED

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

prove to be cost effective when used in lieu of built-up cushion packs or container structures which are formed by laminating together pieces of polyethylene sheet stock.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

INSTRUCTIONS FOR PREPARATION OF REPORT DOCUMENTATION PAGE

RESPONSIBILITY. The controlling DoD office will be responsible for completion of the Report Documentation Page, DD Form 1473, in all technical reports prepared by or for DoD organizations.

CLASSIFICATION. Since this Report Documentation Page, DD Form 1473, is used in preparing announcements, bibliographies, and data banks, it should be unclassified if possible. If a classification is required, identify the classified items on the page by the appropriate symbol.

COMPLETION GUIDE

General. Make Blocks 1, 4, 5, 6, 7, 11, 13, 15, and 16 agree with the corresponding information on the report cover. Leave Blocks 2 and 3 blank.

Block 1. Report Number. Enter the unique alphanumeric report number shown on the cover.

Block 2. Government Accession No. Leave Blank. This space is for use by the Defense Documentation Center.

Block 3. Recipient's Catalog Number. Leave blank. This space is for the use of the report recipient to assist in future retrieval of the document.

Block 4. Title and Subtitle. Enter the title in all capital letters exactly as it appears on the publication. Titles should be unclassified whenever possible. Write out the English equivalent for Greek letters and mathematical symbols in the title (see "Abstracting Scientific and Technical Reports of Defense-sponsored RDT/E," AD-667 000). If the report has a subtitle, this subtitle should follow the main title, be separated by a comma or semicolon if appropriate, and be initially capitalized. If a publication has a title in a foreign language, translate the title into English and follow the English translation with the title in the original language. Make every effort to simplify the title before publication.

Block 5. Type of Report and Period Covered. Indicate here whether report is interim, final, etc., and, if applicable, inclusive dates of period covered, such as the life of a contract covered in a final contractor report.

Block 6. Performing Organization Report Number. Only numbers other than the official report number shown in Block 1, such as series numbers for in-house reports or a contractor/grantee number assigned by him, will be placed in this space. If no such numbers are used, leave this space blank.

Block 7. Author(s). Include corresponding information from the report cover. Give the name(s) of the author(s) in conventional order (for example, John R. Doe or, if author prefers, J. Robert Doe). In addition, list the affiliation of an author if it differs from that of the performing organization.

Block 8. Contract or Grant Number(s). For a contractor or grantee report, enter the complete contract or grant number(s) under which the work reported was accomplished. Leave blank in in-house reports.

Block 9. Performing Organization Name and Address. For in-house reports enter the name and address, including office symbol, of the performing activity. For contractor or grantee reports enter the name and address of the contractor or grantee who prepared the report and identify the appropriate corporate division, school, laboratory, etc., of the author. List city, state, and ZIP Code.

Block 10. Program Element, Project, Task Area, and Work Unit Numbers. Enter here the number code from the applicable Department of Defense form, such as the DD Form 1498, "Research and Technology Work Unit Summary" or the DD Form 1634, "Research and Development Planning Summary," which identifies the program element, project, task area, and work unit or equivalent under which the work was authorized.

Block 11. Controlling Office Name and Address. Enter the full, official name and address, including office symbol, of the controlling office. (Equates to funding/sponsoring agency. For definition see DoD Directive 5200.20, "Distribution Statements on Technical Documents.")

Block 12. Report Date. Enter here the day, month, and year or month and year as shown on the cover.

Block 13. Number of Pages. Enter the total number of pages.

Block 14. Monitoring Agency Name and Address (if different from Controlling Office). For use when the controlling or funding office does not directly administer a project, contract, or grant, but delegates the administrative responsibility to another organization.

Blocks 15 & 15a. Security Classification of the Report: Declassification/Downgrading Schedule of the Report. Enter in 15 the highest classification of the report. If appropriate, enter in 15a the declassification/downgrading schedule of the report, using the abbreviations for declassification/downgrading schedules listed in paragraph 4-207 of DoD 5200.1-R.

Block 16. Distribution Statement of the Report. Insert here the applicable distribution statement of the report from DoD Directive 5200.20, "Distribution Statements on Technical Documents."

Block 17. Distribution Statement (of the abstract entered in Block 20, if different from the distribution statement of the report). Insert here the applicable distribution statement of the abstract from DoD Directive 5200.20, "Distribution Statements on Technical Documents."

Block 18. Supplementary Notes. Enter information not included elsewhere but useful, such as: Prepared in cooperation with . . . Translation of (or by) . . . Presented at conference of . . . To be published in . . .

Block 19. Key Words. Select terms or short phrases that identify the principal subjects covered in the report, and are sufficiently specific and precise to be used as index entries for cataloging, conforming to standard terminology. The DoD "Thesaurus of Engineering and Scientific Terms" (TEST), AD-672 000, can be helpful.

Block 20. Abstract. The abstract should be a brief (not to exceed 200 words) factual summary of the most significant information contained in the report. If possible, the abstract of a classified report should be unclassified and the abstract to an unclassified report should consist of publicly-releasable information. If the report contains a significant bibliography or literature survey, mention it here. For information on preparing abstracts see "Abstracting Scientific and Technical Reports of Defense-Sponsored RDT&E," AD-667 000.