7/

This is an informal report intended primarily for internal or limited external distribution. (The opinions and conclusions stated are those of the author and may or may not be those of the laboratory.) This report is not to be given additional external distribution or cited in external documents without the consent of the author or LLL Technical Information Department.

UCID - 16412

LAWRENCE LIVERMORE LABORATORY

University of California/Livermore, California

Preparation and Testing of Urethane Polymer Rings

Unclassified

A. T. Buckner, E. S. Jessop and H. George Hammon

November 6, 1973

MASTER

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

PREPARATION AND TESTING OF URETHANE POLYMER RINGS

A. T. Buckner, E. S. Jessop and H. George Hammon¹

INTRODUCTION:

This short paper will give general preparation, inspection procedures, and test methods for urethane ring specimens with emphasis on avoidance of mistakes which are usually made in the beginning of any testing program.

PREPARATION OF TEST SPECIMENS:

All specimens at LLL were cut from 15.24 x 15.24 x .178 cm using a fly cutter with finely honed No. 11" X-Acto blades as cutters. These two blades were attached to the outer opposite surfaces of the fly cutter so that one blade was set .147 cm closer to the centerline of the cutter. This permits both blades to cut a ring with an OD of 3.812 cm, ID of 3.518 cm, with a wall thickness of .147 cm and an average diameter of 3.665 cm. Note Figure 1.

Figure 1.

A Bridgeport Milling Machine, set at 80 RPM with a 7.6 cm per minute feed was used for elevated temperature cured Adiprene/MOCA; 6 inches per minute was used for ambient cured material. 100 to 120 RPM was used for polyol materials.

When installing blades on the holder, it was found that the inner cutter should be lower by approximately .064 cm so that the inner diameter is cut first, then the outer diameter - the ring is being held by the outer uncut region until the cutter is completely through the material.

A holder attached to the ways of the milling machine permits the flat stock to be held flat against a .635 cm thick sheet of polyethylene. Note Figure 2.

Figure 2.

After the cutter is properly positioned and the first cut has been made, then the ways are locked so that the location of the cutter in relation to the slab holder remains constant. Two wing nuts at either end of the slab holder permit removal of slab after ring has been cut.

After sufficient rings are cut, each ring is visually inspected and all rings with visible bubbles and irregular surface areas are rejected. Any poor machine cut surface areas are reasons for a ring to be rejected. A properly cut surface should have a shiny, slightly irregular appearance, showing that the blade is sharp and cutting well, rather than grinding through the specimen.

If the ring specimen has a dull appearance on either newly cut surface, it usually means that new sharper blades are needed. Two newly honed blades should normally last for approximately 50 rings.

Material from which rings are cut (such as the area cut from the center of the rings), should have a "wet" density determination. This information together with the ring weight and the known dimensions of the ring, will then give X-sectional area of the rings to be tested.

TENSILE TESTING

An Instron Testing Machine (floor model) was used in the testing of ring specimens. A load cell with an adequate capacity should be used (a 100 Kg-CCTM cell was used for Adiprene L-100/MOCA specimens).

The Instron Cross-Head should be large enough to allow room for required hardware from load-cell and cross-head and allow extension of at least 31 or 32 cms. If rings are tested at elevated temperature, allowances will have to be made for greater extension because of even greater elongation of Adiprene at elevated temperature, plus added allowances for the environmental chamber.

Fixturing for testing should include a load-cell with a rod extending to a ring holding fixture.

Rods holding the Adiprene rings should be .953 cm diameter rods and should be highly finished and as parallel to each other as possible when installed in the Instron Testing Machines. A straight extending rod from the load cell and another from the cross-head and well-centered in relation to each other is vital to a good test. The ring must be located directly under the load cell or a false reading can be obtained from the load cell. See Figure 3.

Figure 3.

Before testing, all rings should be allowed to equilibrate under testing conditions (if testing at room temperature) for at least two hours. Generally, rings were left in the testing room overnight and then tested the next day.

A light grease on both holding fixture and Adiprene rings will help lower friction between rings and holding fixture (DC-7 silicone grease liberally used on rings, then the excess removed, was the procedure followed at LLL).

When rings are installed on the Instron Testing Machine for testing, caution should be taken to prevent premature stretching of rings before testing. The early portion of the testing curve is distorted by premature stretching of the ring.

In earlier tests, it was thought necessary to take the slack out of the ring before testing. Later it was found that the best test results were obtained in the early portion of the test curve by not taking the slack from the ring being tested (the higher portion of the curve is largely unaffected by this slight premature stretching).

ENVIRONMENTAL CHAMBER USE:

When an environmental chamber is used for elevated temperature, the area of the test should be controlled to $\pm 1^{\circ}\text{F}$.

At LLL, a multipoint recorder with at least 7 thermocouples was used;

- #1TC - into a small piece of Adiprene attached to lower ring holding near ring to be tested.
- #2TC - attached to upper rod near ring.
- #3TC - attached to lower rod near ring.
- #4TC - attached to back wall of chamber.
- #5TC - attached to front floor.
- #6 and #7TC - attached to each side wall of chamber.

There will probably be large variations between #4, 5, 6 and 7TC's, but the TC's near the test area should show only minimal changes if this area is insulated from direct air currents.

When testing at temperatures approaching the cure temperature of the ring material, the ring should be in the chamber only long enough to reach the required temperature. If a specimen is exposed to elevated temperature for too long a time, the specimen might gain added cure or partially degrade. #1TC (into pc. of Adiprene located near test specimen) should be the controlling TC. After this TC reaches the required temperature, an additional few minutes with this TC at the test temperature is required before the actual test is begun. Fifteen minutes (or less) is required for specimen to reach temperature and allow specimen to "soak" before beginning the test.

LLL Internal Distribution

J. S. Kane/H. Rizzo
E. R. Bissell/F. Walker
H. G. Hammon
P. G. Fleming
B. Garner
D. F. Croff
L. E. Peck
W. E. Cady
E. S. Jessop
A. T. Buckner
J. K. Lepper
R. F. Hatfield
R. Wasley
R. Brady
D. Seaton
C. Bender
TID File

30

External Distribution

W. May
F. Dubois
Los Alamos Scientific Laboratory
Los Alamos, New Mexico

F. Childress
H. Kite
Union Carbide Corporation
Oak Ridge, Tennessee

F. Jackson
R. Frohberg
C. Smith, Jr.
The Bendix Corporation
Kansas City, Missouri

P. Rand
J. MacDonald
Sandia Laboratories
Albuquerque, New Mexico

D. Adolphson
Sandia Laboratories
Livermore, California

L. Hartzel
Monsanto Research Corporation
Miamisburg, Ohio

Technical Information Center, 2
Oak Ridge

R. Spray
Mason and Hanger-Silas Mason Co., Inc.
P. O. Box 647
Amarillo, Texas 79105

NOTICE

"This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Atomic Energy Commission, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately-owned rights."