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Standard Test Methods for Microcellular Urethane Materials[1]

This standard is issued under the fixed designation D3489; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 These test methods cover the preparation of a standard-size test sample and basic tests for physical property determinations of microcellular urethane materials.

1.2 The values stated in SI units are to be regarded as standard. The values given in ~~brackets~~parentheses are for information only.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—There is no known ISO equivalent to this standard.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D256 Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
D395 Test Methods for Rubber PropertyCompression Set
D412 Test Methods for Vulcanized Rubber and Thermoplastic ElastomersTension
D573 Test Method for RubberDeterioration in an Air Oven
D575 Test Methods for Rubber Properties in Compression
D624 Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
D790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement ~~D1044Test Method for Resistance of Transparent Plastics to Surface Abrasion~~
D1052 Test Method for Measuring Rubber DeteriorationCut Growth Using Ross Flexing Apparatus
D1622 Test Method for Apparent Density of Rigid Cellular Plastics
D1630 Test Method for Rubber PropertyAbrasion Resistance (Footwear Abrader) ~~D1938Test Method for Tear-Propagation Resistance (Trouser Tear) of Plastic Film and Thin Sheeting by a Single-Tear Method~~
D2240 Test Method for Rubber PropertyDurometer Hardness
D2584 Test Method for Ignition Loss of Cured Reinforced Resins
D2632 Test Method for Rubber PropertyResilience by Vertical Rebound
D3040 Practice for Preparing Precision Statements for Standards Related to Rubber and Rubber Testing; Replaced by D4483
D3137 Test Method for Rubber PropertyHydrolytic Stability
D3389 Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform Abrader)
D3574 Test Methods for Flexible Cellular MaterialsSlab, Bonded, and Molded Urethane Foams
D3768 Test Method for Microcellular UrethanesFlexural Recovery
D3769 Test Method for Microcellular Urethanes~~High-Temperature Sag~~ High-Temperature Sag
G195 Guide for Conducting Wear Tests Using a Rotary Platform, Double-Head Abraser

[1] These test methods are under the jurisdiction of ASTM Committee D20 on Plastics and are the direct responsibility of Subcommittee D20.22 on Cellular Materials - Plastics and Elastomers.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

***A Summary of Changes section appears at the end of this standard.**

3. Terminology

3.1 ~~Description~~*Definitions of Terms Specific to This Standard:*

3.1.1 *microcellular urethane*—an elastomeric material made by the interaction of a polyol and an organic isocyanate, having cell diameters in the range from 0.0001 to 0.001 mm, with a minimum density of 160 kg/m^3~~[10 lb/ft^3(10 lb/ft^3)].~~).

NOTE 2—In the following sections, the term "retaining the molded surfaces" refers to the two major surfaces (faces) of the sample and/or specimens prepared from it and was not meant to include the minor surfaces (ends or sides).

4. Significance and Use

4.1 Tests made on materials herein prescribed can be of considerable value in comparing physical properties of different materials, in controlling manufacturing processes, and as a basis for writing specifications.

4.2 Before proceeding with these test methods, reference should be made to the specification of the material being tested. Any test specimen preparation, conditioning, or dimensions, or combination thereof, and testing parameters covered in the materials specification shall take precedence over those mentioned in these test methods. If there are no material specifications, then the default conditions apply.

5. Sampling

5.1 Test samples can be made in any suitable mold. The following three sizes are recommended (length, width, and thickness): 305 by 152 by 3.15 mm ~~[12~~(12 by 6 by ⅛ ~~in.],~~in.), 305 by 152 by 6.3 mm ~~[12~~(12 by 6 by ¼ ~~in.],~~in.), and 305 by 152 by 12.5 mm ~~[12~~(12 by 6 by ½ ~~in.].~~ in.).

5.2 The procedure used to prepare the test sample relating to component ratios, temperature, mixing direction, mold temperature, and curing conditions shall conform to the manufacturer's recommendations.

5.3 The test sample shall be allowed to age a minimum of ~~48~~40 h before testing, at 23 ± 2°C ~~[73.4~~(73.4 ± ~~3.6°F]~~3.6°F) and 50 ± ~~5%~~10 % relative humidity.

6. Density

6.1 Determine the density in accordance with either Test Method D792 or Test Method D1622. Prepare test specimens retaining the molded surfaces. If using Test Method D1622, report any deviations from the specified minimum specimen size.

7. Tensile Properties

7.1 Determine the tensile properties in accordance with Test Method D412. Cut tension specimens using the Die A or any other suitable die in accordance with Test Method D412 from the 3.15-mm ~~[~~(⅛~~-in.]~~-in.) or 6.3-mm ~~[~~(¼~~-in.]~~-in.) test sample. Retain the molded surfaces.

7.2 *Precision*—These precision statements were prepared in accordance with the statistical and other testing terminology and concepts presented in Practice D3040.

7.2.1 The precision of this test method was determined from an interlaboratory study of one microcellular urethane material. One laboratory made the microcellular urethane material. One laboratory made the microcellular urethane material plaques, and three laboratories tested the material on two days.

7.2.2 Table 1 gives the LQC precision data as obtained in the interlaboratory program. The values given are equivalent to" repeatability" for within laboratories testing and "reproducibility" for among laboratories testing.

7.2.3 A "test result" is the average result from the testing of three dumbbell specimens.

8. Tear

8.1 Using Die C, determine the tear strength in accordance with Test Method D624. Cut the specimen from the 3.15-mm ~~[~~(⅛~~-in.]~~-in.) sample, retaining the molded surface.

8.2 Determine the split tear (Type T or trouser tear) strength in accordance with Test Method ~~D1938~~D624. Cut the Type T specimen from the 3.15-mm ~~[~~(⅛~~-in.]~~-in.) sample. The direction of tear shall include both molded surfaces.

8.3 Determine the block tear in accordance with Test Methods D3574, except the specimen shall be 19.0 mm ~~[0.75 in.]~~(0.75 in.) wide by 12.5 mm ~~[0.5 in.]~~(0.5 in.) thick. The tear direction shall be through the core retaining both molded surfaces.

9. Hardness

9.1 Determine the hardness in accordance with Test Method D2240 on the 6.3-mm ~~[~~(¼~~-in.]~~-in.) thick sample. The Type A, or

TABLE 1 LQC Test Precision of Tensile Property Test

Property	Mean	Within Laboratories		Among Laboratories	
		S	LSD	S	LSD
~~100 % tensile stress, MPa [psi]~~	~~2.2 [324]~~	~~0.08 [12]~~	~~0.24 [34]~~	~~0.13 [19]~~	~~0.38 [54]~~
100 % tensile stress, MPa (psi)	2.2 (324)	0.08 (12)	0.24 (34)	0.13 (19)	0.38 (54)
~~Tensile strength, MPa [psi]~~	~~4.3 [624]~~	~~0.18 [26]~~	~~0.51 [74]~~	~~0.24 [35]~~	~~0.69 [99]~~
Tensile strength, MPa (psi)	4.3 (624)	0.18 (26)	0.51 (74)	0.24 (35)	0.69 (99)
Elongation, 90 %	297	9	25	11	31