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Standard Test Method for Cell Size of Rigid Cellular Plastics[1]

This standard is issued under the fixed designation D3576; 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 This test method covers the determination of the apparent cell size of rigid cellular plastics by counting the number of cell-wall intersections in a specified distance.

1.2 Procedure A requires the preparation of a thin slice, not more than one half the average cell diameter in thickness, that is mechanically stable. For most rigid cellular plastics this limits the test method to materials with an average cell size of at least 0.2 mm.

1.3 Procedure B is intended for use with materials whose friable nature makes it difficult to obtain a thin slice for viewing.

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

1.5 *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—The annex to ISO 2896 is technically equivalent to this test method.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D883 Terminology Relating to Plastics

D2842 Test Method for Water Absorption of Rigid Cellular Plastics

D2856 Test Method for Open-Cell Content of Rigid Cellular Plastics by the Air Pycnometer (Withdrawn 2006)[3]

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

2.2 *ISO Standard:*

ISO 2896 Cellular Plastics, Rigid—Determination of Water Absorption[4]

3. Terminology

3.1 Definitions of terms applicable to this test method are given in Terminology D883.

4. Summary of Test Method

4.1 *Procedure A*—The cellular plastic specimen is cut to not more than one half the average cell diameter in thickness on a slicer and the shadowgraph is projected on a screen by the use of a cell-size scale slide assembly and a projector. The average chord length is obtained by counting the cells on cell-wall intersections and converting this value to average cell size by mathematical derivation.

4.2 *Procedure B*— The cellular plastic specimen is sliced to provide a smooth surface. The cell walls are accented by the use of a marking pen. The average chord length is obtained by counting the cell wall intersections and converting this value to average cell size by mathematical derivation.

5. Significance and Use

5.1 Several physical properties of rigid cellular plastics are dependent on cell size and cell orientation. Measuring water absorption and open-cell content in accordance with Test Method D2842 and Test Method D2856 requires knowledge of surface cell volume, which uses cell size values in the calculations.

5.2 This test method provides an apparent cell size because it assumes that there is no measurable edge to edge or top to bottom variation in average cell size and that the cell size distribution about the average cell size is normal. If the analyst is concerned there may be significant variation in either the average cell size or the cell size distribution more detailed analysis may be required.

5.3 Before proceeding with this test method, reference should be made to the specification of the material being tested. Any test specimen preparation, conditioning, dimensions, or

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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.

[3] The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

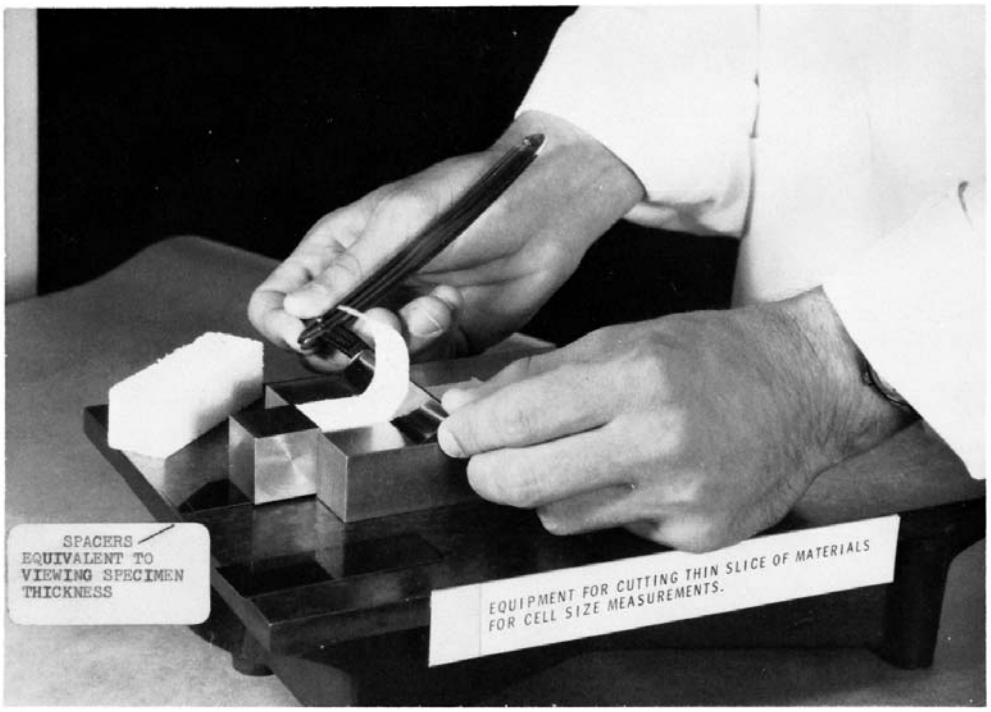

FIG. 1 Razor Blade Cell Size Specimen Slicer

testing parameters, or a combination thereof, covered in the materials specification shall take precedence over those mentioned in this test method. If there are no material specifications, then the default conditions apply.

6. Apparatus

6.1 The apparatus required to perform the test as defined by Procedure A is listed as follows:

6.1.1 *Cell Size Specimen Slicer* [5] —Cutting blade apparatus capable of slicing thin specimens (0.02 mm) for cell size viewing. Fig. 1 shows an acceptable alternative slicing apparatus.

6.1.2 *Cell Size Projector*—Conventional 35-mm slide projector that accepts standard 50 by 50-mm (2 by 2-in.) slides.

6.1.3 *Cell Size Scale Slide Assembly,* consisting of two pieces of slide glass hinged by tape along one edge, between which a calibrated scale (30 mm in length) printed on a thin plastic sheet is placed (see Fig. 2).

6.2 The apparatus required to perform the test as defined by Procedure B is listed as follows:

6.2.1 *Cell Size Specimen Slicer* [5] —Cutting blade apparatus capable of providing a smooth surface.

6.2.2 *Optical Magnification System,* capable of 5 to 25× magnification with a calibrated scale of the appropriate length.

6.2.3 *Highlighting Market,* that does not contain a solvent which will attack the polymer system. The ink used should contrast with the color of the foam.

[5] Hobart Model 610-1, an electrically operated slicer, available from the Hobart Corp., 701 S. Ridge Ave., Troy, OH 45374.

7. Sampling

7.1 Generally one specimen is sufficient to determine the apparent cell size of a sample.

7.2 The number of samples may be dictated by the end-use data needed.

8. Procedures

8.1 *Procedure A:*

8.1.1 Cut a specimen 50 by 50 mm by thickness (2 by 2 in. by thickness) from the sample in the area to be tested.

8.1.2 Prepare the cell size viewing specimen by cutting a thin slice (less than monocellular) from one of the cut surfaces of the specimen. (Slice thickness should be as thin as practicable; so that a shadowgraph will not be occluded by overlapping cell walls. Optimum slice thickness will vary with the average cell size of the foam, with smaller cell foams requiring thinner slices.)

NOTE 2—One cell size measurement will provide a representative apparent cell size for cellular plastics having symmetric cells of relatively uniform size. However, if the cell size in the three normal directions is suspected of varying by a value greater than the precision of this test method, all three directions should be measured and reported for maximum accuracy. An acceptable procedure, in this case, is to determine the cell size in two planes perpendicular to each other. The size of the cells in the three normal directions can then be compared and reported separately if desired.

8.1.3 Insert the thin-sliced foam specimen into the cell size slide assembly. Position the zero on the grid line at the top of the area to be measured. Reassemble the slide.