Designation: D 6790 – 02

Standard Test Method for Determining Poisson's Ratio of Honeycomb Cores[1]

This standard is issued under the fixed designation D 6790; 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 honeycomb Poisson's ratio from the anticlastic curvature radii, see Fig. 1.

1.2 The values stated in SI units are to be regarded as the standard. The inch-pound units given may be approximate.

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.*

2. Referenced Documents

2.1 *ASTM Standards:*

C 271 Test Method for Density of Sandwich Core Materials[2]

C 274 Terminology of Structural Sandwich Constructions[2]

3. Terminology

3.1 *Definitions*—Terminology C 274 defines terms relating to sandwich constructions.

3.2 *Symbols*:

c = chord measurement

d = depth measurement

R_a = anticlastic curvature radius

R_c = cylinder radius

μ = Poisson's ratio

4. Summary of Test Method

4.1 The Poisson's ratio of honeycomb core is determined by bending the core around a cylinder and taking measurements of the anticlastic curvature that occurs.

5. Significance and Use

5.1 Certain sandwich panel finite element programs require the Poisson's ratio of the honeycomb core. It is not possible to measure the honeycomb's Poisson's ratio by standard methods.

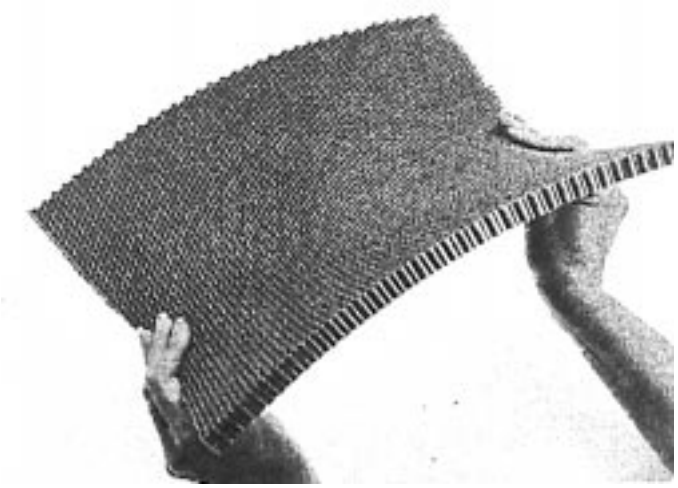

FIG. 1 Anticlastic Curvature

6. Interference

6.1 The test method shown here is one means of obtaining the Poisson's ratio of honeycomb. However, this test method has not been widely used, and it is in its conceptual stage.

7. Apparatus

7.1 *Cylinders*, of various diameters. A 610 mm (24 in.) diameter cylinder is recommended.

7.2 *Scale*, capable of measuring accurately to 0.25 mm (0.01 in.).

8. Sampling and Test Specimens

8.1 Test at least five specimens per test condition unless valid results can be gained through the use of fewer specimens, such as in the case of a designed experiment.

8.2 The test specimen shall be square. The length and width should be great enough to obtain an anticlastic curvature when the specimen is bent over the cylinder. A specimen size of 300 by 300 mm (12 by 12 in.) is recommended.

8.3 Various core thicknesses should be tested. A core thickness of 12.7 mm (0.50 in.) is recommended as a starting thickness.

9. Calibration

9.1 The accuracy of all measuring equipment shall have certified calibrations that are current at the time of use of the equipment.

[1] This test method is under the jurisdiction of ASTM Committee D30 on Composite Materials and is the direct responsibility of Subcommittee D30.09 on Sandwich Construction.

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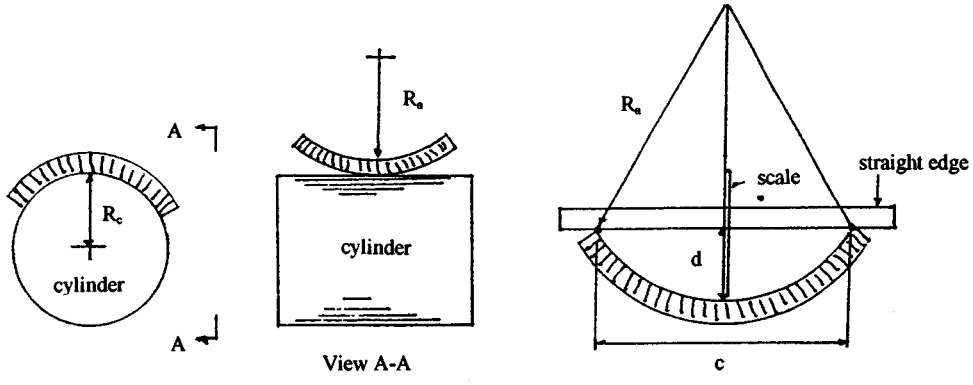
[2] *Annual Book of ASTM Standards*, Vol 15.03.



R_c = cylinder radius R_a = anticlastic radius Measurements

FIG. 2 Measurements

10. Conditioning

10.1 When the physical properties of the core material are affected by moisture, bring the test specimens to constant weight (±1 %) before testing, preferably in a conditioning room with temperature and humidity control and make the tests, preferably, in a room under the same condition. A temperature of 23 ± 3°C (73 ± 5°F) and a relative humidity of 50 ± 5 % are recommended.

11. Procedure

11.1 Determine the plan dimensions of the specimens in mm (in.) to a precision of ±0.5 %.

11.2 Measure the thickness of the specimens in mm (in.) to the nearest 0.025 mm (0.001 in.).

11.3 Bend the honeycomb core specimen around the cylinder of known diameter, making sure all the specimen surface along its centerline is in contact with the cylinder.

11.4 Place a straightedge across the specimen and measure the distance as shown in Fig. 2 while the specimen is bent around the cylinder.

12. Calculations

12.1 Calculate the densities of the specimens using Test Method C 271.

12.2 Calculate the anticlastic curvature radius and Poisson's ratio of the specimens as follows:

$$R_a = \frac{4\,d^2 + c^2}{8\,d} \qquad \mu = \frac{R_c}{R_a}$$

where: (see Fig. 2)
μ = Poisson's ratio,
R_a = anticlastic curvature radius,
R_c = cylinder radius,
c = chord measurement, and
d = depth measurement.

13. Report

13.1 The report shall include the following:

13.1.1 Description of the test specimens; core material, cell size, and density,

13.1.2 Dimensions of the test specimens and which core direction was bent over the cylinder, *L* or *W*,

13.1.3 Specimens conditioning, if any, and

13.1.4 The Poisson's ratios; individual values, average, and standard deviation.

14. Precision and Bias

14.1 *Precision*—The data required for the development of a precision statement are not available for this test method.

14.2 *Bias*—Bias cannot be determined for this test method as no acceptable reference material exists.

15. Keywords

15.1 core; honeycomb; Poisson's ratio