

Australian Standard®

Methods of testing rigid cellular plastics

Method 3: Determination of compressive stress

METHOD

1 SCOPE This Standard sets out a method for determining the compressive stress at 10% relative deformation of rigid cellular plastics.

2 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

AS

2193 Methods for calibration and grading of force-measuring systems of testing machines

2498 Methods of testing rigid cellular plastics

2498.1 Method 1: Sampling and conditioning

2498.2 Method 2: Determination of linear dimensions

3 DEFINITIONS For the purpose of this Standard, the definitions below apply.

3.1 Compressive strength (δ_M)—quotient of the maximum compressive force F_M , reached when the relative deformation ε is $<10\%$, by the initial surface area of the right cross-section of the test specimen. The relative deformation corresponding to δ_M is noted as ε_M .

3.2 Compressive stress at 10% relative deformation (σ_{10})—quotient of the compressive force F_{10} corresponding to a relative deformation $\varepsilon_{10} = 10\%$, by the initial surface area of the right cross-section of the test specimen.

3.3 Relative deformation (ε)—quotient of the variation (in relation to its initial value) of the thickness of the test specimen by its initial thickness. It is expressed as a percentage.

4 PRINCIPLE A compressive force is applied at constant speed, in an axial direction to the faces of a rectangular parallelepiped test specimen. The maximum stress supported by the test specimen is calculated.

If the value of the maximum stress corresponds to a relative deformation of less than 10%, it is noted as the ‘compressive strength’ (or ‘critical compressive stress’). Otherwise, the stress corresponding to a relative deformation of 10% is calculated and its value noted as the ‘compressive stress for a relative deformation of 10%’.

5 APPARATUS

5.1 Compression testing machine Any compression testing machine suited, to the range of force and displacement in question, shall have two square or circular plane parallel plates. The plates shall be polished and cannot be deformed, and the length of one side (or the diameter) shall be at least 10 cm. One of the plates shall be fixed and the other movable; the latter shall be capable of moving at a constant rate of displacement in accordance with the conditions laid down in Clause 7. Compression testing machines, complying with the requirements of Grade B machines of AS 2193, are suitable.

5.2 Measuring devices

5.2.1 Measurement of displacement The compression testing machine shall be fitted with a system allowing continuous measurement of the displacement χ of the movable plate with an accuracy of $\pm 5\%$ or ± 0.1 mm, if this latter value is a more precise measurement (see Note to Clause 5.2.2).

5.2.2 Measurement of force A force sensor shall be fixed to one of the machine plates in order to measure the force F produced by the reaction of the test specimen upon the plates during the test. This sensor shall be such that its own deformation during the course of the measuring operation is negligible compared with that being measured, and in addition it shall allow the continuous measurement of the force at any point in time with an accuracy of $\pm 1\%$ (see Note).

NOTE: A device for the simultaneous recording of the force F and the displacement χ is recommended. It should allow, by obtaining a curve of $F = f(\chi)$, the graphical determination of the pair of values F , χ required in Clause 8 with the accuracy laid down in Clauses 5.2.1 and 5.2.2 and provide additional information on the behaviour of the product.

5.2.3 Calibration The readings of force and displacement provided by the measuring devices of the compression testing machine (and possibly by its graphical recording device) shall be checked periodically using a series of standard masses (corresponding as the sensitivity used for the forces) and spacers of thicknesses, all of which are known to a greater degree of accuracy than that required in Clauses 5.2.1 and 5.2.2.

5.3 Measuring instruments Measuring instruments in accordance with AS 2498.2.

6 TEST SPECIMENS

6.1 Dimensions The test specimens shall be made up of right prisms with a square base having a linear dimension of 50 ± 1 mm and thickness (h_0) of 50 ± 1 mm.

Where the cellular product is of thickness less than 50 mm, thinner test specimens may be used, provided that the thickness is not less than 10 mm. The results obtained with these shall not be compared with those related to a thickness of 50 mm. Under no circumstances shall several test specimens be piled up to produce an initial thickness of 50 mm.

The distance between two faces shall not vary by more than 1% (tolerance on parallelism).

6.2 Preparation Remove any moulding skin from the test specimens; cut their faces with a mechanical saw and, if necessary, machine them without changing the original structure of the product. If the product is suspected of being anisotropic, several sets of test specimens shall be prepared. In this case, a set of test specimens shall be cut so that the direction in which the force is applied corresponds to one of the principal directions of anisotropy.

NOTES:

- 1 In general, any anisotropy is characterized by a plane and the direction perpendicular to this plane; thus, two sets of test specimens need to be considered.
- 2 The test specimens for compression tests in the principal directions of anisotropy are to all have the same dimensions. If the available thickness is less than 50 mm, the test will only be able to be performed in a single direction.