INTERNATIONAL STANDARD

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Sintered metal materials, excluding hardmetals — Determination of transverse rupture strength

Matériaux métalliques frittés à l'exclusion des métaux-durs — Détermination de la résistance à la rupture transversale

Reference number
ISO 3325:1996(E)

Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 3325 was prepared by Technical Committee ISO/TC 119, *Powder metallurgy*, Subcommittee SC 3, *Sampling and testing methods for sintered metal materials (excluding hardmetals)*.

This second edition cancels and replaces the first edition (ISO 3325:1975), which has been technically revised.

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Sintered metal materials, excluding hardmetals — Determination of transverse rupture strength

1 Scope

This International Standard specifies a method for the determination of the transverse rupture strength of sintered metal materials, excluding hardmetals. The method is particularly suitable for comparing the sintered strength of a batch of metal powder with that of a reference powder or with a reference strength.

The method is applicable to sintered metal materials, excluding hardmetals, whether they have been subjected to heat treatment after sintering or not, and also to materials that have been sized or coined after sintering.

It is specially suitable for materials having a uniform hardness throughout their section and negligible ductility, i.e. a ductility corresponding to a permanent deformation of less than about 0,5 mm measured between the two supports during the transverse rupture strength determination. If the test is applied to materials under conditions other than those specified above, the conditions shall be reported.

NOTE 1 The permanent deformation can be measured with sufficient precision from the two fragments of the broken or cracked bar by indexing the lower surface. Alternatively, the deflection of a straight line drawn horizontally on the side of the test piece can be measured using an optical instrument such as a measuring microscope or optical comparator.

2 Principle

A test piece resting on two supports is broken by the application of a load at the midpoint between the supports, under short-term static loading conditions.

3 Apparatus

3.1 Test equipment, of any type providing static loading conditions and an accuracy of ±1 %.

The equipment shall have two support cylinders (rollers) with a fixed distance between them and a load-application cylinder (roller). All three cylinders shall be 3,2 mm ± 0,1 mm in diameter and shall be made either of hardened steel with a hardness of at least 700 HV or of hardmetal.

The support cylinders shall be mounted parallel to each other, and the distance between their centre-lines shall be either 25,0 mm ± 0,2 mm or 25,4 mm ± 0,2 mm, measured with an accuracy of ± 0,1 mm for the calculation. The load-application cylinder shall be mounted midway between the support cylinders.

For better accuracy, the mounting of the cylinders should preferably be such as to compensate for any deviation from parallelism between the top and bottom faces of the test piece. This can be accomplished by mounting the support cylinders so that each can be adjusted vertically (see figure 1).

A diagrammatic arrangement of a typical test rig is shown in figure 1.

The fixture should preferably be surrounded by a suitable safety guard.

4 Test piece

4.1 The test piece shall be nominally 6 mm thick and produced from a die cavity of nominal dimensions 30 mm × 12 mm. The test piece thickness shall be uniform to within 0,1 mm over the whole length and to within 0,04 mm across any width line perpendicular to the height and length.

4.2 Alternatively, machined test pieces may be used, in which case care shall be taken during machining to ensure that no stress raisers are introduced into the test piece. The test piece shall be cut with the 30 mm × 12 mm faces perpendicular to the compaction axis, on account of possible anisotropy, choosing a region of uniform density. Furthermore, the machining technique employed to obtain the test piece shall not cause significant structural changes, such as densification when shearing a soft material or microstructural changes produced by electro-erosion machining techniques. If such changes do occur, grinding to remove the disturbed material is recommended.

5 Procedure

5.1 Measure the width and thickness of the test piece at its midpoint to the nearest 0,01 mm.

5.2 Place the test piece on one of its 30 mm × 12 mm faces symmetrically on the support cylinders so that its longitudinal axis is at 90° ± 30′ to the longitudinal axes of the cylinders. Precise positioning of the test piece can be easily ensured by pushing the side of the test piece up against a suitably located, removable stop. Apply a load at a position midway between the two cylinders. Increase the load slowly and steadily, so that the time to fracture is not less than 10 s. Record the value at which the load suddenly drops due to formation of the first crack.

5.3 Repeat the determination with a suitable number of test pieces.

6 Expression of results

6.1 The transverse rupture strength R_{tr}, in newtons per square millimetre, is given by the equation

$$R_{tr} = \frac{3FL}{2bh^2}$$

where

F is the load, in newtons, required for fracture;

L is the distance, in millimetres, between the supports;

b is the width, in millimetres, of the test piece at right angles to its height;

h is the height (thickness), in millimetres, of the test piece parallel to the direction of application of the test load.

Report the arithmetical mean of the transverse rupture strength determinations, rounded to the nearest 10 N/mm^2.

6.2 The absolute uncertainty of this method is given by the equation

$$\Delta R = R\left(\frac{\Delta F}{F} + \frac{\Delta L}{L} + \frac{\Delta b}{b} + 2\frac{\Delta h}{h}\right)$$

or

$$\Delta R = R\left(\frac{1}{100} + \frac{0,1}{25} + \frac{0,01}{12} + \frac{2 \times 0,01}{6}\right)$$

or

$$\Delta R = 0,02R$$

This value shall be taken into account if any precision statement is made.

7 Test report

The test report shall include the following information:

a) a reference to this International Standard;

b) all details necessary for identification of the test sample;

c) the distance between the centres of the support cylinders;

d) the result obtained;

e) details of any operation not specified by this International Standard, as well as any operation regarded as optional;

f) details of any incident which may have affected the result.

Dimensions in millimetres

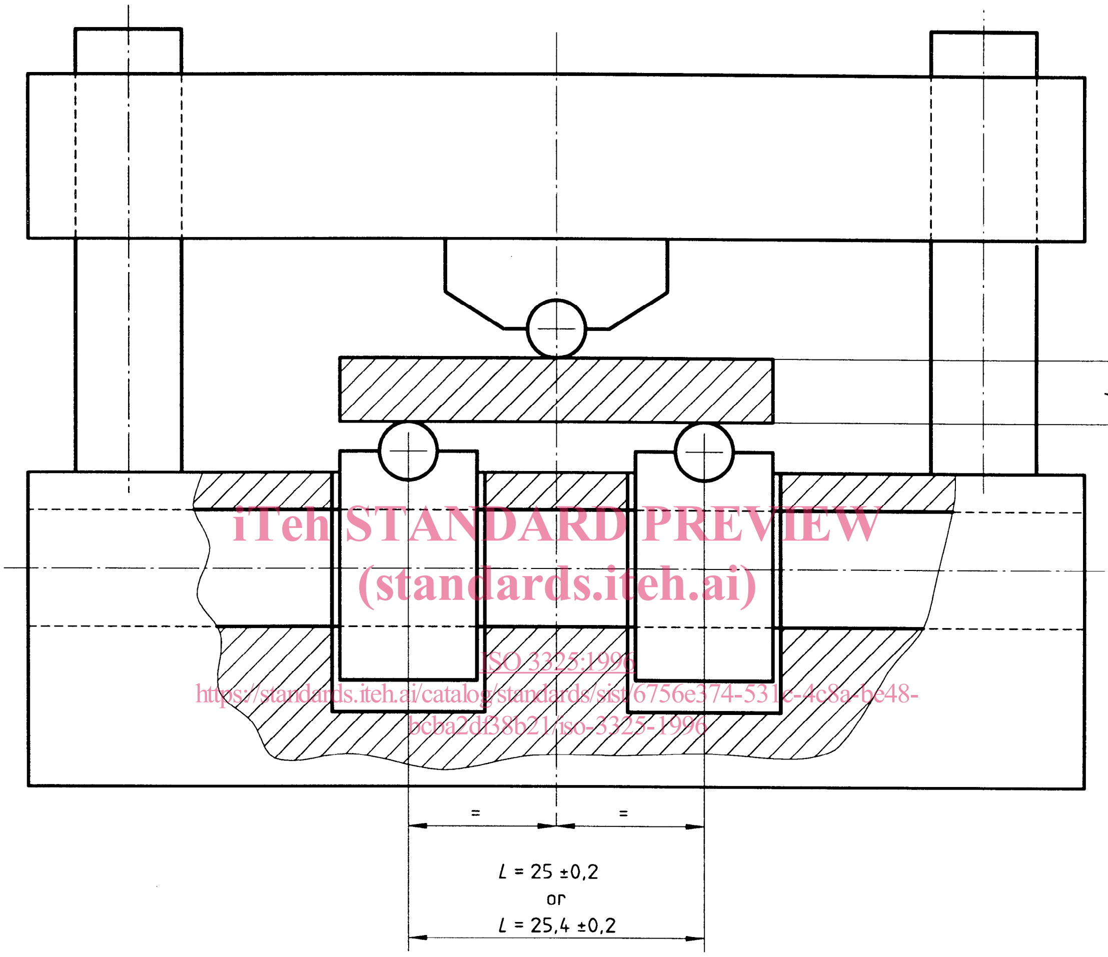

Figure 1 — Test equipment for determination of transverse rupture strength

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