	Determining the flexural strength of carbonaceous materials by four-point loading	**DIN** **51944**

ICS 71.060.10

Descriptors: Carbonaceous materials, flexural strength, testing.

Prüfung von Kohlenstoffmaterialien – Bestimmung der Biegefestigkeit nach dem Vierpunkt-Verfahren – Feststoffe

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

Foreword

This standard has been prepared by Technical Committee *Prüfverfahren für Kohlenstoff und Graphit* of the *Normenausschuß Materialprüfung* (Materials Testing Standards Committee).

All dimensions are in mm.

1 Scope

This standard sets out a procedure for determining the flexural strength of solid carbonaceous and graphitic materials at room temperature by four-point loading.

2 Normative references

This standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the titles of the publications are listed below. For dated references, subsequent amendments to or revisions of any of these publications apply to this standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

DIN 862	Vernier callipers – Requirements and testing
DIN 1319-3	Basic concepts in metrology – Evaluating measurements of a single measurand and expression of uncertainty
DIN 4768	Determination of surface roughness parameters R_a, R_z, and R_{max}, using electric stylus instruments – Concepts and measuring conditions
DIN 51223	Compression testing machines - Requirements
DIN 51902	Determining the flexural strength of carbonaceous materials by three-point loading
DIN EN 10002-2	Metallic materials – Tensile testing – Verification of the force-measuring system of tensile testing machines

3 Definitions

3.1 Flexural strength

The ratio of the bending moment, M_B, at failure of the test piece, expressed in N/mm², when subjected to four-point loading, to the section modulus, W, as shown in equation (1):
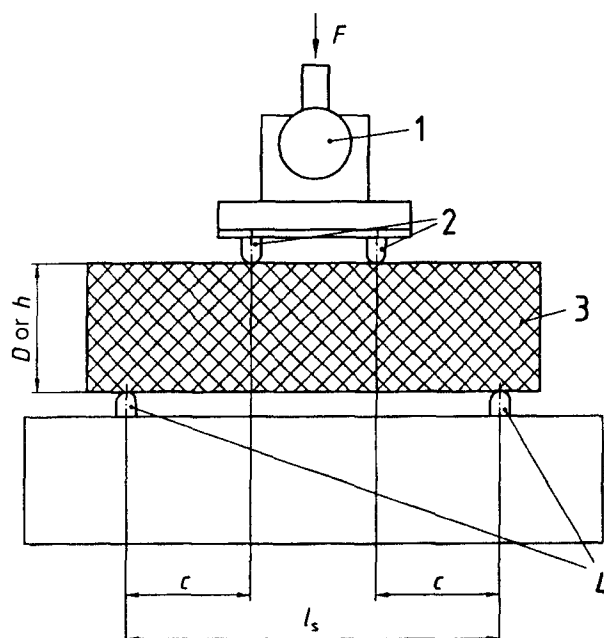
$$\sigma_{bB} = \frac{M_B}{W} \tag{1}$$

NOTE: Cf. DIN 51902.

Translation by DIN-Sprachendienst.
In case of doubt, the German-language original should be consulted as the authoritative text.

1 Universal joint
2 Load applicators
3 Test piece
4 Supports

Figure 1: Test set-up (schematic)

3.2 Bending moment

The maximum bending moment, M_B, calculated from the maximum load indicated by the testing machine. In the case of carbonaceous materials, this load is usually close to the load at failure.

4 Principle

A rod-shaped test piece is laid on two supports and its middle section subjected to a load that is applied via two points, until failure occurs. The flexural strength is calculated from the force at failure, the distance between the load applicators, c, and the supports, and the cross-sectional dimensions of the test piece.

5 Apparatus

5.1 Compression testing machine, as specified in DIN 51223 and fulfilling the requirements for class 2 as in DIN EN 10002-2.

5.2 Test apparatus with two supports and two load applicators, enabling the load to be distributed evenly over the span (e.g. via a universal joint and adjustable supports; cf. figure 1). The radius of curvature of the load applicators and the supports shall be 2 mm to 5 mm.

NOTE: The distance between the support blocks and the load applicators shall be adjustable, so that different-sized test pieces can be accommodated.

5.3 Measuring device (e.g. vernier callipers as in DIN 862), for determining the test piece dimensions to within 0,5 %.

5.4 Stylus instrument, for determining the surface roughness of test pieces.

6 Test pieces

6.1 Sampling and preparation

Sampling (location and number of test pieces) shall be agreed with the client. The longitudinal surface of the test pieces shall have a surface roughness, R_a*), of less than 15 μm (ignoring obvious pores).

Unless other arrangemen ts have been made, five test pieces in the air-dry state shall be tested.

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*) Arithmetical mean deviation of the profile, R_a, according to DIN 4768.