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Fine ceramics (advanced ceramics, advanced technical ceramics) — Determination of elastic modulus of ceramics at high temperature by thin wall C-ring method

Céramiques techniques (céramiques avancées, céramiques techniques avancées) – Détermination du module élastique des céramiques à haute température par la méthode de l'anneau en C à parois minces

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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This document was prepared by Technical Committee ISO/TC 206, *Fine ceramics*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Fine ceramics (advanced ceramics, advanced technical ceramics) — Determination of elastic modulus of ceramics at high temperature by thin wall C-ring method

1 Scope

This document specifies the determination of elastic modulus of ceramics at high temperatures up to 2 100 °C by using the thin wall relative C-ring method. Procedures for test piece preparation, test modes, heat rate, load rates, data collection and reporting are given.

This document applies primarily to ceramic materials including monolithic fine ceramics, refractory materials, whisker and particulate-reinforced ceramic composites. This method is not applicable to super plastic ceramics or ceramics with high creep rate. This test method can be used for material research, quality control and characterization and design data generation purposes.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3611, *Geometrical product specifications (GPS) — Dimensional measuring equipment: Micrometers for external measurements — Design and metrological characteristics*

ISO 7500-1, *Metallic materials — Calibration and verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Calibration and verification of the force-measuring system*

IEC 60584-1, *Thermocouples — Part 1: Reference tables*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
elastic modulus
ratio of stress to strain, also known as Young's modulus

3.2
C-ring test piece
test piece in the shape of a split ring, prepared by cutting an incision from a thin wall ring

Note 1 to entry: *R* is the outer radius, *r* is the inner radius, and *b* is the width (axial length), as shown in Figure 1.

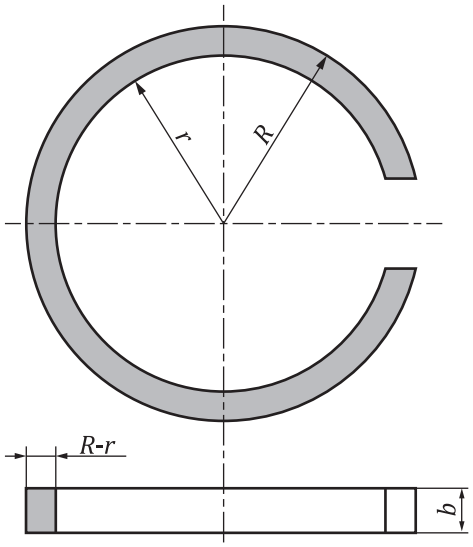


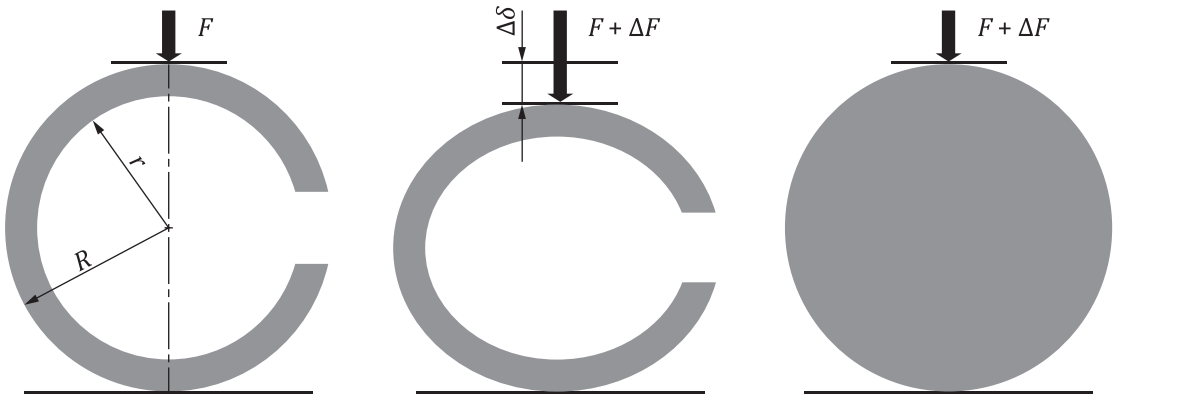
Figure 1 — Schematic diagram of C-ring test piece

3.3
rigid disk
disk which has the same radius and width as the *C-ring test piece* (3.2), but which is much stiffer

3.4
relative C-ring method
testing method for determining the deformation of the C-ring by comparing the crossbeam displacements of the C-ring and the rigid disk under same testing conditions

4 Principle

At ambient temperature, install a C-ring test piece on the fixture and keep the notch at the middle height. Place the fixture on the flat anvil of a mechanical testing machine and apply a symmetrically compressive load, F, on the C-ring within its range of elasticity, as shown in Figure 2 a) and b). There is a linear relationship between the load increment, ΔF, and the displacement increment, $\Delta\delta$. The compressive deformation of the C-ring can be directly measured by an accurate inductance micrometer or any other displacement meter at room temperature. The elastic modulus can be obtained from the load-deformation curve and the test piece dimensions.



a) C-ring

b) Deformed C-ring under loading

c) Rigid disk under loading

Figure 2 — Schematic diagram of C-ring and rigid disk, loading mode and deformation