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Metallic materials — Unified method of test for the determination of quasistatic fracture toughness

Matériaux métalliques — Méthode unifiée d'essai pour la détermination de la ténacité quasi statique

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

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 164, *Mechanical testing of metals*, Subcommittee SC 4, *Toughness testing — Fracture (F), Pendulum (P), Tear (T)*.

This second edition cancels and replaces the first edition (ISO 12135:2002), which has been technically revised. It also incorporates the Technical Corrigendum ISO 12135:2002/Cor 1:2008.

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Metallic materials — Unified method of test for the determination of quasistatic fracture toughness

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1 Scope

This document specifies methods for determining fracture toughness in terms of K, δ, J and R-curves for homogeneous metallic materials subjected to quasistatic loading. Specimens are notched, precracked by fatigue and tested under slowly increasing displacement. The fracture toughness is determined for individual specimens at or after the onset of ductile crack extension or at the onset of ductile crack instability or unstable crack extension. In some cases in the testing of ferritic materials, unstable crack extension can occur by cleavage or ductile crack initiation and growth, interrupted by cleavage extension. The fracture toughness at crack arrest is not covered by this document. In cases where cracks grow in a stable manner under ductile tearing conditions, a resistance curve describing fracture toughness as a function of crack extension is measured. In most cases, statistical variability of the results is modest and reporting the average of three or more test results is acceptable. In cases of cleavage fracture of ferritic materials in the ductile-to-brittle transition region, variability can be large and additional tests may be required to quantify statistical variability. Special testing requirements and analysis procedures are necessary when testing weldments and these are described in ISO 15653 which is complementary to this document.

When fracture occurs by cleavage or when cleavage is preceded by limited ductile crack extension, it may be useful to establish the reference temperature for the material by conducting testing and analysis in accordance with ASTM E1921.[2]

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 3785, *Metallic materials — Designation of test specimen axes in relation to product texture*

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*

ISO 9513, *Metallic materials — Calibration of extensometer systems used in uniaxial testing*

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:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
stress intensity factor
K
magnitude of the elastic stress-field singularity for a homogeneous, linear-elastic body

Note 1 to entry: The stress intensity factor is a function of applied force, crack length, specimen size and specimen geometry.

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