INTERNATIONAL STANDARD

ISO 12106

Second edition
2017-03

Metallic materials — Fatigue testing — Axial-strain-controlled method

Matériaux métalliques — Essais de fatigue — Méthode par déformation axiale contrôlée

Reference number
ISO 12106:2017(E)

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

Contents

Page

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 voluntary nature of standards, 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.

This document was prepared by Technical Committee ISO/TC 164, *Mechanical testing of metals*, Subcommittee SC 5, *Fatigue testing*.

This second edition cancels and replaces the first edition (ISO 12106:2003), which has been technically revised.

Introduction

Materials and their microstructure may change when subjected to cyclic deformations and their mechanical properties can be significantly altered when compared with that resultant from monotonic deformations, for example, uniaxial stress-strain response. The design of mechanical components subjected to fatigue loadings and cyclic deformations requires, in a number of industrial sectors (i.e. nuclear, aerospace, ground vehicles, medical devices, etc.), knowledge of the cyclic behaviour of the materials under reversed strain control conditions, referred to as low-cycle fatigue, when cyclic plasticity is present.

In order to ensure reliability and consistency of results from different laboratories, it is necessary to collect all data using test methodologies that comply with a number of key points.

This document concerns both the generation of such strain-controlled fatigue data at room or elevated temperatures at fixed *R*-ratios (strain) and the presentation of results for fatigue properties, strain-life behaviour and cyclic stress-strain responses of metallic materials determined at an R_e-ratio = –1. Since there is a close relationship with strain-controlled, high-temperature testing, there is also a section devoted to creep-fatigue testing methodology.

This document does not address safety or health concerns, should such issues exist, that may be associated with its use or application. The user of this document has the sole responsibility to establish any appropriate safety and health concerns, as well as to determine the applicability of any national or local regulatory limitations regarding the use of this document.

Metallic materials — Fatigue testing — Axial-strain-controlled method

1 Scope

This document specifies a method of testing uniaxially deformed specimens under strain control at constant amplitude, uniform temperature and fixed strain ratios including at R_e = –1 for the determination of fatigue properties. It can also be used as a guide for testing under other *R*-ratios, as well as elevated temperatures where creep deformation effects may be active.

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 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*

ISO 23788, *Metallic materials — Verification of the alignment of fatigue testing machines*

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
engineering stress
instantaneous force divided by the initial cross-sectional area of the gauge length

$$S = F / A_0$$

3.2
true stress
instantaneous force divided by the instantaneous cross-sectional area of the gauge length

$$\sigma = F / A$$

Note 1 to entry: At strains to approximately 10 %, the true stress is approximated by the engineering stress, F/A_0. It is also important to note that at strains to approximately 10 %, it is the engineering strain that is actually measured by the extensometer and it is the controlled parameter in a test.

3.3
initial length
gauge length
L_0
initial length between extensometer measurement points at test temperature