INTERNATIONAL STANDARD

ISO 7539-7

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Corrosion of metals and alloys — Stress corrosion testing —

Part 7: Method for slow strain rate testing

Corrosion des métaux et alliages — Essais de corrosion sous contrainte —

Partie 7: Méthode d'essai à faible vitesse de déformation

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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.

ISO 7539-7 was prepared by Technical Committee ISO/TC 156, *Corrosion of metals and alloys*.

This second edition cancels and replaces the first edition (ISO 7539-7:1989), Clauses 1, 3, 4, 6, 7 and 8 of which have been technically revised.

ISO 7539 consists of the following parts, under the general title *Corrosion of metals and alloys — Stress corrosion testing*:

— *Part 1: General guidance on testing procedures*

— *Part 2: Preparation and use of bent-beam specimens*

— *Part 3: Preparation and use of U-bend specimens*

— *Part 4: Preparation and use of uniaxially loaded tension specimens*

— *Part 5: Preparation and use of C-ring specimens*

— *Part 6: Preparation and use of pre-cracked specimens for tests under constant load or constant displacement*

— *Part 7: Method for slow strain rate testing*

— *Part 8: Preparation and use of specimens to evaluate weldments*

— *Part 9: Preparation and use of pre-cracked specimens for tests under rising load or rising displacement*

Corrosion of metals and alloys — Stress corrosion testing —

Part 7:
Method for slow strain rate testing

1 Scope

This part of ISO 7539 covers procedures for conducting slow strain rate tests for investigating susceptibility of a metal to stress corrosion cracking, including hydrogen-induced failure.

The term “metal” as used in this part of ISO 7539 includes alloys.

Slow strain rate tests are adaptable for testing a wide variety of product forms, including plate, rod, wire, sheet and tubes, as well as composites of these and parts joined by welding. Notched specimens may be used, as well as initially plain specimens.

The principal advantage of the test is the rapidity with which susceptibility to stress corrosion cracking of a particular metal/environment combination can be assessed.

2 Normative references

The following referenced documents are indispensable for the application 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 7539-1:1987, *Corrosion of metals and alloys — Stress corrosion testing — Part 1: General guidance on testing procedures*

ISO 7539-4:1989, *Corrosion of metals and alloys — Stress corrosion testing — Part 4: Preparation and use of uniaxially loaded tension specimens*

ISO 7539-6:2003, *Corrosion of metal and alloys — Stress corrosion testing — Part 6: Preparation and use of pre-cracked specimens for tests under constant load or constant displacement*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7539-1 and the following apply.

3.1
creep
time-dependent mechanical deformation of a specimen after application of the initial load

3.2
elongation to fracture
ratio, of the increase in gauge length which has occurred during a test, to the original gauge length, expressed as a percentage

3.3
maximum load
maximum value of the load achieved during a test taken to total failure or, in the case of composite materials, the load corresponding to failure of one element

3.4
nominal stress-elongation curves
plot of the nominal stress calculated from the instantaneous applied load and the original cross-sectional area of a specimen, against the elongation of the gauge length at the time of the load measurement

3.5
plastic strain to failure
estimated plastic contribution to the total strain to failure determined by subtracting the elastic strain at failure from the total strain at failure

3.6
reduction of area
ratio of the maximum decrease in cross-sectional area which has occurred during a test, to the original cross-sectional area, expressed as a percentage

3.7
strain rate
initial rate of increase in gauge length of an initially plain tensile specimen

4 Principle

4.1 The test consists of subjecting a specimen to increasing strain whilst exposed to a specified environment with a view to determining stress corrosion susceptibility by reference to one or more of the parameters enumerated in Clause 7.

4.2 Corrosive environments may cause a deterioration of the properties of stressed materials beyond those observed with the same combination of environment and material when the latter is not subjected to slow dynamic strain. This enhanced deterioration, usually due to the initiation and growth of cracks, may be expressed in a number of different ways for the purpose of assessing stress corrosion susceptibility.

4.3 Tests may be conducted in tension or in bending, on initially plain or notched specimens. The most important characteristic of the test is the relatively slow strain rate generated at the region of crack initiation or growth in the metal, hence the preference for such tests being referred to as slow strain rate tests.

5 Specimens

5.1 A variety of specimen shapes and sizes can be used, but those most commonly utilized are described in ISO 7539-4 and ISO 7539-6.

5.2 The remarks in the aforementioned documents concerning specimen design, preparation and gripping are equally applicable to specimens for slow strain rate tests.

6 Procedure

6.1 The equipment required for slow strain rate testing consists of a device that permits a selection of deflection rates whilst being powerful enough to cope with the loads generated. Deflection rates that have been used most frequently in testing initially plain specimens are in the range 10^{-3} s^{-1} to 10^{-7} s^{-1}.

6.2 Notched specimens may be used when it is desired to restrict cracking to a particular location, e.g. when testing the heat-affected zone associated with a weld or whenever a given piece of material exhibits a