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Steel — Measurement method for the evaluation of hydrogen embrittlement resistance of high-strength steels —

Part 2: Slow strain rate test

Acier — Méthode de mesure pour l'évaluation de la résistance à la fragilisation par l'hydrogène des aciers à haute résistance —

Partie 2: Essai à déformation lente

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

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For an explanation of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 7, *Methods of testing (other than mechanical tests and chemical analysis)*.

A list of all parts in the ISO 16573 series shall be found on the ISO website.

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.

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Introduction

The mechanical properties of high-strength steels, such as tensile strength, elongation and reduction of area would be degraded by the effect of hydrogen, known as hydrogen embrittlement, and the susceptibility of hydrogen embrittlement becomes greater by increasing the strength level of steels.

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Steel — Measurement method for the evaluation of hydrogen embrittlement resistance of high-strength steels —

Part 2: Slow strain rate test

1 Scope

This document provides an evaluation method of the resistance of high-strength steels to hydrogen embrittlement (i.e. hydrogen delayed fracture) using slow strain rate test with hydrogen pre-charged specimens. The amount of hydrogen absorbed in the specimens is analysed quantitatively by thermal desorption analysis such as gas chromatography, mass spectrometry and so on. This document includes testing methods for either smooth or notched specimens.

It is applicable to ferritic base steels.

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 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

ISO 6892-2, *Metallic materials — Tensile testing — Part 2: Method of test at elevated temperature*

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*

3 Terms and definitions

No terms and definitions are listed in this document.

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

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

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

4 Principle

Figure 1 shows schematic sequences for the overall testing method including hydrogen pre-charging (such as electrochemical method described in ISO 16573-1), mechanical testing and hydrogen analysis. Mechanical properties such as, yield strength, tensile strength, fracture strength, elongation to fracture and reduction of area are measured by applying tensile load at slow strain rate before and after hydrogen charging. Hydrogen contents in the specimen shall be measured by thermal desorption analysis, and the relationship between the diffusible hydrogen content and the degradation of mechanical properties shall be obtained. Thermal desorption analysis of pre-charged but not deformed samples allows the quantification of the initial diffusible hydrogen content. However, thermal desorption analysis of pre-charged and deformed samples is only valid when the slow strain rate test is carried out using the

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