International Standard

ISO 20198

Metallic materials — Steel — Method of test for the determination of brittle crack arrest temperature (CAT)

Matériaux métalliques — Acier — Méthode d'essai pour la détermination de la température d'arrêt de la fissure fragile (CAT)

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This document was prepared by Technical Committee ISO/TC 164, *Mechanical testing of metals*, Subcommittee SC 4, *Fatigue, fracture and toughness testing.*

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Introduction

This document is applicable to either ferritic or bainitic, or both steel base metals which exhibits ductile to brittle transition behaviour. This document provides a test method for determining the brittle crack arrest temperature (CAT) using wide plates with a local temperature-gradient (LTG)[1] and electron beam welding (EBW)[2][3] test pieces of isothermal type.

Recently, rolled steel plates with tensile strengths ranging from 570 N/mm^2 to 720 N/mm^2 and thicknesses between 50 mm and 100 mm are commonly used for the upper deck structures of container carriers[4][5]. The International Association of Classification Societies (IACS) has developed the requirements for these steel plates with brittle crack arrest properties[6][7]. The brittle crack arrest properties can be evaluated by the test method of determining either the brittle crack arrest toughness K_{ca} or the crack arrest temperature (CAT). Reference [8] is a test method to evaluate the lower bound crack arrest toughness under plane strain conditions.

The test method for the determination of brittle crack arrest toughness, K_{ca}, of steel plates with a temperature gradient is specified in ISO 20064. The K_{ca} test method applies varying stress levels and temperature gradients depending on the test conditions to determine the crack length and the temperature at which the crack arrest occurs, and then derives the K_{ca} value at the arrest temperature. On the other hand, the CAT test is a method that assesses the go and no-go behaviour of brittle cracks under iso-thermal conditions and design stress[9].

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Metallic materials — Steel — Method of test for the determination of brittle crack arrest temperature (CAT)

1 Scope

This document specifies a test method for the determination of the brittle crack arrest temperature (CAT). This document is applicable to either ferritic or bainitic, or both steel base metals with a body-centred cubic (BCC) crystal lattice structure that exhibit ductile to brittle transition behaviour. The applicable materials are rolled steel plates. This document is intended for steels with a tensile strength of 950 MPa or less and a thickness greater than 6 mm but not exceeding 200 mm. The range of arrest temperatures is between −196 °C and + 100 °C.

This document also specifies the requirements for test method and test procedures when using the isothermal crack arrest test to judge valid test results under isothermal conditions and in order to determine the crack arrest temperature.

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 20064:2019, *Metallic materials — Steel — Method of test for the determination of brittle crack arrest toughness,* K_{ca}

ASTM E220-19, *Standard Test Method for Calibration of Thermocouples By Comparison Techniques*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 20064 and the following apply.

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/

3.1
arrest temperature
temperature at the point where a brittle crack is arrested in the test temperature

[SOURCE: ISO 20064:2019, 3.5, modified — "in the temperature gradient type arrest toughness test" is revised to "in the test temperature."]

3.2
brittle crack arrest temperature
CAT
lowest temperature at which running brittle crack is arrested

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