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Microbeam analysis — Electron backscatter diffraction — Quantitative determination of austenite in steel

Analyse par microfaisceaux — Diffraction d'électrons rétrodiffusés — Détermination quantitative de l'austénite dans l'acier

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Foreword

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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 202, *Microbeam analysis*.

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.

Introduction

This test method produces a total quantification result of austenite, separate quantification results of austenite with different aspect ratio, as well as morphology and distribution of austenite. The retained austenite in steel, such as transformation induced plasticity (TRIP), twinning induced plasticity (TWIP), quenching and partitioning (Q&P) steel, can give steel good plasticity due to its TRIP effect, which is that high plasticity can be induced during deformation by the transformation of austenite into martensite. The TRIP effect is greatly affected by the content and stability of austenite. The stability of austenite can be divided into chemical stability and mechanical stability. The chemical stability is mainly influenced by the carbon content of the austenite. The mechanical stability is primarily affected by the morphology, aspect ratio, distribution in the matrix of austenite. It is important to understand the effect of austenite on the mechanical properties through the quantitative results of electron backscatter diffraction (EBSD).

In a conventional scanning electron microscope (SEM) with a tungsten filament, a spatial resolution of about 0,25 µm for EBSD can be achieved; however, with a field-emission gun SEM (FEG-SEM), the resolution limit is 10 nm to 50 nm for EBSD, although the value is strongly dependent both on the instrument and the instrument operating parameters. See ISO 24173.

Microbeam analysis — Electron backscatter diffraction — Quantitative determination of austenite in steel

1 Scope

This document specifies procedures for quantitative analysis of austenite in steel using electron backscatter diffraction (EBSD). This document is mainly applied in low and medium carbon steels, low and medium carbon alloy steels.

This document is used to analyse austenite with grain size larger than 50 nm. This method is not used to quantify austenite with grain size smaller than 50 nm, which can significantly affect the accuracy of the analysis results.

NOTE 1 The size limit is strongly dependent both on the instrument and the instrument operating parameters.

NOTE 2 The size limit is the minimum grain size of the detectable austenite.

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 13067, *Microbeam analysis — Electron backscatter diffraction — Measurement of average grain size*

ISO 22309, *Microbeam analysis — Quantitative analysis using energy-dispersive spectrometry (EDS) for elements with an atomic number of 11 (Na) or above*

ISO 22493, *Microbeam analysis — Scanning electron microscopy — Vocabulary*

ISO 24173, *Microbeam analysis — Guidelines for orientation measurement using electron backscatter diffraction*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13067, ISO 22493, ISO 24173 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
equivalent circle diameter
ECD
diameter of the circle with an area equivalent to the grain section area

3.2
aspect ratio
ratio of the length of the minor axis to the length of the major axis of an ellipse fitted round a grain

Note 1 to entry: It is sometimes referred to as grain elongation.

Note 2 to entry: The value lies in the range 0 to 1.