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Microbeam analysis — Electron backscatter diffraction — Measurement of average grain size

Analyse par microfaisceaux — Diffraction d'électrons rétrodiffusés — Mesurage de la taille moyenne des grains

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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 202, *Microbeam analysis*.

This second edition cancels and replaces the first edition (ISO 13067:2011), which has been technically revised. The main changes compared to the previous edition are as follows:

— Data from a round robin (Annex B) have been used to:

  — Include information on expected precision (Clause 7 and Annex B);

  — Include more detail on sources of errors (Clause 7);

  — Clarify statements on minimum numbers of grains measured (5.8) and acceptable clean up procedures (6.3–6.3);

  — Clarify the distinction between sectional grain size measured on a 2D section and average grain size determined from some 2D measurements of grain sections which can be related by stereology to the 3D grain size;

  — Additionally, improvements have been made to the description of calculation of average values (6.5) and representation of the data (6.6).

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 and electromagnetic properties of engineering materials are strongly influenced by their crystal grain size and distribution. For example, strength, toughness and hardness are all important engineering properties that are strongly influenced by these parameters. Both bulk materials and thin films, even as narrow two-dimensional structures, are influenced by grain size. For this reason, it is important to have standard methods for its measurement with commonly used and agreed terminology. This document describes procedures for measuring average grain size from maps of local orientation measurements using electron backscatter diffraction.

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Microbeam analysis — Electron backscatter diffraction — Measurement of average grain size

1 Scope

This document describes procedures for measuring average grain size derived from a two-dimensional polished cross-section using electron backscatter diffraction (EBSD). This requires the measurement of orientation, misorientation and pattern quality factor as a function of position in the crystalline specimen[1]. The measurements in this document are made on two dimensional sections. The reader should note carefully the definitions used (3.3) which draw a distinction between the measured sectional grain sizes, and the mean grain size which can be derived from them that relates to the three dimensional grain size.

NOTE 1 While conventional methods for grain size determination using optical microscopy are well-established, EBSD methods offer a number of advantages over these techniques, including increased spatial resolution and quantitative description of the orientation of the grains.

NOTE 2 The method also lends itself to the measurement of the grain size of complex materials, for example those with a significant duplex content.

NOTE 3 The reader is warned to interpret the results with care when attempting to investigate specimens with high levels of deformation.

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 16700, *Microbeam analysis — Scanning electron microscopy — Guidelines for calibrating image magnification*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

ISO 23833, *Microbeam analysis — Electron probe microanalysis (EPMA) — 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 24173 and ISO 23833 and the following apply.

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

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

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

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