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Microbeam analysis — Electron probe microanalysis — Quantitative analysis of Mn dendritic segregation in continuously cast steel product

Analyse par microfaisceaux — Analyse par microsonde de Castaing — Analyse quantitative de la ségrégation dendritique du manganèse dans un produit en acier coulé en continu

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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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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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*, Subcommittee SC 2, *Electron probe microanalysis*.

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

Electron probe X-ray microanalysis (EPMA) is a modern technique used to qualitatively determine and quantitatively measure the elemental composition of solid materials, including metal alloys, ceramics, glasses, minerals, polymers, powders, etc., on a spatial scale of approximately one micrometer laterally and in depth. EPMA is based on the physical mechanism of electron-stimulated X-ray emission and X-ray spectrometry (see ISO 23833).

The dendritic segregation rich in Mn is unavoidable during steel solidification, which is the direct cause of banded structure in steel product formed in the hot rolling process. The toughness and strength of steel are greatly affected by the banded structure. The quantification of the dendritic segregation can facilitate steel maker to optimize steel-making process parameters, and therefore control the banded structure in the final product.

It is a new method to quantify the dendritic segregation through EPMA by measuring inhomogeneity of Mn with EPMA. In order to obtain comparative and repeatable results it is necessary to standardize this method. These enable products to be compared and evaluated for the purpose of quality control.

Microbeam analysis — Electron probe microanalysis — Quantitative analysis of Mn dendritic segregation in continuously cast steel product

1 Scope

This document specifies procedures for quantitative analysis of Mn dendritic segregation in steel billets, blooms, slabs using electron probe microanalysis (EPMA).

This document is mainly applicable to continuously cast products with Mn content more than 0,01 % by mass. It can also be used for steel ingots and steel products, such as cast iron and cast steel.

The minimum size of analysable dendrites is totally dependent on the resolution of microscope of EPMA and beam size of filament used for quantitative analysis.

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 11938, *Microbeam analysis — Electron probe microanalysis — Methods for elemental-mapping analysis using wavelength-dispersive spectroscopy*

ISO 14594, *Microbeam analysis — Electron probe microanalysis — Guidelines for the determination of experimental parameters for wavelength dispersive spectroscopy*

ISO 14595, *Microbeam analysis — Electron probe microanalysis — Guidelines for the specification of certified reference materials (CRMs)*

ISO 22489, *Microbeam analysis — Electron probe microanalysis — Quantitative point analysis for bulk specimens using wavelength dispersive X-ray spectroscopy*

ISO 23833, *Microbeam analysis — Electron probe microanalysis (EPMA) — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in 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 www.iso.org/obp

— IEC Electropedia: available at www.electropedia.org

3.1
dendritic segregation
phenomenon that element content differs in the first-crystallized dendrite arms and post-crystallized inter-dendritic spaces during alloy solidification in a dendritic pattern

3.2
mapping analysis
method of analysing element in EPMA, through which element distribution in an area can be obtained