

ICS 71.040.50
CCS G 04



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 30703-2014

**Microbeam analysis -- Guidelines for orientation measurement
using electron backscatter diffraction**

微束分析 电子背散射衍射取向分析方法导则

(English Translation)

Issued on: June 9, 2014

Implemented on: December 1, 2014

Issued by: Standardization Administration of China

Table of Contents

Preface
Introduction
1 Scope
2 Normative references
3 Terms and definitions
4 EBSD device
5 7 operating condition
6 EBSP index calibration required correction
7 Analysis process
8 Measurement uncertainty
9 Analysis results release
Appendix A (Informative Appendix) EBSD works
Appendix B (Normative Appendix) EBSD sample preparation
Annex C (informative) crystallography, EBSP calibration and other useful information associated with EBSD
References

Foreword

This standard was drafted in accordance with GB/T 1.1-2009 given rules.

The standard translation method using equivalent international standards. ISO 24173:2009 "micro-beam analysis of electron backscatter diffraction determination of orientation Guidelines".

Correspondence between the consistency of the standards of international documents and normative references of the following documents.

--- GB/T 27025-2008 testing and calibration laboratories General requirements (ISO/IEC 17025:2005, IDT).

The standard micro-beam analysis by the National Standardization Technical Committee (SAC/TC38) and focal points.

This standard was drafted. Shanghai Power Equipment Research Institute, Baosteel Group Central Research Institute, Chinese Academy of Sciences Shanghai Silicate Institute the study.

Introduction

Electron backscatter diffraction (EBSD) with a scanning electron microscope (SEM), or SEM-FIB (focused ion beam) or electron probe was Micro Analyzer (EPMA) and surface scanning measuring the crystal samples obtained crystallographic information technology [1,2].

Electron backscattering pattern (EBSP) is inclined to the surface of the crystal sample high fixed incident electron beam irradiation, and interact with the surface atoms and the occurrence of back-scattering results. In order to improve the efficiency of back-scattering, usually the sample surface normal direction of the electron swept about 70 ° angle. EBSP pass in EBSD formed of a scintillation counter (e.g., single crystal YAG or screen) and a charge coupled device (CCD camera) imaging is often composed of the detector can also be imaged on photographic film.

Through analysis of the EBSP, crystal orientation can be measured, it may be some minor phase structure within the region analyzed. Since EBSD is Incident electron with the sample surface atoms tens of nanometers diffraction effects within the depth of interaction occurs, and therefore the application of this technique requires special Do not pay attention to the preparation of the sample [3].

EBSD spatial resolution is strongly dependent on the operating parameters of the instrument and the nature of the material to be measured, in general, a tungsten filament SEM Receive approximately 0.25μm spatial resolution, and the resolution limit of the electron field emission gun scanning electron microscope (FEGSEM) up to 10nm ~ 50nm. Typically, crystal orientation measurement accuracy is approximately 0.5 °.

By EBSD sample surface analysis of a region, you can get in the region reflect spatial variations in the orientation phase composition, EBSP quality and other related surface profile measurements. These data can be used for quantitative analysis of the microstructure, e.g., measuring the average grain size (or size Distribution), crystallographic texture (orientation distribution) or contain the number of the special nature of grain boundaries (such as twin grain boundaries). EBSD technique combined with precision even Continued cutting techniques, such as focused ion beam (FIB) technology, you can get a three-dimensional microstructure characteristics of the material [4].

In order to better grasp the EBSD technique and accurate data processing, EBSD users should be familiar with the principles and characterization of crystal orientation Various methods (both aspects are related literature [5,6] has been described in).

Microbeam analysis of electron backscatter diffraction orientation Analysis Guidelines

1 Scope

This standard gives the electron backscatter diffraction (EBSD) technology for crystal orientation measurement guidelines, the measurement data with higher Reliability and reproducibility of this standard to establish a sample preparation, instrument configuration, calibration and general principles of data collection.

This standard applies to bulk crystal grain orientation for EBSD analysis of the sample.

2 Normative references

The following documents for the application of this document is essential. For dated references, only the dated version suitable for use herein Member. For undated references, the latest edition (including any amendments) applies to this document.

ISO/IEC 17025 General requirements for testing and calibration laboratories
(General requirements for the competence of testing and calibration laboratories) ISO/IEC Guide 98-3 Measurement Uncertainty Part 3. Guide to the Expression of Uncertainty in Measurement (GUM:1995) (Uncertainty of measurement-Part 3. Guide to the expression of uncertainty in measurement (GUM:1995))

3 Terms and Definitions

The following terms and definitions apply to this document.

Crystal

In space by the rules, you can repeat the arrangement of atoms composed. Common space groups, crystal lattice constant (including the length between the edge and the edge Angle) and the position of atoms in the unit cell described [7,8].

Note 1: For example, the aluminum crystal can be a side length 0.40494nm face-centered cubic (single cell) to represent.

Note 2: respectively along the [100], [111] and [110] crystal direction of observation of aluminum (4 x 4 x 4 unit cell) model of the atomic arrangement shown in Figure 1, while Figure 1 shows the its corresponding orientation of each crystal spherical Kikuchi pattern, the fourth, third and second symmetrical apparent, looks like mirror.

Note 3: For those unfamiliar with crystallography beginners, we recommend that reference to some standard textbooks [7-9].

Note 4: Introduction to the knowledge about crystallography and having a cubic crystal symmetry material EBSD index calibration guide in Appendix C.

Planes crystal plane

Usually (the hkl) plane represented by a representative of the unit cell of the crystal planes

a, b, c axis intercept is $1/h$, $1/k$, $1/l$, where, h, k, l is an integer.

Note 1: h, k, l are usually called crystal plane Miller indices.

Note 2: For more, see Appendix C.

Crystal orientation crystaldirection Usually the direction $[uvw]$ expressed, on behalf of a vector in the direction of a, b, c crystal axes vectors of multiples.

NOTE: For more, see Appendix C.