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

GB/T 20176-2025

Replacing GB/T 20176-2006

**Surface chemical analysis - Secondary-ion mass spectrometry -
Determination of boron atomic concentration in silicon using
uniformly doped materials**

表面化学分析 二次离子质谱 用均匀掺杂物质测定硅中硼的原子浓度

(English Translation)

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Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part 1: Structure and drafting rules for standardization documents" Drafting.

This document replaces GB/T 20176-2006 "Surface chemical analysis secondary ion mass spectrometry for the determination of boron in silicon using uniformly doped substances" Compared with GB/T 20176-2006, the main technical changes are as follows.

--- Changed the test conditions for oxygen ion beam (see 7.1, 7.1 of the 2006 edition).

This document is equivalent to ISO 14237:2010 "Surface chemical analysis - Determination of boron in silicon using uniformly doped materials using secondary ion mass spectrometry" Atomic Concentration.

Introduction

Developed to determine the degree.

Quantitative analysis by SIMS requires reference materials. They are expensive and calibrated reference materials are only suitable for specific combinations of matrix and impurities.

These reference materials are inevitably consumed in every SIMS measurement.

Every laboratory can prepare secondary reference materials for calibration with standard reference materials, which are useful in routine analysis.

This document describes a standard procedure for the quantitative analysis of boron in single crystal silicon using a secondary reference material that has been calibrated and implanted Calibration with boron reference material.

Surface chemical analysis secondary ion mass spectrometry Determination of boron atomic concentration in silicon using uniformly doped materials

1 Scope

This document details the determination of the atomic concentration of boron in single crystal silicon using a calibrated uniform dopant (calibrated using a boron-implanted reference material).

The secondary ion mass spectrometry method is suitable for uniform boron doping with a concentration range of 1×10^{16} atoms/cm³ to 1×10^{20} atoms/cm³.

2 Normative references

The contents of the following referenced documents constitute the essential provisions of this document through normative reference in the text.

For referenced documents without a date, only the latest version (including all amendments) shall apply to this document.

For use in this document.

Note: GB/T 40109-2021 Surface chemical analysis - Boron depth profiling method in silicon by secondary ion mass spectrometry (ISO 17560:2014, IDT) ISO 18114 Surface chemical analysis Secondary ion mass spectrometry Determination of relative sensitivity factors (Sur-Note. GB/T 25186-2010 Surface chemical analysis secondary ion mass spectrometry - Determination of relative sensitivity factors by ion implantation reference materials (ISO 18114. 2003, IDT)

3 Principles

The oxygen or cesium ion beam impinges on the sample surface and the emitted boron and silicon secondary ions are mass analyzed and detected.

A uniformly doped secondary reference material (calibrated with the primary reference material by ion implantation) was used as the working reference material.

4.1 Primary reference materials

The primary reference material is used to determine the atomic concentration of boron in the secondary reference material. The primary reference material should be a calibrated boron-doped silicon.

4.2 Secondary reference materials

4.2.1

Secondary reference materials are used to determine the atomic concentration of boron in each test sample. There should be at least one boron-doped and one non-boron-doped reference material.

The material is used for routine analysis. It is recommended to use two other reference materials with different boron doping levels to determine the performance of the instrument (see Appendix C).