



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

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**Surface chemical analysis - Determination of surface elemental
contamination on silicon wafers by total-reflection X-ray
fluorescence (TXRF) spectroscopy**

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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 of Standardization Documents"

Drafting.

This document is equivalent to ISO 14706.2014 "Surface Chemical Analysis Total Reflection X-ray Fluorescence Spectrometry (TXRF) Determination of Silicon Wafer Surface

Surface element pollution."

The Chinese documents that have consistent correspondence with the normatively cited international documents in this document are as follows.

---GB/T 25915.1-2010 Clean room and related controlled environment Part 1.Air cleanliness level (ISO 14644-1.

1999, IDT)

Introduction

This document is formulated for the need to measure elemental contamination on the surface of silicon wafers. It is based on ASTM F1526, SEMI M33, and basic semiconductors.

A UCS issued by the Institute of Basic Semiconductor Technology Development (Institute of Basic Semiconductor Technology Development)

(Ultra-Clean Society, Ultra-Clean Society) developed on the basis of standardized documents.

TXRF requires the use of reference materials for quantitative analysis. A certified reference material with an atomic surface density lower than 10^{10} atoms/cm² is difficult

To get. Even if it is available, pollution introduced from the environment may shorten the validity period of these reference materials.

For calibration purposes, relevant analytical laboratories will need to prepare and analyze TXRF reference materials. Therefore, it needs to be formulated separately

Two standardized documents are prepared for TXRF measurement procedures and reference materials. This document is the former, which is about the standardization of TXRF measurement procedures

file.

Surface chemical analysis

Total reflection X-ray fluorescence spectrometry (TXRF)

Determination of element contamination on the surface of silicon wafers

1 Scope

This document describes TXRF that measures the surface density of atoms contaminated by elements on the surface of silicon wafers that have been chemically mechanically polished or epitaxially grown.

method.

This document applies to the following situations.

---Elements with atomic numbers from 16 (S) to 92 (U);

---Polluting elements with atomic surface density between

$1 \times 10^{10} \text{ atoms/cm}^2 \sim 1 \times 10^{14} \text{ atoms/cm}^2$;

---The atomic surface density obtained by the VPD (Vapour Phase Decomposition) sample preparation method is between $5 \times 10^8 \text{ atoms/cm}^2 \sim 5 \times 10^{12} \text{ atoms/cm}^2$;

Contaminant elements between $10^1 \sim 10^4 \text{ atoms/cm}^2$ (see 3.4).

2 Normative references

The contents of the following documents constitute the indispensable clauses of this document through normative references in the text. Among them, dated quotations

Only the version corresponding to that date is applicable to this document; for undated reference documents, the latest version (including all amendments) is applicable to

This document.

ISO 14644-1 Clean room and related control environment Part 1. Air cleanliness level (Cleanrooms and associated

controlled environments-Part 1. Classification of air cleanliness)

3 Terms and definitions

The following terms and definitions apply to this document.

3.1

Total reflection

When grazing incident X-rays are irradiated to a medium with a larger X-ray density, the complete reflection occurs at the boundary of the two mediums.

Note. The refractive index of silicon wafers for X-rays is less than 1. X-rays incident on the surface of the silicon wafer at a small grazing angle will be totally reflected on the surface of the silicon wafer.

The angle of incidence is equal to the glancing angle.

3.2

Glancing angle

The angle between the plane of the sample surface and the virtual plane containing the X-rays incident on the sample surface.

3.3

Critical angle

The grazing angle corresponding to the first inflection point in the graph of sample matrix

X-ray fluorescence intensity and grazing angle.

3.4

VPD-TXRF method VPD-TXRF method

A method of collecting surface impurities through the VPD program. Use a drop of collection reagent (usually ultra-pure hydrofluoric acid) to collect oxygen on the surface of the silicon wafer

The non-volatile product formed after the acid decomposition of the compound is then dried in the least polluted environment, and the final droplet residue formed is used