INTERNATIONAL STANDARD

ISO 14706

Second edition
2014-08-01

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

Analyse chimique des surfaces — Détermination de la contamination en éléments à la surface des tranches de silicium par spectroscopie de fluorescence X à réflexion totale

Reference number
ISO 14706:2014(E)

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Published in Switzerland

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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.

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 201, *Surface chemical analysis*.

This second edition cancels and replaces the first edition (ISO 14706:2000), which has been technically revised.

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Introduction

This International Standard was prepared for the measurement of surface elemental contamination on silicon wafers on the basis of three existing standards: ASTM F 1526, SEMI Standard M33, and a UCS (Ultra-Clean Society) standard published by the Institute of Basic Semiconductor Technology Development.

TXRF needs reference materials to perform quantitative analyses. Certified reference materials are not available at low densities of 10^{10} atoms/cm^2. Even if they were available, the possibility of contamination from the environment reduces the shelf life of such reference materials.

Therefore, the TXRF reference materials are to be prepared and analysed for calibration by each relevant analytical laboratory. Thus, two standards, one for the TXRF measurement procedure and the other for the preparation of reference materials, are necessary. This International Standard concerns the former part.

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

1 Scope

This International Standard specifies a TXRF method for the measurement of the atomic surface density of elemental contamination on chemomechanically polished or epitaxial silicon wafer surfaces.

The method is applicable to the following:

— elements of atomic number from 16 (S) to 92 (U);

— contamination elements with atomic surface densities from 1×10^{10} atoms/cm^2 to 1×10^{14} atoms/cm^2;

— contamination elements with atomic surface densities from 5×10^{8} atoms/cm^2 to 5×10^{12} atoms/cm^2 using a VPD (vapour-phase decomposition) specimen preparation method (see 3.4).

2 Normative reference

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 14644-1, *Cleanrooms and associated controlled environments — Part 1: Classification of air cleanliness*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
total reflection
complete reflection of glancing X-ray radiation into a medium having larger X-ray optical density value at a boundary between two media

Note 1 to entry: The refractive index of silicon for X-rays is less than 1. X-rays which are incident on the surface at a small glancing angle are therefore, totally reflected from the surface at an angle equal to the glancing angle.

3.2
glancing angle
angle between the specimen surface plane and the virtual plane containing incident X-rays which impinge on the sample surface

3.3
critical angle
glancing angle corresponding to the first point of inflection in the plot of the sample matrix X-ray fluorescence against the glancing angle

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