SLOVENSKI STANDARD
SIST EN ISO 23131:2023

01-januar-2023

Elipsometrija - Načela (ISO 23131:2021)

Ellipsometry - Principles (ISO 23131:2021)

Ellipsometrie - Grundlagen (ISO 23131:2021)

Ellipsométrie - Principes (ISO 23131:2021)

Ta slovenski standard je istoveten z: **EN ISO 23131:2022**

ICS:

17.020	Meroslovje in merjenje na splošno	Metrology and measurement in general

SIST EN ISO 23131:2023 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 23131

November 2022

ICS 17.020

English Version

Ellipsometry - Principles (ISO 23131:2021)

Ellipsométrie - Principes (ISO 23131:2021)

Ellipsometrie - Grundlagen (ISO 23131:2021)

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CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Ref. No. EN ISO 23131:2022 E

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European foreword

The text of ISO 23131:2021 has been prepared by Technical Committee ISO/TC 107 "Metallic and other inorganic coatings" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 23131:2022 by Technical Committee CEN/TC 262 "Metallic and other inorganic coatings, including for corrosion protection and corrosion testing of metals and alloys" the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2023, and conflicting national standards shall be withdrawn at the latest by May 2023.

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INTERNATIONAL STANDARD

ISO 23131

First edition
2021-04

Ellipsometry — Principles

Ellipsométrie — Principes

Reference number
ISO 23131:2021(E)

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Published in Switzerland

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Foreword

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This document was prepared by Technical Committee ISO/TC 107, *Metallic and other inorganic coatings*.

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

The ellipsometry measuring method is a phase-sensitive reflection technique using polarized light in the optical far-field. Over a long time, ellipsometry has been established as a non-invasive measuring method in the field of semiconductor technology — especially within the integrated production — in the first instance as a single-wavelength, then as a multiple-wavelength and later as a spectroscopic measuring method.

By means of ellipsometry, optical or dielectric constants of any material as well as the layer thicknesses of at least semi-transparent layers or layer systems can be determined. Ellipsometry is an indirect measuring method, the analysis of which is based on model optimization. The measurands, which differ according to the procedural principle, are converted into the ellipsometric factors Ψ (Psi, amplitude information) and Δ (Delta, phase information), based on which the physical target figures of interest (optical or dielectric constants, layer thicknesses) will then be determined by means of a parameterized fit.

Ellipsometry shows a high precision regarding the ellipsometric transfer quantities Ψ and Δ, which can be equivalent to a layer thickness sensitivity of 0,1 nm for ideal layer substrate systems. As a result, the measuring method can verify even the slightest discrepancies in the surface characteristics. This is closely linked to the homogeneity and the isotropy of the material surface. In order to achieve high precision, carrying out measurements at the exact same measuring point is a prerequisite for inhomogeneous materials. The same applies to the orientation of the incident plane relative to the material surface for anisotropic materials.

The absolute accuracy, e.g. of layer thickness values, substantially depends on the quality of the chosen model for describing the material surface. For ideal layer substrate systems, such as SiO_2 (ideal transparent layer) on a Si wafer (nearly atomically smooth substrate surface with homogeneous and isotropic material properties), the accuracy of the layer thickness can indeed reach the precision values, since the model describes the reality of the layer substrate system in an ideal manner. For inhomogeneous, anisotropic, contaminated, multi-component, damaged, imperfect or rough surfaces or layers, the accuracy of the layer thickness determination can be significantly lower and generally depends on the quality of the chosen model.

Despite these limitations, ellipsometry is a powerful procedure, which either enables material fingerprints (without modelling) or which allows a model-based determination of optical and dielectric constants (to the nearest 0,001) or of layer thicknesses (to the nearest 0,1 nm) within a broad layer thickness range of approximately 0,1 nm up to approximately 10 µm (in special cases exceeding 100 µm).