International Standard

ISO 23131-3

Ellipsometry —

Part 3:
Transparent single layer model

Ellipsométrie —

Partie 3: Modèle de couche unique transparente

First edition
2026-01

Reference number
ISO 23131-3:2026(en)

Contents

Page

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 107, *Metallic and other inorganic coatings*, in collaboration with ISO/TC 35, *Paints and varnishes*, SC 9, *General test methods for paints and varnishes*.

A list of all parts in the ISO 23131 series can be found on the ISO website.

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. Ellipsometry has been established as a non-invasive measuring method in the field of semiconductor technology, in particular the field of integrated production. The method was originally conceived as a single-wavelength measuring method, then as a multiple-wavelength and later as a spectroscopic measuring method.

Ellipsometry can be used to determine optical or dielectric constants of any material as well as the layer thicknesses of at least semi-transparent layers or layer systems. 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 transfer quantities Ψ (psi, amplitude information) and Δ (delta, phase information). The physical target quantities of interest (optical or dielectric constants, layer thicknesses) are determined based on these measurands 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 detect even the slightest discrepancies in 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.

In the transparent single layer model, a fitting procedure is used to determine the layer thickness d and the refractive index n of the layer while the optical constants of the substrate are known. For ideal transparent materials, it is assumed that $k = 0$. Therefore, fitting only refers to the layer thickness d, which is by definition independent of the wavelength and of the angle of incidence, and the wavelength-dependent refractive index n, which does not depend on the angle of incidence. Consequently, the transparent single layer model allows the determination of the layer thickness and of the refractive index.