

**Oorganiska ytbeläggningar – Översikt över  
metoder för skiktjockleksmätning**  
(ISO 3882:2003)

**Metallic and other inorganic coatings – Review  
of methods of measurement of thickness**  
(ISO 3882:2003)

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## Metallic and other inorganic coatings - Review of methods of measurement of thickness (ISO 3882:2003)

Revêtements métalliques et autres revêtements inorganiques - Vue d'ensemble sur les méthodes de mesurage de l'épaisseur (ISO 3882:2003)

Metallische und andere anorganische Überzüge - Übersicht über Verfahren zur Schichtdickenmessung (ISO 3882:2003)

This European Standard was approved by CEN on 21 March 2003.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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## Foreword

This document (EN ISO 3882:2003) has been prepared by Technical Committee ISO/TC 107 "Metallic and other inorganic coatings" in collaboration with Technical Committee CEN/TC 262 "Metallic and other inorganic coatings", 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of an identical text or by endorsement, at the latest by October 2003, and conflicting national standards shall be withdrawn at the latest by October 2003.

This document supersedes EN ISO 3882:1994.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

**NOTE FROM CMC** The foreword is susceptible to be amended on reception of the German language version. The confirmed or amended foreword, and when appropriate, the normative annex ZA for the references to international publications with their relevant European publications will be circulated with the German version.

## Endorsement notice

The text of ISO 3882:2003 has been approved by CEN as EN ISO 3882:2003 without any modifications.

## Introduction

This International Standard summarizes the various methods used for the measurement of coating thickness and describes their working principles. Methods of measuring coating thickness may be either destructive or non-destructive (see Table 1). The information given in Table 2 will assist in the choice of typical instrumental methods suitable for thickness measurements. For all instrumental methods, manufacturers' instructions should be followed.

The thickness ranges covered by the different methods depend on the coating materials, thickness of the coating, substrates and instruments used (see Table 3); e.g., although X-ray spectrometry can be used to measure the thickness of a chromium coating, thicknesses of 20  $\mu\text{m}$  or more cannot be measured with sufficient precision. Similarly, while magnetic methods may be used to measure the thickness of a gold coating over a magnetic steel substrate, many magnetic instruments do not have the sensitivity to measure accurately thicknesses of gold coatings less than 2  $\mu\text{m}$ .

Where a referee method is required the appropriate coating specification should be consulted.

# Metallic and other inorganic coatings — Review of methods of measurement of thickness

## 1 Scope

This International Standard reviews methods for measuring the thickness of metallic and other inorganic coatings on both metallic and non-metallic substrates (see Tables 1, 2 and 3). It is limited to tests already specified, or to be specified, in International Standards, and excludes certain tests that are used for special applications.

**Table 1 — Methods of measuring coating thickness**

Non-destructive		Destructive	
Split beam microscope (light section)	ISO 2128 <sup>a</sup>	Microscopical (optical)	ISO 1463
Magnetic	ISO 2178 and ISO 2361	Fizeau multiple-beam interferometry	ISO 3868 <sup>b</sup>
Eddy current	ISO 2360	Profilometric (stylus)	ISO 4518 <sup>b</sup>
X-ray spectrometric	ISO 3497	Scanning electron microscope	ISO 9220
Beta backscatter	ISO 3543	Dissolution methods: Gravimetric strip and weigh method and gravimetric analytical method	ISO 10111
		Coulometric method	ISO 2177
<sup>a</sup> Can be destructive in some applications. <sup>b</sup> Can be non-destructive in some applications.			

## 2 Normative references

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

ISO 1463, *Metallic and oxide coatings — Measurement of coating thickness — Microscopical method*

ISO 2064, *Metallic and other inorganic coatings — Definitions and conventions concerning the measurement of thickness*

ISO 2128, *Anodizing of aluminium and its alloys — Determination of thickness of anodic oxide coatings — Non-destructive measurement by split-beam microscope*

ISO 2177, *Metallic coatings — Measurement of coating thickness — Coulometric method by anodic dissolution*

ISO 2178, *Non-magnetic coatings on magnetic substrates — Measurement of coating thickness — Magnetic method*

ISO 2360, *Non-conductive coatings on non-magnetic basis materials — Measurement of coating thickness — Amplitude-sensitive eddy current method*

ISO 2361, *Electrodeposited nickel coatings on magnetic and non-magnetic substrates — Measurement of coating thickness — Magnetic method*

ISO 3497, *Metallic coatings — Measurement of coating thickness — X-ray spectrometric methods*

ISO 3543, *Metallic and non-metallic coatings — Measurement of thickness — Beta backscatter method*

ISO 3868, *Metallic and other non-organic coatings — Measurement of coating thicknesses — Fizeau-multiple beam interferometry method*

ISO 4518, *Metallic coatings — Measurement of coating thickness — Profilometric method*

ISO 9220, *Metallic coatings — Measurement of coating thickness — Scanning electron microscope method*

ISO 10111, *Metallic and other inorganic coatings — Measurement of mass per unit area — Review of gravimetric and chemical analysis methods*

### **3 Terms and definitions**

For the purposes of this document, the terms and definitions given in ISO 2064 apply.

### **4 Non-destructive methods**

#### **4.1 Split beam microscope (light section) method, ISO 2128**

This equipment, originally designed for the measurement of surface roughness, is used for measuring the thickness of transparent and translucent coatings, in particular, anodic oxide coatings on aluminium. A light beam is projected on to the surface at an angle of 45°. Part of the beam is reflected from the surface of the coating and the rest penetrates the coating and is reflected from the coating/metal substrate interface. The distance that separates the two images observed in the eyepiece of the microscope is proportional to the thickness of the coating and can be measured by means of a vernier screw which controls a calibrated graticule. The method can be used where sufficient light is reflected from the coating/metal substrate interface to give a clear image in the microscope. For transparent or translucent coatings, such as anodic oxide films, this method is non-destructive.

For measuring the thickness of opaque coatings, a small area of the coating is removed and in this application the method is destructive. The step between the surface of the coating and the basis metal produces a deflection of the light beam which gives an absolute measure of the coating thickness.

The method is not suitable for hard anodic coatings or for coatings that are very thin (less than 2 µm thick), very thick (greater than 100 µm thick) or rough. It is not suitable for coatings on heavily shot-blasted surfaces. Other methods such as eddy current (ISO 2360), interference microscope (ISO 3868) and microscopical (ISO 1463) may be applicable for thickness measurement where the split beam microscope method cannot be used.

The method is best suited to small parts because of the ease with which they can be set up on the microscope stage.

The measurement uncertainty of the method is usually less than 10 % of the thickness.

#### **4.2 Magnetic methods, ISO 2178 and ISO 2361**

Instruments for these methods measure either the magnetic attraction between a magnet and the basis metal, as influenced by the presence of the coating, or the reluctance of a magnetic flux path passing through the coating and the basis metal.

All instruments using magnetic methods are sensitive to the magnetic condition and properties of the test specimen, surface curvature, surface cleanliness, surface roughness, and thickness of the basis metal and of the coating.