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

Revêtements électrolytiques de nickel sur substrat magnétique et non magnétique — Mesurage de l'épaisseur du revêtement — Méthode magnétique

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Foreword

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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).

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This document was prepared by Technical Committee ISO/TC *107, Metallic and other inorganic coatings*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 262, *Metallic and other inorganic coatings, including for corrosion protection and corrosion testing of metals and alloys*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 2361:1982), which has been technically revised.

The main changes are as follows:

— the nickel measuring methods were split into Type A, Type B and Type A and B;

— common measurement ranges were added for every method;

— subclauses on the factors that influence the measurement uncertainty were added;

— restructured and split into clauses and subclauses;

— Clause 9 on the test report was added;

— editorial changes were made.

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.

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

1 Scope

This document specifies the method for non-destructive thickness measurement via the magnetic type of electrodeposited nickel coatings, also called “e-nickel”, on magnetic or non-magnetic substrates.

It is possible that the method is not applicable to autocatalytic (electroless) nickel coatings, since these coatings are often non-magnetic due to their chemical composition.

For the purposes of this document, two types of substrates are distinguished:

a) nickel coatings on magnetic substrates (type A coatings);

b) nickel coatings on non-magnetic substrates (type B coatings).

Not all instruments are applicable to both types of coating.

The effective measuring ranges of instruments using the principle of magnetic attraction are up to 50 µm for type A coatings and up to 25 µm for type B coatings.

For instruments using the principle of reluctance, the effective ranges are much greater, up to 1 mm or even more. This method is applicable to both types of coatings.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 2177, *Metallic coatings — Measurement of coating thickness — Coulometric method by anodic dissolution*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
calibration
operation that, under specified conditions, in a first step, establishes a relation between the quantity values with measurement uncertainties provided by measurement standards and corresponding indications with associated measurement uncertainties and, in a second step, uses this information to establish a relation for obtaining a measurement result from an indication

Note 1 to entry: A calibration may be expressed by a statement, calibration function, calibration diagram, calibration curve or calibration table. In some cases, it may consist of an additive or multiplicative correction of the indication with associated measurement uncertainty.

Note 2 to entry: Calibration should not be confused with adjustment of a measuring system, often mistakenly called "self-calibration", nor with verification of calibration.

Note 3 to entry: Often, the first step alone in the above definition is perceived as being calibration.

[SOURCE: ISO/IEC Guide 99:2007, 2.39]

3.2
adjustment of a measuring system
set of operations carried out on a measuring system so that it provides prescribed indications corresponding to given values of a quantity to be measured

Note 1 to entry: Types of adjustment of a measuring system include zero adjustment of a measuring system, offset adjustment and span adjustment (sometimes called gain adjustment).

Note 2 to entry: Adjustment of a measuring system should not be confused with calibration, which is a prerequisite for adjustment.

Note 3 to entry: After an adjustment of a measuring system, the measuring system must usually be recalibrated.

Note 4 to entry: The term "calibration" is often incorrectly used instead of the term "adjustment". Similarly, the terms "verification" and "checking" are often used instead of the correct term "calibration".

[SOURCE: ISO/IEC Guide 99:2007, 3.11, modified — Note 4 to entry has been added.]

4 Principle of measurement

Coating thickness instruments of the magnetic type measure either the magnetic attraction between a permanent magnet and the coating/substrate combination, or the reluctance of a magnetic flux path passing through the coating and the substrate.

Regarding this document, the measuring uncertainty is defined as that obtained with an instrument correctly adjusted and used.

5 Factors affecting the measuring accuracy

5.1 Type A coatings: Nickel on a magnetic substrate

5.1.1 Magnetic properties of the basis metal

Thickness measurements by the magnetic method are affected by variations in the magnetic properties of the basis metal. For practical purposes, thickness shall be measured on different spots of the basis metal. In general, magnetic variations in low carbon steels can be considered as insignificant. A calibration on the basis material generally reduces measurement error.