SLOVENSKI STANDARD
SIST EN ISO 16773-4:2017

01-junij-2017

Nadomešča:
SIST EN ISO 16773-4:2009

Barve in laki - Elektrokemijska impedančna spektroskopija (EIS) premazanih in nepremazanih kovinskih vzorcev - 4. del: Primeri spektrov nepremazanih vzorcev in s polimeri premazanih vzorcev (ISO 16773-4:2017)

Paints and varnishes - Electrochemical impedance spectroscopy (EIS) on coated and uncoated metallic specimens - Part 4: Examples of spectra of polymer-coated and uncoated specimens (ISO 16773-4:2017)

Elektrochemische Impedanzspektroskopie (EIS) an beschichteten und unbeschichteten metallischen Proben - Teil 4: Beispiele für Spektren von polymerbeschichteten und unbeschichteten Proben (ISO 16773-4:2017)

Spectroscopie d'impédance électrochimique (SIE) sur des éprouvettes métalliques revêtues et non revêtues - Partie 4: Exemples de spectres d'éprouvettes revêtues de polymères et non revêtues (ISO 16773-4:2017)

Ta slovenski standard je istoveten z: **EN ISO 16773-4:2017**

ICS:

87.040	Barve in laki	Paints and varnishes

SIST EN ISO 16773-4:2017 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

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English Version

Electrochemical impedance spectroscopy (EIS) on coated and uncoated metallic specimens - Part 4: Examples of spectra of polymer-coated and uncoated specimens (ISO 16773-4:2017)

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN ISO 16773-4:2017) has been prepared by Technical Committee ISO/TC 35 “Paints and varnishes” in collaboration with Technical Committee CEN/TC 139 “Paints and varnishes” the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by October 2017, and conflicting national standards shall be withdrawn at the latest by October 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

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Endorsement notice

The text of ISO 16773-4:2017 has been approved by CEN as EN ISO 16773-4:2017 without any modification.

INTERNATIONAL STANDARD

ISO 16773-4

Second edition
2017-03

Electrochemical impedance spectroscopy (EIS) on coated and uncoated metallic specimens —

Part 4: Examples of spectra of polymer-coated and uncoated specimens

Spectroscopie d'impédance électrochimique (SIE) sur des éprouvettes métalliques revêtues et non revêtues —

Partie 4: Exemples de spectres d'éprouvettes revêtues de polymères et non revêtues

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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.

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

For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 9, *General test methods for paints and varnishes* in collaboration with ISO/TC 156, *Corrosion of metals and alloys*.

This second edition cancels and replaces the first edition (ISO 16773-4:2009), which has been technically revised with the following changes.

a) The introductory element of the title, *Paints and varnishes*, has been omitted, because the scope has been broadened to include metals and alloys. The main element of the title has been changed to *Electrochemical impedance spectroscopy (EIS) on coated and uncoated metallic specimens*.

b) A reference to ISO/TR 16208 and ASTM G106 for examples of spectra for low-impedance systems (range from, e.g. 10 Ω to 1 000 Ω) has been added.

c) Examples for uncoated specimens have been added.

A list of all parts in the ISO 16773 series can be found on the ISO website.

Electrochemical impedance spectroscopy (EIS) on coated and uncoated metallic specimens —

Part 4: Examples of spectra of polymer-coated and uncoated specimens

1 Scope

This document gives some typical examples of impedance spectra of polymer-coated and uncoated specimens (see Annex A). Some guidance on interpretation of such spectra is also given. Further examples of spectra of low-impedance systems (range from, e.g. 10 Ω to 1 000 Ω) are given in ISO/TR 16208 and in ASTM G106. ISO 16773-2 gives guidelines for optimizing the collection of EIS data with focus on high-impedance systems.

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 16773-1, *Electrochemical impedance spectroscopy (EIS) on coated and uncoated metallic specimens — Part 1: Terms and definitions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16773-1 apply.

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

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

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

4 Theoretical background

4.1 Basic considerations

A basic introduction to electrochemical impedance spectroscopy, especially in connection with corrosion, is given in ASTM G106.

It is not intended to limit the interpretation of EIS measurements to the models given below. Other interpretations may be valid. The choice of the proper model requires other experimental and theoretical considerations to be taken into account.

4.2 Examples of models

4.2.1 Purely capacitive coating

A metal covered with an undamaged coating generally has a very high impedance. The equivalent circuit for such a situation is shown in Figure 1.

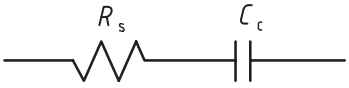
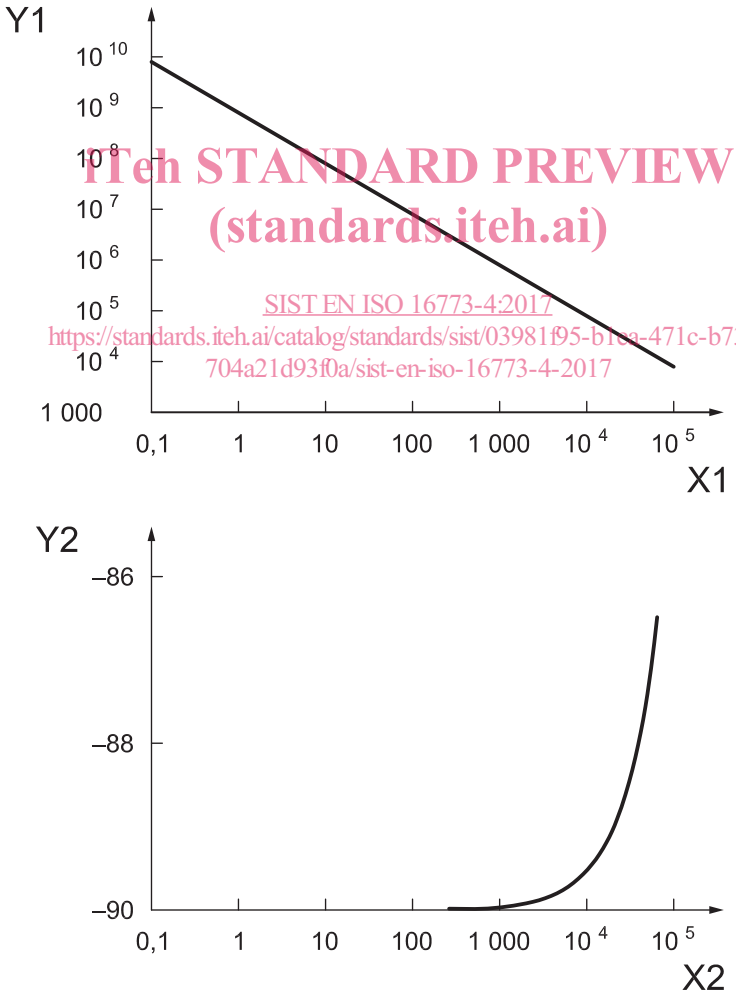


Figure 1 — Equivalent circuit for a purely capacitive coating

The model includes a resistor representing the resistance R_S, of the solution and, connected in series with it, a capacitor representing the capacitance C_C, of the coating.

In practice, the resistance of a perfect coating can often not be seen in the given frequency range. Any deviation from the graph given in the Bode plot in Figure 2 indicates either a modified model or the input limits of the impedance device (see ISO 16773-2:2016, Annex A).



Key

X1 frequency, f, in Hz
Y1 impedance, Z, in Ω
X2 frequency, f, in Hz
Y2 phase angle, φ, in degrees

Figure 2 — Bode plot for a perfect coating

4.2.2 Randles equivalent circuit

The Randles equivalent circuit includes the resistance of the solution R_S, the capacitance of the coating C_C and the ohmic resistance of the coating R_C, as shown in Figure 3.

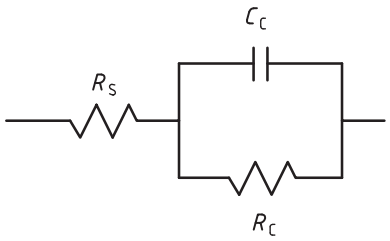
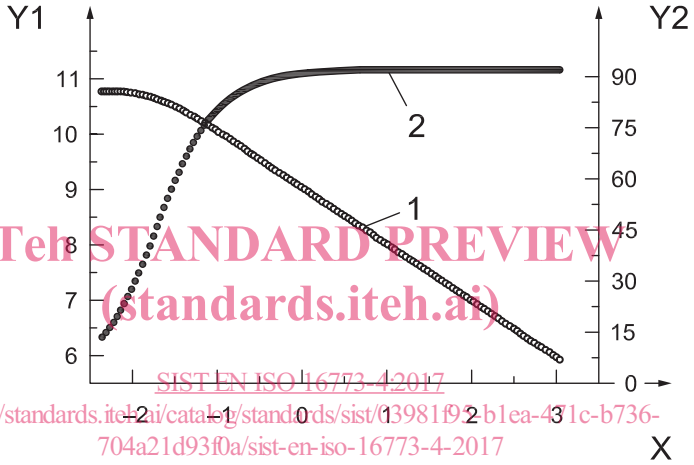


Figure 3 — Randles equivalent circuit

The Bode plot for a Randles equivalent circuit is shown in Figure 4.



Key

X $\log f$ (f in Hz)
Y1 $\log|Z|$ (Z in Ω)
Y2 $|\varphi|$ (degrees)
1 impedance, Z
2 phase angle, φ

Figure 4 — Bode plot for a Randles equivalent circuit

4.2.3 Extended Randles equivalent circuit

Quite often, fitting experimental data to the model shown in Figure 3 results in systematic errors. In such cases, the literature shows that it is possible to use the model shown in Figure 5 to obtain a better fit.