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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 46782-2025

**Metallic and other inorganic coatings - Simultaneous thickness
and electrode potential determination of individual layers in
multilayer nickel deposits (STEP test)**

金属及其他无机覆盖层 多层镍电镀层中各镍镀层厚度和层间电位差同步测试方法
(STEP测试)

(English Translation)

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Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part 1: Structure and Drafting Rules of Standardization Documents".

Drafting.

This document is modified to adopt ISO 16866:2020 "Metallic and other inorganic coatings - Thickness and interlayer spacing of nickel plating in multilayer nickel plating".

Potential difference synchronization test method (STEP test) the technical differences between this document and ISO 16866:2020, and the reasons therefor, are as follows.

---The scope of application has been expanded (see Chapter 1);

---ISO 2177 (see 8.1) has been replaced by GB/T 4955 (normative reference), and GB/T 6682 has been replaced by [other standards/standards].

ISO 3696 (see 4.2) should be adopted to adapt to my country's technical conditions.

---The normative reference GB/T 12334 (see Chapter 3) has been added to adapt to my country's technical conditions;

---The requirements for test reports have been revised (see Chapter 10) to suit my country's technical conditions.

The following editorial changes have been made to this document.

---ISO 3497 has been replaced by GB/T 16921 (informative reference), and ISO 4519 has been replaced by GB/T 12609 (informative reference).

The reference GB/T 6462 has been added.

Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents.

This document was proposed by the China Machinery Industry Federation.

This document is under the jurisdiction of the National Technical Committee on Standardization of Metallic and Non-metallic Coatings (SAC/TC57).

Introduction

The STEP test method for simultaneous testing of the thickness of each nickel plating layer and the interlayer potential difference in multilayer nickel plating can be applied to multilayer nickel plating systems.

The testing process involves simultaneous testing of relevant parameters (thickness of each nickel plating layer and potential difference between different nickel plating layers), and also allows for the use of appropriate methods.

The device is used to record the above test data.

Coulometric testing is widely used in coating thickness measurement, and the STEP test is an improvement upon it. In the STEP test...

During the process, after the nickel electroplated layer is dissolved at the anode, the

electrode potential will produce a certain step, and the potential of the plating layer can be tested through a reference electrode.

Although the STEP test has been included in the enterprise standards of some companies (especially in the automotive industry), the potential difference between different nickel plating layers still exists.

There is controversy and no consensus has been reached. Currently, it is generally assumed that the potential of the semi-bright nickel layer is positive than that of the bright nickel layer, and the potential difference between the two nickel plating layers is located at...

Between 80mV and 150mV.

Furthermore, there is currently no mandatory potential difference between bright nickel layers and other special nickel layers (e.g., in the case of microporous chromium plating).

Numerical value.

In multilayer nickel plating layers with metal and other inorganic coatings Synchronous testing method for thickness of each nickel plating layer and interlayer potential difference (STEP test)

1 Scope

This document describes a method for measuring the thickness of each nickel plating layer and the interlayer potential difference in a multilayer nickel plating system.

This document applies to the measurement of multilayer nickel plating.

This document does not apply to measurements of coatings or layers other than multilayer nickel plating.

2 Normative references

The contents of the following documents, through normative references within the text, constitute essential provisions of this document. Dated citations are not included.

For references to documents, only the version corresponding to that date applies to this document; for undated references, the latest version (including all amendments) applies.

This document.

GB/T 4955 Metallic Coatings - Coating Thickness Measurement - Anodic Dissolution Coulometric Method (GB/T 4955-2005, ISO 2177.

2003, IDT)

GB/T 6682 Specifications and test methods for water used in analytical laboratories (GB/T 6682-2008, ISO 3696:1987, MOD) GB/T 9797 Metallic and Other Inorganic Coatings -

Nickel, Nickel-Chromium, Copper-Nickel and Copper-Nickel-Chromium Electroplating Coatings (GB/T 9797-2022, ISO 1456:2009, MOD) GB/T 12334 Definitions and general rules for thickness measurement of metallic and other non-organic coatings (GB/T 12334-2001) ISO 2064:1996, IDT

3 Terms and Definitions

The terms and definitions defined in GB/T 12334 apply to this document.

4.1 Construction of the test electrolytic cup

Figure 1 shows schematic diagrams of two electrolytic cups used for simultaneously testing the thickness of each nickel plating layer and the interlayer potential difference in multilayer nickel electroplating.

The reference electrode in the electrolytic cup is different. In Figure 1a), the reference electrode is a silver wire coated with silver chloride located on the edge of the electrolytic cup; in Figure 1b), the reference electrode is...

The electrode is a silver ring coated with silver chloride, located at the bottom of the electrolytic cell. Both reference electrodes exhibit the same level of effectiveness in terms of uncertainty in the test results.

The results, including the measurement of potential difference and coating thickness (after calibration), are not significantly related to the reference electrode.

Note 1: During the testing of nickel plating thickness and interlayer potential difference, when using a silver ring reference electrode [Figure 1b], because no adjustment of the silver wire is required, the test results are...

It has higher accuracy and better repeatability.

Note 2: The electrolyte circulation volume is usually 0.1 mL/s.