

ICS 25.220.40

CCS A 29



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

GB/T 43659-2024

**Metallic and other inorganic coatings - Electrodeposited
nickel-ceramics composite coatings**

金属及其他无机覆盖层 电沉积镍-陶瓷复合镀层

(English Translation)

Issued on: March 15, 2024

Implemented on: October 1, 2024

**Issued by: State Administration for Market Regulation, China National
Standardization Administration**

Table of Contents

Preface
Introduction
1 Scope
2 Normative references
3 Terms and Definitions
4 Logo
5 Requirement
5.1 Alternative specimen
5.2 Appearance and surface roughness
5.3 Thickness
5.4 Hardness
5.5 Bonding strength
5.6 Porosity
5.7 Heat treatment for stress relief
5.8 Heat treatment to reduce hydrogen embrittlement
5.9 Shot Peening
5.10 Internal stress
5.11 Ductility
6 Sampling
Appendix A (Informative) Watt nickel and aminosulfonic acid nickel composite plating process and performance
Appendix B (Normative) Coating Thickness Measurement Method
B.1 General
B.2 Destructive Measurement
B.3 Non-destructive measurement
References

Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part 1: Structure and drafting rules for standardization documents" Drafting.

This document is modified to adopt ISO 19487:2016 "Electrodeposited nickel-ceramic

composite coatings of metallic and other inorganic coatings".

This document has the following structural adjustments compared to ISO 19487:2016.

--- Swap the positions of Appendix A and Appendix B in the original ISO text to adapt to my country's technical conditions;

--- Split Table A.1 into three separate tables by category (see Tables A.1, A.2 and A.3) to standardize the table format.

The technical differences between this document and ISO 19487:2016 and their reasons are as follows.

--- Added normative references GB/T 3138, GB/T 3505, GB/T 12332 and GB/T 12334 (see Chapter 3), in order to Adapt to my country's technical conditions;

--- Replaced ISO 2177 with the normative reference GB/T 4955 (see B.2.2); replaced with the normative reference GB/T 5270 ISO 2819 (see 5.5); replaced ISO 10289 (see 5.6) with the normative reference GB/T 6461; replaced ISO 10289 (see 5.6) with the normative reference GB/T 6461 GB/T 6462 replaces ISO 1463 (see B.2.1); GB/T 6463, which is a normative reference, replaces ISO 3882 (see B.1); replace ISO 4519 with the normative reference GB/T 12609 (see Chapter 6); replace ISO 4519 with the normative reference GB/T 13744 Replaced ISO 2361 (see B.3.1); replaced ISO 3497 (see B.3.3) with the normative reference GB/T 16921; replaced ISO 3497 (see B.3.3) with the normative reference GB/T 19349, which is a normative reference, replaces ISO 9587 (see 5.7); GB/T 19350, which is a normative reference, replaces ISO 9588 (see 5.8); GB/T 20018 replaced ISO 3543 (see B.3.2); GB/T 20018 replaced ISO 3543 (see B.3.2) GB/T 20015 replaces ISO 12686 (see 5.9); GB/T 31563, which is a normative reference, replaces ISO 9220 (see B.2.3).

The following editorial changes were made to this document.

--- The title of Appendix A is modified to "Watt nickel and aminosulfonic acid nickel composite plating process and performance" (see Appendix A).

Introduction

Electrochemical co-deposition of ceramic particles and metals is a low-cost, low-temperature method for preparing composite materials. Ceramic particles can be hard Oxides or carbides, such as Al₂O₃, SiC, Si₃N₄, TiO₂, WC or diamond, in addition, it may include solid lubricants, such as PTFE (PTFE), graphite, h-BN or MoS₂. The addition of ceramic particles can improve the mechanical properties, tribological properties and corrosion resistance of the electroplated layer.

As an engineering material, nickel-ceramic composite coating is widely used in semiconductor tools, heat exchangers, automobile shackle pins, glass molds, etc.

It has a wide range of applications, including mechanical components, tools, electronics, microsystem technology, electrochemistry, acoustics, decoration, etc. In addition, electrodeposition Nickel-ceramic composite coatings can be applied to automotive parts, including cylinder bores, pistons and piston rings, to improve engine performance.

There are many different types, depending on the type of ceramic particles added. For increased hardness and corrosion resistance, hard ceramic particles can be used.

To improve wear resistance, self-lubricating solid particles such as h-BN, PTFE or MoS₂ are mainly used.

Therefore, it is important to select the appropriate ceramic particles for a particular application. Appendix A gives typical plating solutions for Watt nickel and nickel sulfamate.

Composition, process conditions and mechanical properties of coatings.

This document aims to provide the process and requirements for nickel-ceramic composite coatings to help both suppliers and buyers prepare composite materials.

Metal and other inorganic coatings Electrodeposited Nickel-Ceramic Composite Coating

1 Scope

This document specifies the requirements for electrodeposited nickel-ceramic composite coatings for engineering applications on ferrous and non-ferrous metal substrates.

The invention discloses a method for preparing a ceramic particle composite coating.

This document applies to nickel-based composite coatings for engineering applications.

This document does not apply to alloys or composite materials with a nickel volume fraction less than 40%.

2 Normative references

The contents of the following documents constitute the essential clauses of this document through normative references in this document.

For referenced documents without a date, only the version corresponding to that date applies to this document; for referenced documents without a date, the latest version (including all amendments) applies to this document.

GB/T 3138 Terminology for surface treatment of metals and other inorganic coatings (GB/T 3138-2018, ISO 2080:2008, IDT) GB/T 3505 Product Geometry Specification (GPS) Surface Structure Profile Method Terminology, Definitions and Surface Structure Parameters (GB/T 3505-2009, ISO 4287:1997, IDT) GB/T 4955 Metallic coatings - Coulometric method for coating thickness by anodic dissolution (GB/T 4955-2005, ISO 2177).

2003, IDT)

GB/T 5270 Review of the test method for adhesion strength of electrodeposited and chemically deposited metal coatings on metal substrates (GB/T 5270-2005, ISO 2819:1980, IDT) GB/T 6461 Rating of samples and test pieces of metal and other inorganic coatings on metal substrates after corrosion tests (GB/T 6461-2002, ISO 10289:1999, IDT) GB/T 6462 Metal and oxide coating thickness measurement microscope method (GB/T 6462-2005, ISO 1463:2003, IDT) GB/T 6463 Review of the measurement method of thickness of metal and other inorganic coatings (GB/T 6463-2005, ISO 3882:2003, IDT) GB/T 12332 Nickel electroplating for metal coatings for engineering purposes (GB/T 12332-2008, ISO 4526:2004, IDT) GB/T 12334 Definitions and general rules for thickness measurement of metals and other non-organic coatings (GB/T 12334-2001, ISO 2064:1996, IDT) GB/T 12609 Sampling procedures for inspection of electrodeposited metallic coatings and related finishes by counting (GB/T 12609-2005, ISO 4519:1980, IDT) GB/T 13744 Measurement of nickel coating thickness on magnetic and non-magnetic substrates (GB/T 13744-1992, ISO 2361:1982, IDT) GB/T 16921 Metallic coatings - Measurement of coating thickness - X-ray spectrometry (GB/T 16921-2005, ISO 3497.

2000, IDT)

GB/T 19349 Pretreatment of steel with metallic and other inorganic coatings to reduce the risk of hydrogen embrittlement (GB/T 19349-2012, ISO 9587:2007, IDT) GB/T 19350 Treatment of coated steel with metallic and other inorganic coatings to reduce the risk of hydrogen embrittlement (GB/T 19350-2012, ISO 9588:2007, IDT)