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GB/T 19350-2012 / ISO 9588:2007

Replacing GB/T 19350-2003

Metallic and other inorganic coatings - Post-coating treatments of iron or steel to reduce the risk of hydrogen embrittlement

金属和其他无机覆盖层

为减少氢脆危险的涂覆后钢铁的处理

(ISO 9588:2007, IDT)

Issued on: December 31, 2012 **Implemented on: October 1, 2013**

Issued by: General Administration of Quality Supervision, Inspection and Quarantine;

Standardization Administration Committee.

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Foreword

This Standard was drafted in accordance with the rules given in GB/T 1.1-2009.

This Standard replaces GB/T 19350-2003 *Metallic and other inorganic coatings - Post-coating treatments of iron or steel to reduce the risk of hydrogen embrittlement*. Compared with GB/T 19350-2003, the main technical modifications in this Standard are as follows:

- modified some content of introduction;
- modified the scope of Clause 1;
- readjusted the normative references;
- modified the requirements in Clause 4;
- modified 6.1;
- modified the note in 6.5;
- modified Table 1 and added Table 2;
- modified Figure 1.

This Standard used translation method to identically adopt ISO 9588:2007 *Metallic and other inorganic coatings - Post-coating treatments of iron or steel to reduce the risk of hydrogen embrittlement*.

See Annex NA for Chinese documents which have consistency with the international normative references in this Standard.

This Standard made the following editorial modifications:

- used the foreword of this Standard to replace the foreword of ISO 9587:2007;
- used “this Standard” to replace “this International Standard”;
- added the informative Annex NA that shows Chinese documents which have consistency with the international normative references in this Standard.

This Standard was proposed by China Machinery Industry Federation.

Introduction

When atomic hydrogen enters steels and certain other metals, for example aluminium and titanium alloys, it can cause loss of ductility or load-carrying ability, or cracking (usually as sub-microscopic cracks), or catastrophic brittle failures at applied stresses well below the yield strength, or even the normal design strength, for the alloys. This phenomenon often occurs in alloys that show no significant loss in ductility, when measured by conventional tensile tests, and is frequently referred to as hydrogen-induced delayed brittle failure, hydrogen stress cracking or hydrogen embrittlement. The hydrogen can be introduced during cleaning, pickling, phosphating, electroplating and autocatalytic processes, as well as in service as a result of cathodic protection or corrosion reactions. Hydrogen can also be introduced during fabrication prior to cleaning, pickling and application of coatings, for example, during roll forming, machining and drilling, due to the breakdown of unsuitable lubricants, as well as during welding or brazing operations.

The susceptibility to hydrogen embrittlement, resulting from the absorption of atomic hydrogen and/or the tensile stresses induced during fabrication, can be reduced by heat treatment. The time-temperature relationship of the heat treatment is dependent on the composition and structure of steels, as well as on the specific coatings being applied and the nature of the coating procedures. For most high-strength steels, the effectiveness of the heat treatment falls off rapidly with reduction of time and temperature.

This Standard is intended for use by purchasers in specifying requirements to the electroplater, supplier or processor and is to be indicated on the part drawing or purchase order.

Metallic and other inorganic coatings - Post-coating treatments of iron or steel to reduce the risk of hydrogen embrittlement

1 Scope

This Standard specifies procedures for reducing susceptibility, or degree of susceptibility, to hydrogen embrittlement that can arise in surface finishing processes.

The heat-treatment procedures for iron or steel specified in this Standard have been shown to be effective in reducing the susceptibility to hydrogen embrittlement. These heat-treatment procedures are used after surface finishing, but prior to any secondary conversion-coating operation.

Stress-relief heat-treatment procedures applied after fabrication, but prior to surface finishing, are specified in ISO 9587.

This Standard does not apply to fasteners.

NOTE The heat treatment does not guarantee complete freedom from the adverse effects of hydrogen embrittlement.

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 2080, *Metallic and other inorganic coatings - Surface treatment, metallic and other inorganic coatings - Vocabulary*

ISO 9587, *Metallic and other inorganic coatings - Pretreatment of iron or steel to reduce the risk of hydrogen embrittlement*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 2080 and the following apply.

5 Embrittlement-relief treatment classes

5.1 With the exception of surface-hardened parts, the heat-treatment conditions shall be selected on the basis of the actual tensile strength. When only the minimum tensile strength is specified or if the tensile strength is not known, the heat-treatment condition shall be selected by relating known or measured hardness values to equivalent tensile strengths. The tensile strength, or equivalent derived from known or measured hardness values, shall be supplied by the purchaser.

Steels that have been wholly or partly surface-hardened shall be considered as being in the category appropriate to the hardness of the surface-hardened layer.

5.2 If the purchaser requires any tests to be performed to verify an adequate embrittlement-relief treatment, then the test method and the sampling plan to be used shall be specified.

6 Heat treatment after processing

6.1 The heat treatment shall commence as soon as possible, preferably within 1 h but not later than 3 h after surface finishing, and before commencement of any grinding or other mechanical operation. For cadmium, tin, zinc, their alloys or any other coating receiving a chromate treatment, heat treatment shall be carried out before chromate treatment, with the exception of electrodeposited zinc-cobalt alloys that should be passivated prior to hydrogen-embrittlement-relief heat treatment.

NOTE 1: Chromate coatings undergo change at temperatures above 66°C. The coating changes from an amorphous structure to a crystalline structure and no longer exhibits “self-healing” properties. Although the crystallized chromate coating will provide satisfactory corrosion protection under most natural environments, the chromate coating will no longer pass accelerated corrosion tests.

NOTE 2: The time period referred to in this Clause is the time between the end of the plating operation and the loading of the article concerned into the heat-treatment processor.

6.2 For high-strength steels, the conditions given in Tables 1 and 2 and Figure 1 shall apply. For steels of actual tensile strength less than 1000 MPa, heat treatment after plating is not essential.

6.3 If threads or sharp notches exist or the articles have a thickness greater than 25 mm, then, for articles electroplated with cadmium or zinc, heat treatment shall be carried out immediately after electroplating for a minimum period of 24 h.

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