GB

NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS 77.040.99
H 24

GB/T 224-2008

Replacing GB/T 224-1987

Determination of depth of decarburization of steels

(ISO 3887:2003, MOD)

Issued on: August 5, 2008 **Implemented on: April 1, 2009**

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

Standardization Administration (SAC) of the People's Republic of China.

Table of Contents

Foreword

This standard is modified in relation to ISO 3887:2003 "Steels-Determination of Depth of Decarburization", and adds the sampling requirements and reference pictures for metallographic method assessment according to ASTME1077-01 "Standard Test Methods for Estimating the Depth of Decarburization of Steel Specimens".

For the convenience of application, this standard has made the following modifications over ISO 3887:2003:

a) The phase "this international standard" is replaced by "this standard";

b) The decimal comma "," is replaced by decimal point ".";

c) The international standards in the references are replaced by relevant national standards;

d) The definition of "complete decarburization" is modified in relation to ASTME1077;

e) Sampling schematic diagrams of specimens of different specifications are increased;

f) Rockwell Hardness Method is increased in the hardness methods;

g) Pictures of decarburized metallurgical structures are increased as informative Annex A.

This standard replaces GB/T 224-1987 "Determination of Depth of Decarburization of Steel".

The main differences between this standard and GB/T 224-1987 are as follows:

a) Add "Foreword" and "Normative References";

b) Modify the terms and definitions; add the terms and definitions of "complete decarburization", "depth of total decarburization", and "depth of functional decarburization" and "schematic diagram of typical decarburization";

c) Sampling schematic diagrams of specimens of different specifications are added;

d) 4.2.2 "sample preparation" recommends to use automatic or semi-automatic system samples;

e) 4.2.3.1 "determination of total decarburization" adds the high degree

Determination of Depth of Decarburization of Steels

1 Scope

This standard specifies the terms and definitions, measuring methods and test report of steel decarburization.

Methods stated in this standard are applicable to determining the depth of decarburization of steel products (billet).

2 Normative References

The following normative documents contain the provisions which, through reference in this text, constitute the provisions of this standard. For dated reference, subsequent amendments or revisions of these publications do not apply. For undated references, the latest edition of the normative document referred to applies.

GB/T 230.1 Metallic Rockwell Hardness Test - Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T) (GB/T 230.1-2004, ISO 6508-1:1999, MOD)

GB/T 1172-1999 Conversion of hardness and strength for ferrous metal

GB/T 4340.1 Metallic materials - Vickers hardness test - Part 1: Test method (GB/T 4340.1-1999, eqv ISO 6507-1:1997)

GB/T 20126-2006 Unalloyed steel - Determination of low carbon content - Part 2: Infrared absorption method after combustion in an induction furnace (with preheating) (GB/T 20126-2006, ISO 15349-2:1999, IDT)

3 Terms and Definitions

For the purposes of this standard, the terms and definitions given in the following apply.

3.1

Decarburization

It refers to carbon loss on the steel surface layer. This carbon loss shall include:

a) Partial decarburization;

b) Complete decarburization, namely the carbon content on the surface layer of the steel specimens is lower than the maximum solubility of carbon in ferrite.

Note: the complete decarburization described in b) only exists in the ferrite structures.

3.2

Depth of functional decarburization

It refers to the distance from the product surface to the point of stated carbon content or hardness, which shall be not subject to the service performance impacts due to decarburization (for example: minimum carbon content stated in product standard).

3.3

Depth of total decarburization

It refers to the distance from the product surface to the point with carbon content equaling to matrix carbon content, equaling to the sum of partial decarburization and complete decarburization.

3.4

Depth of ferrite decarburization

It refers to the depth of the complete decarburization on the surface.

Note: the depth of ferrite decarburization shall be determined by micro-structural examination.

Different decarburization zones are shown in Figure 1.

used for observation to determine the boundary. It shall carry out preliminary observation in low magnification to guarantee that the peripheral decarburization change may find the deepest uniform decarburization zone.

The deepest point of the decarburized layer shall be determined by preliminary detection on the sample surface, and is not affected by surface defects and angle effects. For each sample, within the field of view of microscope of the deepest uniform decarburization zone, several measures at least five shall be carried out at random. The average value of these measured values is regarded as the depth of total decarburization. For bearing steel, tool steel and spring steel, the deepest depth of total decarburization shall be measured. If there are no special regulations in product standards or technical agreements, in measure, the deepest points of decarburization of the sample shall be excluded (but the deficiencies shall be indicated in the test record).

4.2.3.2 The determination of complete decarburization

The measuring method of complete decarburization is same as 4.2.3.1.

4.2.3.3 The determination of functional decarburization

The measuring method of functional decarburization is same as 4.2.3.1. The functional decarburization shall be judged by the product standards or determined by the mutual agreement.

4.2.3.4 The typical structure picture of the depth of decarburization determined through metallographic method

The typical structures pictures of depth of decarburization determined by metallographic method are illustrated in Annex A.

4.3 Hardness Method

4.3.1 Micro (Vickers) Hardness Measurement

This method is measuring the distribution gradient of the micro-hardness value be normal to surface direction on the sample's cross section.

This method is only applicable to hypo-steel, eutectoid steel and hypereutectoid steel with rather deep decarburized layer and relative thin quenching zone. This kind of decarburized layer is completely in the hard zone. It is inaccurate for low carbon steels.

4.3.1.1 Selection and Preparation of Samples

The selection and preparation of samples are same as metallographic method (4.2.2), but whether the sample is eroded or not shall be determined by the accurate

determined impress dimension. The over - heating of samples shall be prevented with caution.

4.3.1.2 Determination

The testing method shall be carried out according to provisions stated in GB/T 4340.1.

In order to reduce the dispensability of measured data, load as large as possible shall be applied. In principle, this load shall be with in the range of 0.49 N ~ 4.9 N (50 gf ~ 500 gf). The distance between impresses shall at least be 2.5 times of the length of impress diagonal.

The depth of decarburization is stated as distance from the surface to the point reaching the required hardness value (dispensability shall be considered in measure).

In principle, two-sets of determination shall be carried out at two locations with distance as far as possible, and the average value shall be regarded as the depth of decarburization.

Measuring boundary of the depth of decarburization may be:

a) From the sample fringe to the section with hardness value stated in product standard or technical agreement;

b) From the fringe to the section with stable hardness value;

c) From the sample fringe to the percentage of the section with stable hardness value.

Which measuring boundary shall be adopted is determined by product standard or mutual agreement.

4.3.2 Rockwell Hardness Measurement

While the Rockwell hardness tester is used, for products not allowing decarburized layer, it shall directly detect on the surface of the sample's originating product; for specimen allowing decarburization, it shall detect on the surface removing the decarburized layer.

Rockwell Hardness Method is to determine the Rockwell hardness value HRC according to GB/T 230.1, and is only used to verdict whether the product is qualified.

4.3.3 The conversion of hardness value

Conversion of the hardness and strength maybe carried out according to standard GB/T 1172.

4.4 Method of determining the Carbon Content

This method is to determine the distribution gradient of the carbon content in the direction normal to sample surface, and it may be used for any structure state of steel.

4.4.1 Chemical analysis method

This method is only applicable to samples with proper geometric shape (circular cylinder or polyhedron), whose dimension is suitable for mechanical process and which requires no heat treatment (if requiring, with mutual agreement, heat treatment may be carried out, but the depth of decarburization shall not be affected). Unless it gets mutual agreement, this method generally is not applicable partial decarburization.

4.4.1.1 Selection and Preparation of Samples

With mechanically processing method, the test leavings of 0.1 mm thick shall be taken layer by layer parallel to the sample surface. Note that any sully shall be avoided and the oxidation film shall be removed ahead. The metal test leavings on each layer shall be collected, and shall be tested for carbon content according to GB/T 20126.

4.4.2 Spectral Analysis

This method is only applicable to plane sample which has proper dimension.

4.4.2.1 Selection and Preparation of Samples

The plane sample shall be peeled layer by layer, with interval of 0.1mm. The spectrographic determination of carbon shall be carried out on each layer. It shall see to that the spectral spark discharge zones do not overlap.

4.4.3 The analysis of test result (chemical analysis and spectral analysis)

With chemical analysis in 4.4.1 and spectral analysis in 4.4.2, the depth of decarburization may be determined. The method is to measure the distance from the surface to the point with carbon content reaching the predetermined value. If there are no provisions on the carbon content value, the carbon content of the terminal of the determination shall takes into account the allowable wave allowance in analysis, and difference between the carbon content's nominal ranges of the product shall be no greater than the following values:

Nominal carbon content of the product	Maximal allowable offset
C<0.6%	0.03%C
C≥0.6%	5% of the product's nominal carbon content

This is an excerpt of the PDF (Some pages are marked off intentionally)

------ The End ------