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GB/T 9790-2021

Replacing GB/T 9790-1988

Metallic Materials - Vickers and Knoop Microhardness Tests of Metallic and Other Inorganic Coatings

金属材料 金属及其他无机覆盖层的维氏和努氏显微硬度试验

(ISO 4516:2002, Metallic and Other Inorganic Coatings - Vickers and Knoop Microhardness Tests, MOD)

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Standardization Administration of the People's Republic of China.

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Foreword

This Standard was drafted in accordance with the rules in GB/T 1.1-2020 *Directives for Standardization - Part 1: Rules for the Structure and Drafting of Standardizing Documents*.

This Standard serves as a replacement of GB/T 9790-1988 *Metallic and Related Coatings - Vickers and Knoop Microhardness Tests*. In comparison with GB/T 9790-1988, apart from structural adjustments and editorial modifications, the main technical changes are as follows:

---The test forces in the Scope are modified; the stipulations of the measurement of surface microhardness of coatings are added (see Chapter 1; Chapter 1 of Version 1988);

---Terms and Definitions are added (see Chapter 3);

---The expression of principles is modified (see Chapter 4; Chapter 3 of Version 1988);

---Examples of result expression of hardness value and contents of multiple symbols are added (see Chapter 5);

---The stipulations of the measurement compliance of hardness tester are added (see 6.1);

---The Vickers indenter and Knoop indenter parameters are modified (see 6.2.1.1 and 6.2.1.2; 5.2.1.1 and 5.2.1.2 of Version 1988);

---The stipulations of hardness reference blocks are modified (see 6.3; 5.3 of Version 1988);

---The expression form of test force selection range is modified from text to a table; an annotation to the guideline of test force selection for materials with hardness value less than 100 is added (see 7.1; 6.1 of Version 1988);

---The description of vibration influencing factors is modified (see 7.4; 6.4 of Version 1988);

---The description of roughness influencing factors is modified (see 7.5.1; 6.5.1 of Version 1988);

---The stipulations of surface inclination of specimen are modified (see 7.6.2; 6.6.2 of Version 1988);

---The description of microscope resolution influencing factors is modified (see 7.8; 6.8 of Version 1988);

---The influence of the microstructure of coatings on the indentation location is added (see 7.9);

---The description of a summary of the measurement process is added (see 8.1);

---The content of coating thickness when Vickers indenter is used is modified (see 8.3.1; 7.2.1 of Version 1988);

---The content of specimen preparation is modified (see 8.3.2; 7.2.2 of Version 1988);

---The content of indentation is modified (see 8.3.3; 7.2.3 of Version 1988);

---The content of the measurement of coating surface is modified (see 8.4; 7.3 of Version 1988);

---The content of optical measurement is modified (see 8.6; 7.5 of Version 1988);

---The stipulations of length difference of two diagonals are modified (see 8.7; 8.6 of Version 1988);

---The content of alternative specimen is modified (see 8.8; 7.7 of Version 1988);

---The uncertainty of results is added (see Chapter 9).

This Standard adopts the re-drafting method in the modification and adoption of ISO 4516:2002 *Metallic and Other Inorganic Coatings - Vickers and Knoop Microhardness Tests*.

In comparison with ISO 4516:2002, this Standard has many structural adjustments. Appendix A lists a table of comparison of chapter No. between this Standard and ISO 4516:2002.

There are technical differences between this Standard and ISO 4516:2002. The clauses involved in these differences have been marked by a vertical single line (|) on the outer margins. Appendix B provides a table of technical differences between this Standard and ISO 4516:2002 and the causes for the differences for reference.

This Standard makes the following editorial modifications:

---The title of the Standard is modified into *Metallic Materials - Vickers and Knoop Microhardness Tests of Metallic and Other Inorganic Coatings*;

---The bibliography of ISO 4516:2002 is deleted.

Please be noted that certain content of this document might involve patents. The institution issuing this document does not undertake the responsibility of identifying these patents.

Metallic Materials - Vickers and Knoop Microhardness Tests of Metallic and Other Inorganic Coatings

1 Scope

This Standard specifies the principles, symbols and descriptions, equipment, influencing factors of measurement accuracy, test procedures, uncertainty of results and test reports of Vickers and Knoop microhardness tests of metallic and other inorganic coatings.

This Standard is applicable to the determination of multiple coatings, such as: electrodeposited coatings, autocatalytic coatings, sprayed aluminum coatings and aluminum anodized coatings, etc. During the determination, the test force is generally not greater than 9.807 N (1 kgf). 8.3 of this Standard is applicable to the determination of microhardness of coating cross-sections. 8.4 of this Standard is applicable to the determination of microhardness of coating surface.

NOTE 1: Part 1 ~ Part 4 of GB/T 18449 describes the test of Knoop hardness of metallic materials. Part 1 ~ Part 4 of GB/T 4340 describes the test of Vickers hardness of metallic materials. GB/T 21838 (all parts) describes instrumented indentation test for metallic material hardness and material parameters.

NOTE 2: the test force of coatings is usually selected from the test force within the range of Vickers microhardness in GB/T 4340.1-2009. However, since the test force shall be as large as possible, the test force within the small force value of Vickers hardness range of GB/T 4340.1-2009 may also be selected.

2 Normative References

The contents of the following documents constitute the indispensable clauses of this document through normative references in the text. In terms of references with a specified date, only versions corresponding to the date are applicable to this document. In terms of references without a specified date, the latest version (including all the modifications) is applicable to this document.

GB/T 4340.1-2009 Metallic Materials - Vickers Hardness Test - Part 1: Test Method (ISO 6507-1:2005, MOD)

GB/T 4340.2 Metallic Materials - Vickers Hardness Test - Part 2: Verification and Calibration of Testing Machines (GB/T 4340.2-2012, ISO 6507-2:2005, MOD)

GB/T 4340.4 Metallic Materials - Vickers Hardness Test - Part 4: Tables of Hardness

Values (GB/T 4340.4-2009, ISO 6507-4:2005, IDT)

GB/T 6462 Metallic and Oxide Coatings - Measurement of Coating Thickness - Microscopical Method (GB/T 6462-2005, ISO 1463:2003, IDT)

GB/T 18449.1-2009 Metallic Materials - Knoop Hardness Test - Part 1: Test Method (ISO 4545-1:2005, MOD)

GB/T 18449.2 Metallic Materials - Knoop Hardness Test - Part 2: Verification and Calibration of Testing Machines (GB/T 18449.2-2012, ISO 4545-2:2005, MOD)

GB/T 18449.4 Metallic Materials - Knoop Hardness Test - Part 4: Tables of Hardness Values (GB/T 18449.4-2009, ISO 4545-4:2005, IDT)

JJG 151 Verification Regulation of Metallic Vickers Hardness Testers

JJG 1047 Metallic Knoop Hardness Testers

3 Terms and Definitions

There are no terms and definitions that need to be defined in this document.

4 Principle

With the specified test force, slowly and vertically press a diamond indenter with a certain shape, at an appropriate press-in velocity, into the measured coating; after maintaining it for a specified time, remove the test force; use a microscope to measure the diagonal length of the indentation. Substitute the measured diagonal length into the hardness calculation formula, or in accordance with the diagonal length, check the table of hardness values (check GB/T 4340.4 for Vickers hardness; check GB/T 18449.4 for Knoop hardness) to obtain the Vickers or Knoop microhardness value.

5 Symbols and Descriptions

Vickers and Knoop microhardness are respectively represented by HV and HK. The figure before the symbol indicates hardness value, and the symbol is followed by:

a) Test force (Newton multiplied by the proportional coefficient 0.102) (see Table 1);

b) Test force retention time, expressed in seconds. Generally speaking, the test force is maintained for 10 s ~ 15 s. If the test force retention time is not within the range of 10 s ~ 15 s, indicate the test force retention time.

The representation method of Vickers hardness is shown in Example 1. The

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