GB

NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS 77.160

H 16

GB/T 34501-2017

Hardmetals - Abrasion Tests for Hardmetals

硬质合金 耐磨试验方法

(ISO 28080: 2011, NEQ)

Issued on: October 14, 2017 **Implemented on: May 01, 2018**

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

Standardization Administration of the People's Republic of China.

Table of Contents

Hardmetals - Abrasion Tests for Hardmetals

1 Scope

This Standard specifies abrasion tests for hardmetals.

This Standard applies to the destructive simulative abrasion test for hardmetals. The test procedures of this Standard can be used for test conditions such as matching wheels of different stiffness (such as steel and rubber), wet or dry grindings, different abrasive grains and different chemical environments.

2 Normative references

The following documents are indispensable for the application of this document. For dated references, only the dated version applies to this document. For undated references, the latest edition (including all amendments) applies to this document.

GB/T 3850, Impermeable sintered metal materials and hardmetals. Determination of density

ASTM B611, Standard Test Method for Abrasive Wear Resistance of Cemented Carbides

ASTM G65, Standard Test Method for Measuring Abrasion Using the Dry Sand / Rubber Wheel Apparatus

3 Terms and definitions

The following terms and definitions are applicable to this document.

3.1 Abrasion volume loss

V

The abrasion volume loss of the sample during the test.

3.2 Abrasion scar depth

D

The depth of the middle point of the abrasion scar.

3.3 Abrasion wear

Under the action of pressure, the abrasion that is produced by pasty abrasive materials on the surface of the sample that is contact with the rotating surface.

4 Principle

Press the sample against a rotating wheel; introduce abrasive materials between the wheel and the sample, so as to cause sample abrasion.

5 Materials

5.1 Sample

5.1.1 Overall size

Generally, the sample shall be designed so that all the wear marks are located in the sample test surface; the sample area shall be larger than the contact area between the sample and the rotating wheel. The sample area is (40 mm ~ 70 mm) × (20 mm ~ 25 mm). However, some special wear tests specify the shape and size of the contact surface of the sample. In this case, the abrasion occurs on the entire contact surface of the sample. As long as the sample strength is sufficient and the abrasion occurs completely within the sample, the thickness of the sample is not required.

When testing coated samples, the test time needs to be adjusted to ensure that the abrasion only occurs within the coating. It is possible to confirm whether the abrasion only occurs in the coating by the inspection after the test.

5.1.2 Surface preparation

The sample surface preparation may affect the test results; therefore, the surface weakening of the sample during the preparation process may result in an increase in the initial abrasion value. Conversely, when there is residual compressive stress in the surface layer of the sample, the initial abrasion value may be reduced. In both cases, when the surface area is worn away, the abrasion value will be close to the normal value of the material.

5.2 Abrasive

There shall be good quality control procedures to ensure consistency of abrasives which are used in the test, so as to ensure a minimum performance difference. Generally, the results of the abrasive wear test are critically dependent on the shape, particle size, and particle size distribution of the abrasive. For this reason, if different test results are to be compared, the relevant tests shall use the same abrasive.

The abrasive shall be dry and free to flow, so as to avoid blocking of the test

Notes:

1 -- abrasive;

2 -- weight;

3 -- sample;

4 -- abrasive slurry tank;

5 -- rubber rim;

6 -- fluid supply;

7 -- feed trough;

8 -- abrasive supply device.

Figure 1 -- Schematic diagram of the device that is used to measure the abrasion wear by the rotating wheel, which uses horizontal or vertical samples respectively

6.2 Abrasive feed method

The abrasive can be supplied, respectively, to the sample and the rotating wheel contact surface by different methods, including:

a) vibration feed;

b) screw feed;

c) the slotted rotating disc for controlling the flow rate of the abrasive, plus a draft tube.

The basic feature of all of these methods is that they can stably supply abrasives and well control the abrasive to the sample and the rotating wheel contact surface. All of these methods are effective in controlling the feed rate of the abrasive.

6.3 Vacuum extraction system

For the dry testing, it is important to install a vacuum extraction system, because it can collect all the fine debris (which may be harmful to the human body) that falls from the sample, and dispose them safely.

6.4 Rotating wheel speed control

It shall use a motor of the appropriate power to stabilize the rotating wheel speed, so as to ensure that the rotating wheel speed is not affected by the applied load. The speed shall be calibrated periodically (once a year is recommended) to ensure stable operation.

6.5 Abrasive flow rate calibration

In the test, the abrasive flow rate is a very critical factor that needs to be carefully measured. It is important to ensure that only abrasives that pass through the wear-resistant contact surfaces are measured. In general, a series

of baffles are arranged to separate the abrasives that have not flowed through the contact surface, so as to collect the abrasives that flow through the contact surface only, and to weigh within the pre-set time, so as to calculate the abrasive flow rate.

To ensure that the abrasion load can be compared between the two measuring devices, the abrasive flow rate can be converted to the abrasive coverage index by Formula (1):

$$Ca = Q / A_c \qquad \cdots\cdots (1)$$

Where:

Ca -- the abrasive coverage index, in cubic meters per square meter second [$m^3/(m^2 \cdot s)$];

Q -- the volume flow rate, in cubic meters per second (m^3/s);

A_c -- the abrasive coverage, in square meters (m^2).

Only when the matching end faces are consistent, during the test when abrasion occurs, will the contact area not increase significantly and this conversion step be useful.

6.6 Test load

Static loads are generally applied by the lever arm system. However, other types of load systems can also be effectively utilized. Before the test device is used, the actual applied load shall be calibrated and periodically checked (usually once a year or once every 200 tests).

6.7 Fluid flow

In the test system that is equipped with liquid ingress, calibrate the flow rate before use. In general, use simple gravity analysis to perform the test.

6.8 Instruments and devices

Some test devices, that are used to perform abrasion test for hardmetals, are usually equipped with various instruments which are used to measure and obtain test results such as the friction factor F_F, the normal force F_N and the abrasion scar depth D. Test data can be obtained with the help of appropriate signal conditioning, analogue-to-digital converter and personal computer. Install an appropriate pressure sensor to measure F_F; install a pressure sensor on the lever arm to measure F_N; use the displacement sensor to monitor the depth of the rotating wheel in the sample, so as to obtain D.

8 Test steps

8.1 Overview

The test can be completed through a single step that is relatively long in length; it can also be intermittently performed through a set of steps which are relatively short in length, of which, the sample mass needs to be re-measured between each step.

Intermittent tests can be used to determine if there is a sudden change in abrasion, for example, the effect of the sample surface defects. However, it is worth noting that, of the same test time, the intermittent test may give a different result than non-interrupted test. This may be caused by the surface interference that is resulted from the cleaning and reweighing process of the sample at the end of each step; it may also be influenced by the fact that the sample cannot be accurately placed back to the original position from one step to the next.

8.2 Sample fixation

The fixed position that the sample is clamped on the experimental device. If necessary, the reference of the sample shall be inspected and adjusted, so that there is a contact plane in the width of the rotating wheel.

8.3 Typical operating conditions

The designed test operating conditions shall simulate the actual application conditions. In the case where the actual application conditions cannot be determined, the test is carried out under the following conditions:

a) the load is 130 N;

b) the speed is 1 m/s;

c) the abrasive flow rate through the contact surface is 150 g/min;

d) The test time is 20 min.

8.4 Start of the test

Before the motor is started, the sample shall be removed without touching the rotating wheel. Start the motor and let the abrasive flow in. When the motor speed and the abrasive flow rate are stable, release the sample, so that the sample is brought into contact with the rotating wheel to start the test.

If an instrument is used to test the system, turn on the data acquisition system before the sample touches the rotating wheel.

9 Result expression

9.1 Single-step test

Calculate the sample mass loss amount M by subtracting the sample mass at the end of the test from the initial mass; use Formula (2) to convert it into the abrasion volume loss V.

$$V = M/\rho \qquad \cdots\cdots(2)$$

Where:

V -- the abrasion volume loss, in cubic meters (m^3);

M -- mass loss amount, in kilograms (kg);

ρ -- sample density, in kilograms per cubic meter (kg/m^3).

9.2 Multi-step test

9.2.1 List

Tabulate the mass values which are determined in 7.2; calculate the mass loss by subtracting these values from the initial mass. Use the checkerboard or similar programs to calculate a table of mass loss and abrasive mass. Use the determined sample density to convert the mass loss amount of the sample into the abrasion volume loss. A graph is usually used to show the relationship between abrasion volume loss and the abrasive mass.

9.2.2 Calculation of the abrasion rate

Use data points near the asymptote, through regression analysis, to obtain the abrasion rate of the material under the test conditions.

9.3 Relation chat of abrasion tendency, friction and normal force

If the instrument test system is used, draw the trend of abrasion scar depth, friction and normal force according to Figure 4.

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

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