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**Hard metals -- Abrasion tests for hard-metals
(English Translation)**

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Table of Contents

Foreword...	3
1 Scope...	4
2 Normative references...	4
3 Terms and definitions...	4
4 Principle...	5
5 Materials...	5
6 Equipment...	7
7 Sample preparation...	10
8 Test steps...	11
9 Result expression...	13
10 Test report...	15

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

The abrasion volume loss of the sample during the test.

3.2 Abrasion scar depth

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.

5.1.1 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) x (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):

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);

Ac -- 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