



# SURFACE VEHICLE RECOMMENDED PRACTICE

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Sintered Carbide Tools

## RATIONALE

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1. **Scope**—This recommended practice covers methods for measuring or evaluating five properties or characteristics of sintered carbide which contribute significantly to the performance of sintered carbide tools. These properties are: hardness, specific gravity, apparent porosity, structure, and grain size. They are covered under separate headings below.
2. **References**—There are no referenced publications specified herein.
3. **Hardness**
  - 3.1 **General**—The Rockwell hardness tester provides a simple, rapid, and reliable means of measuring the hardness of sintered carbide tools. A hardness value is easily obtained, but is subject to error if precautionary measures are not taken in making this test. Hardness determinations, therefore, shall be made according to the requirements outlined below and in ASTM E 18, Methods of Test for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials.
  - 3.2 **Apparatus**
    - a. Rockwell hardness testing machine with 60 kg load and diamond brale penetrator for use with the A scale<sup>1</sup>.
    - b. Two tungsten carbide test blocks with a hardness of 90.0 and 92.0 Rockwell A (RA) respectively.
  - 3.3 **Material - Sample**—Preparation of the surface of the specimen prior to making the hardness test is of major importance. It is recommended that a finish equivalent to that produced with a 220 grit diamond grinding wheel be obtained on the surface which is to be checked for hardness. Because of the shallow penetration of the diamond penetrator used in making this test, the surface being tested for hardness must be parallel to the surface opposite of that being tested. Both surfaces must be smooth and devoid of any bulge or other irregularity affecting parallelism. If these two surfaces are only slightly out of parallel, an error will be obtained in the hardness reading.

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1. It is recommended that a diamond brale especially selected for use with the Rockwell "A" scale be used for this type of testing. This type of penetrator is of higher quality, free from chips and other imperfections, and should be specified for Rockwell "A" scale use. Slowing down of the rate of speed at which the major load is applied during testing will aid in increasing the life of the diamond brale. This change in load application does not affect the accuracy of the hardness reading. The use of the superficial scale is not recommended for hardness testing of sintered carbides unless extreme care is exercised with regard to parallelism and smoothness during surface preparation of the specimen.

It is important that the Rockwell hardness testing machine is located in such a manner and area that it is free from vibration while hardness tests are being performed. Vibration is detected by the bounding effect transmitted through the needle of the indicator after the major load has been applied.

- 3.4 Procedure**—The hardness test shall be made using the RA scale. This reading is obtained by observing the deflection of the needle pointer on the black scale with a 60 kg load and the diamond brale penetrator.<sup>2</sup>

Before making the hardness test on the carbide material, the Rockwell testing machine shall be checked for accuracy, using a tungsten carbide test block of known hardness. Two check blocks of different hardness values are recommended to assure accurate hardness readings over the general range of hardness of the common grades of sintered carbides. The check blocks should have a hardness of 90.0 and 92.0 RA respectively. The check block having the hardness closest to the expected hardness of the carbide material to be checked shall be selected for calibrating the Rockwell tester. The average of five readings should check within  $\pm 0.2$  of a hardness number. If the Rockwell tester varies appreciably from the hardness number of the test block, the dial of the machine must be adjusted so that the correct reading is obtained. The amount of variation is noted and this correction plus or minus is applied when taking the hardness reading on the specimens of sintered carbide being tested. This dial adjustment will be made just before the major load is applied. With careful manipulations, hardness readings can be accurately duplicated when the hardness tester is calibrated in this manner.

#### 4. Specific Gravity

- 4.1 General**—The specific gravity of sintered carbide tool materials shall be determined by the immersion method, using as a basis the difference in weight of the carbide in air and in water.

#### 4.2 Apparatus

- a. A standard analytical balance of 200 g capacity and 0.1 mg sensitivity at full load.
- b. A 150- or 250-ml beaker, depending upon the size of the carbide specimen.
- c. Small diameter nonferrous wire.
- d. Thermometer 0–100 °C for room temperatures capable of being read to nearest 0.5 °C.

#### 4.3 Materials

- a. The specimen shall be surface ground all over with a 100 grit diamond wheel before testing.
- b. Distilled water.

#### 4.4 Procedure

- a. Weigh the specimen, to the nearest 0.5 mg.
- b. Support a beaker of distilled water<sup>3</sup> over the pan of the balance by a suitable bridge. Water level should be high enough to cover the specimen by at least 1/4 in.
- c. Suspend the specimen and the wire from the beam hook, placing the specimen in the water, and weigh to the nearest 0.5 mg.
- d. Remove the specimen from the wire and weigh the wire alone in water. Subtract this weight from the total weight found in step c.
- e. Observe the temperature of the water to the nearest 1.0 °C.

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2. See Footnote 1.

3. Care should be used to see that no air bubbles are present on the sample after immersion, and that the wire twist on the sample is completely submerged. Several drops of a suitable wetting agent will aid in eliminating air bubbles.