
INTERNATIONAL STANDARD



4505

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Hardmetals — Metallographic determination of porosity and uncombined carbon

Métaux-durs — Détermination métallographique de la porosité et du carbone non combiné

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FOREWORD

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4505 was developed by Technical Committee ISO/TC 119, *Powder metallurgical materials and products*, and was circulated to the member bodies in April 1977.

It has been approved by the member bodies of the following countries:

Australia	Ireland	Spain
Austria	Italy	Sweden
Bulgaria	Japan	Turkey
Canada	Mexico	United Kingdom
Chile	Poland	U.S.A.
Czechoslovakia	Portugal	U.S.S.R.
France	Romania	Yugoslavia
Germany	South Africa, Rep. of	

No member body expressed disapproval of the document.

Hardmetals — Metallographic determination of porosity and uncombined carbon

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies methods for the metallographic determination of the presence, type, and distribution of porosity and uncombined carbon in hardmetals.

2 APPARATUS

2.1 Metallographic microscope, or other suitable equipment permitting observations and measurements on a screen up to the required magnification (see clause 4).

2.2 Equipment for preparation of test-piece sections.

3 PREPARATION OF TEST-PIECE SECTIONS

The test-piece section shall be prepared as for metallographic examination and the surface to be examined shall be free from grinding and polishing marks. Care shall be taken to avoid tearing out of particles, which may lead to a wrong evaluation of porosity.

NOTE — There are several methods for the preparation of hardmetal surfaces for metallographic examination. Firstly, careful coarse grinding is carried out to remove sufficient material to ensure that the true structure is revealed. After grinding with fine diamond grit wheels, polishing is effected by using diamond paste or diamond powders of progressively finer grain size down to 1 μm on rigidly supported laps of, for example, thin plastic, thin felt or paper.

4 PROCEDURE

Pore size is defined as the maximum dimension of the pore in the section. Special reference shall be made to the presence of cracks or slits.

4.1 Pores up to 10 μm shall be assessed by scanning the surface of the test-piece section at a magnification of either 100 or 200 X. An area fully representative of the test-piece section shall be examined and compared with the range of photomicrographs shown in figure 1 or 2, according to the chosen magnification. The porosity level shall be reported by reference to the appropriate photomicrograph and designated as A02, A04, A06 or A08.

4.2 Pores within the range 10 to 25 μm shall be assessed by scanning the surface of the test-piece section at a magnification of 100 X. An area fully representative of the test-piece section shall be examined and shall be compared with the range of photomicrographs shown in figure 3. The porosity level shall be reported by reference to the appropriate photomicrograph and designated as B02, B04, B06 or B08.

4.3 If it is necessary to inspect for pores larger than 25 μm , they shall be examined at a suitable magnification up to 100 X and shall be counted and reported as the number of pores per unit area. The size ranges shall be chosen as follows: 25 to 75 μm , 75 to 125 μm , over 125 μm .

4.4 Uncombined carbon shall be assessed by scanning the surface of the test-piece section at a magnification of 100 X. An area fully representative of the test-piece section shall be examined and shall be compared with the range of photomicrographs shown in figure 4. The level of uncombined carbon shall be reported by reference to the appropriate photomicrographs and designated as C02, C04, C06 or C08.

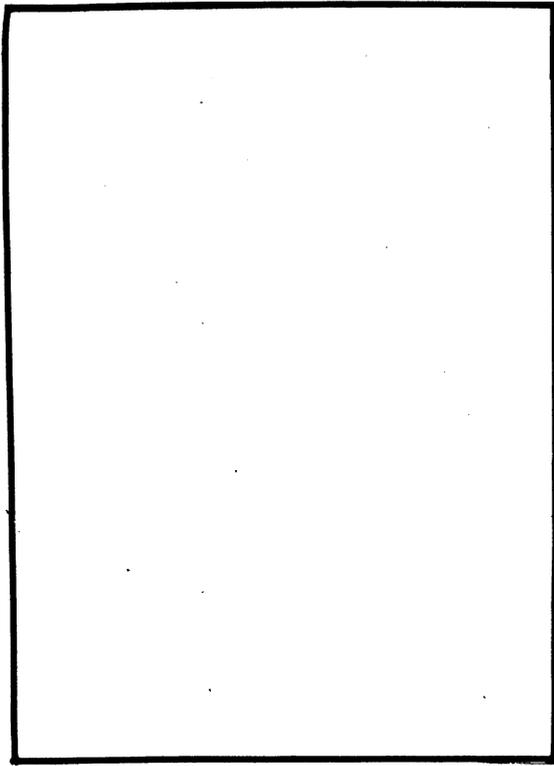
4.5 If A or B type porosity or C type uncombined carbon is not detected, it shall be reported as A00, B00 or C00 as applicable.

4.6 If the porosity or uncombined carbon is not uniform over the area of the test-piece section being examined, the locations on the section to which the evaluation refers must be identified, for example as top, bottom, edge, rim (case), core, etc.

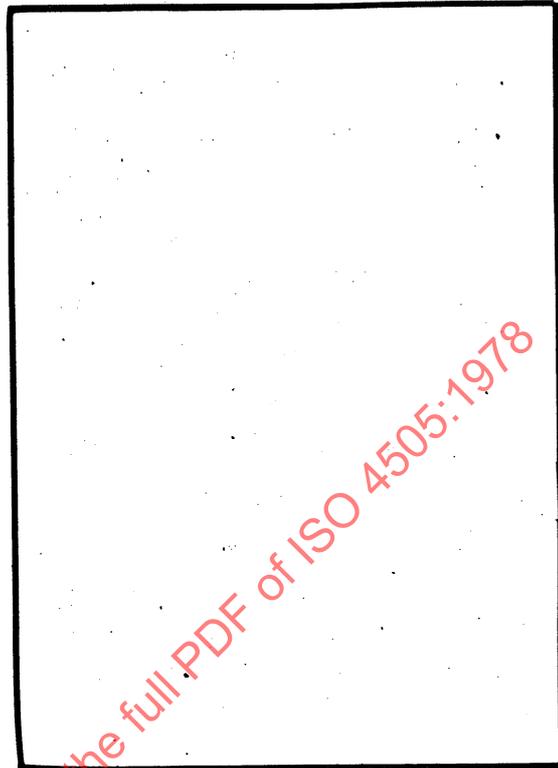
5 TEST REPORT

The test report shall include the following information :

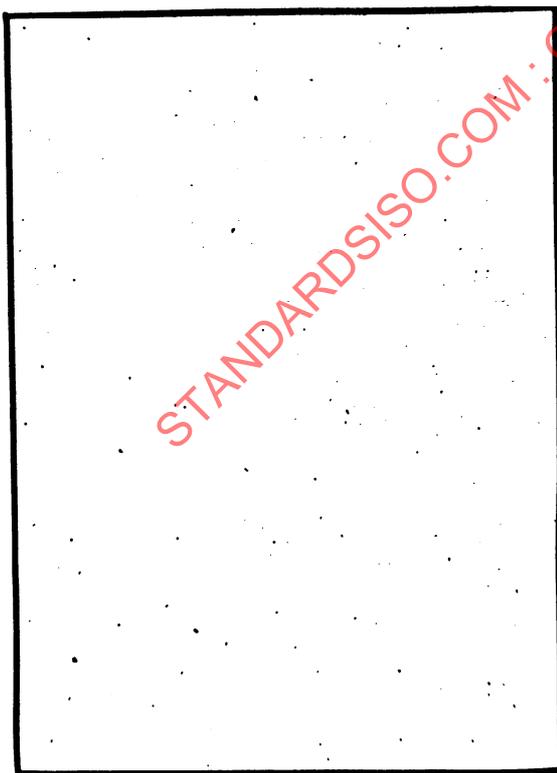
- a) reference to this International Standard;
- b) all details necessary for identification of the test sample;
- c) the result obtained;
- d) all operations not specified by this International Standard, or regarded as optional;
- e) details of any occurrence which may have affected the result.



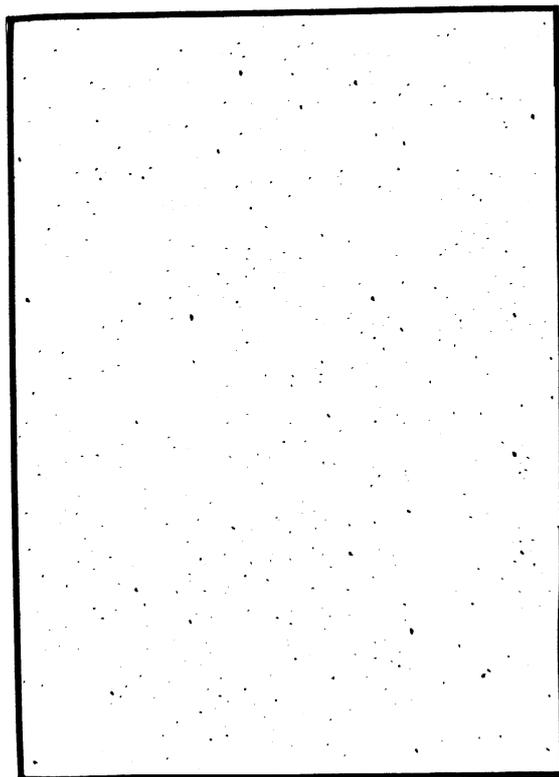
A02 0,02 % (vol.)



A04 0,06 % (vol.)

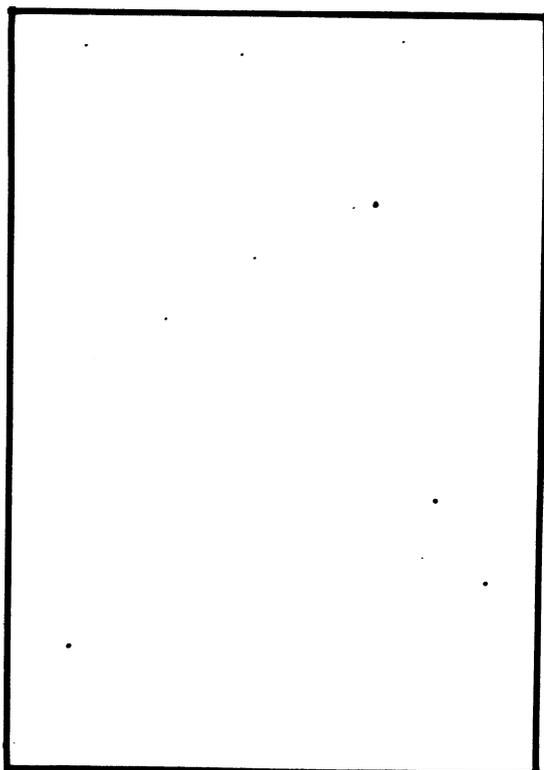


A06 0,2 % (vol.)



A08 0,6 % (vol.)

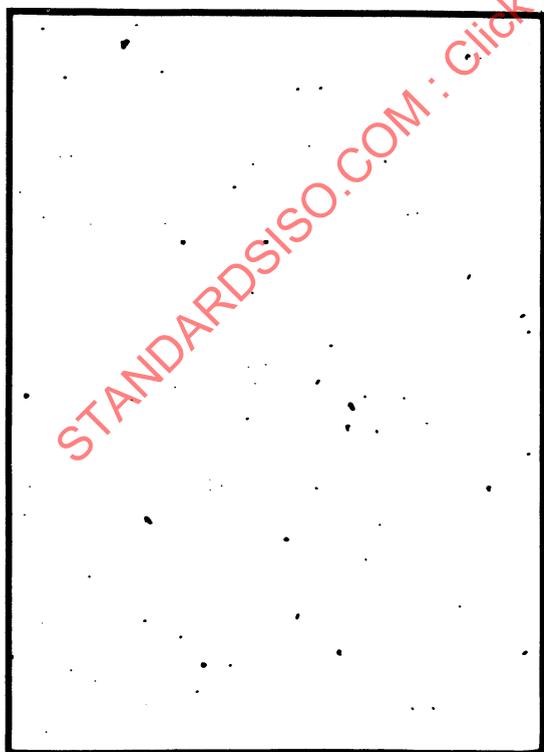
FIGURE 1 — Type A apparent porosity (X 100)



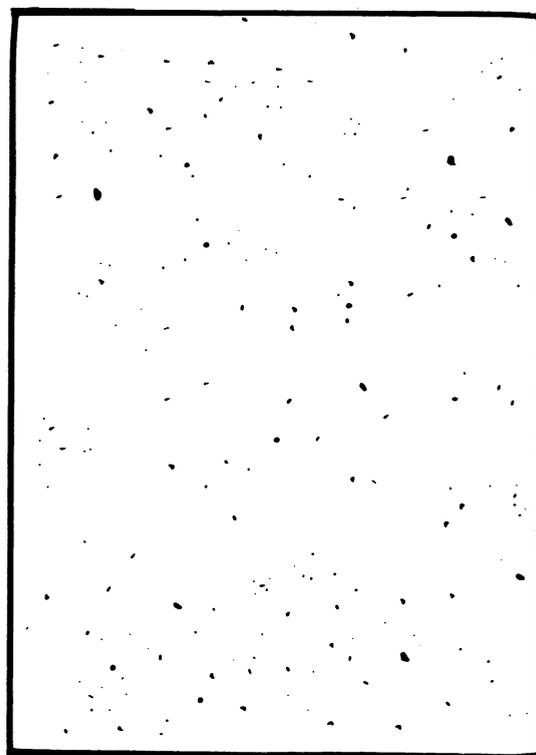
A02 0,02 % (vol.)



A04 0,06 % (vol.)

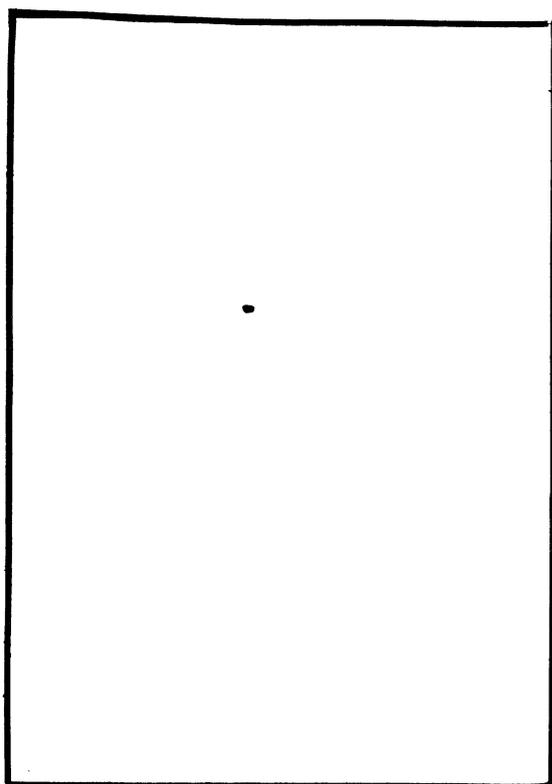


A06 0,2 % (vol.)



A08 0,6 % (vol.)

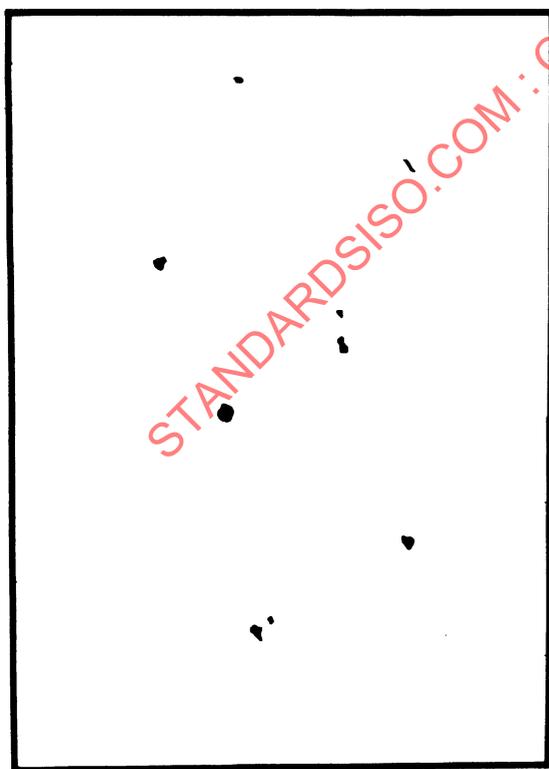
FIGURE 2 – Type A apparent porosity (X 200)



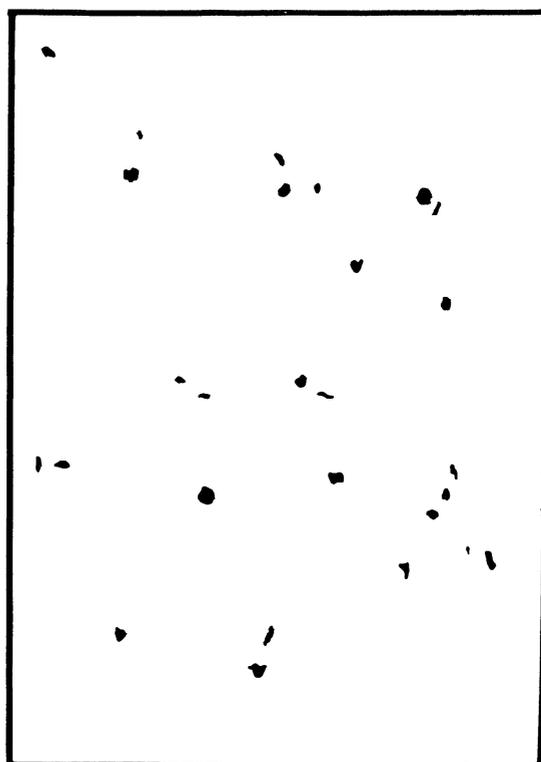
B02 0,02 % (vol.)
(140 pores/cm²)



B04 0,06 % (vol.)
(430 pores/cm²)



B06 0,2 % (vol.)
(1 300 pores/cm²)



B08 0,6 % (vol.)
(4 000 pores/cm²)

FIGURE 3 – Type B apparent porosity (X 100)