### **INTERNATIONAL STANDARD**



Second edition 2020-07

#### Hardmetals — Metallographic determination of microstructure -

# H C Part 2: **Measurement of WC grain size**

-Dcre -esurage de . Métaux-durs — Détermination métallographique de la microstructure —

Partie 2: Mesurage de la taille des grains de WC



Reference number ISO 4499-2:2020(E)



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#### Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see <a href="https://www.iso.org/directives">www.iso.org/directives</a>).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see <a href="https://www.iso.org/patents">www.iso.org/patents</a>).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see <a href="https://www.iso.org/iso/foreword.html">www.iso.org/iso/foreword.html</a>.

This document was prepared by Technical Committee ISO/TC 119, *Powder metallurgy*, Subcommittee SC 4, *Sampling and testing methods for hardmetals*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/SS M11, *Powder metallurgy*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 4499-2:2008), which has been technically revised.

The main changes compared to the previous edition are as follows:

- former 3.1 has been removed;
- <u>3.2</u> has been expanded;
- in <u>Clause 5</u>, "Electron back scatter diffraction (EBSD)" has been added;
- in <u>7.2.1</u>, the list has been revised;
- in <u>7.3.3</u>, <u>Table 1</u>, row "Electron back scatter diffraction" has been added and in the row "Scanning electron microscope", the value for the "Minimum visible intercept length" has been corrected from 200 nm into 400 nm.

A list of all parts in the ISO 4499 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at <u>www.iso.org/members.html</u>.

## Hardmetals — Metallographic determination of microstructure —

#### Part 2: Measurement of WC grain size

#### 1 Scope

This document gives guidelines for the measurement of hardmetal grain size by metallographic techniques only using optical or electron microscopy. It is intended for WC/Co hardmetals (also called cemented carbides or cermets) containing primarily tungsten carbide (WC<sup>1</sup>) as the hard phase. It is also intended for measuring the grain size and distribution by the linear-intercept technique.

This document essentially covers four main topics:

- calibration of microscopes, to underpin the accuracy of measurements;
- linear analysis techniques, to acquire sufficient statistically meaningful data;
- analysis methods, to calculate representative average values;
- reporting, to comply with modern quality requirements.

This document is supported by a measurement case study to illustrate the recommended techniques (see <u>Annex A</u>).

This document is not intended for the following:

- measurements of size distribution;
- recommendations on shape measurements. Further research is needed before recommendations for shape measurement can be given.

Measurements of coercivity are sometimes used for grain-size measurement, however, this document is concerned only with a metallographic measurement method. It is also written for hardmetals and not for characterizing powders. However, the method can, in principle, be used for measuring the average size of powders that are suitably mounted and sectioned.

#### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3369, Impermeable sintered metal materials and hardmetals — Determination of density

ISO 3738-1, Hardmetals — Rockwell hardness test (scale A) — Part 1: Test method

ISO 3738-2, Hardmetals — Rockwell hardness test (scale A) — Part 2: Preparation and calibration of standard test blocks

ISO 4489:2019, Hardmetals — Sampling and testing

<sup>1)</sup> DE: Wolframcarbid, EN: tungsten carbide.

#### ISO 4499-2:2020(E)

ISO 6507-1, Metallic materials — Vickers hardness test — Part 1: Test method

ISO 6507-2, Metallic materials — Vickers hardness test — Part 2: Verification and calibration of testing machines

ISO 6507-3, Metallic materials — Vickers hardness test — Part 3: Calibration of reference blocks

ISO 6507-4, Metallic materials — Vickers hardness test — Part 4: Tables of hardness values

#### 3 Terms, definitions, symbols and abbreviated terms

#### 3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

ISO Online browsing platform: available at <u>https://www.iso.org/obp</u>

— IEC Electropedia: available at <a href="http://www.electropedia.org/">http://www.electropedia.org/</a>

#### **3.1.1 nano** with WC grain size <0,2 μm

Note 1 to entry: Measured by the mean-linear-intercept method described in this document.

## 3.1.2 ultrafine with WC grain size 0,2 $\mu m$ to 0,5 $\mu m$

Note 1 to entry: Measured by the mean-linear-intercept method described in this document.

#### **3.1.3 submicron** with WC grain size 0,5 μm to 0,8 μm

Note 1 to entry: Measured by the mean-linear-intercept method described in this document.

#### **3.1.4 fine** with WC grain size 0,8 μm to 1,3 μm

Note 1 to entry: Measured by the mean-linear-intercept method described in this document.

#### 3.1.5 medium

with WC grain size 1,3  $\mu m$  to 2,5  $\mu m$ 

Note 1 to entry: Measured by the mean-linear-intercept method described in this document.

#### 3.1.6

coarse with WC grain size 2,5  $\mu m$  to 6,0  $\mu m$ 

Note 1 to entry: Measured by the mean-linear-intercept method described in this document.

#### **3.1.7 extra coarse** with WC grain size >6,0 μm

Note 1 to entry: Measured by the mean-linear-intercept method described in document.