

Hardmetals - Metallographic determination of
microstructure - Part 2: Measurement of WC grain size
(ISO 4499-2:2020)

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN ISO 4499-2:2020 sisaldab Euroopa standardi EN ISO 4499-2:2020 ingliskeelset teksti.	This Estonian standard EVS-EN ISO 4499-2:2020 consists of the English text of the European standard EN ISO 4499-2:2020.
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English Version

**Hardmetals - Metallographic determination of
microstructure - Part 2: Measurement of WC grain size
(ISO 4499-2:2020)**

Métaux-durs - Détermination métallographique de la
microstructure - Partie 2: Mesurage de la taille des
grains de WC (ISO 4499-2:2020)

Hartmetalle - Metallographische Bestimmung der
Mikrostruktur - Teil 2: Messung der WC Korngröße
(ISO 4499-2:2020)

This European Standard was approved by CEN on 1 August 2020.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

This document (EN ISO 4499-2:2020) has been prepared by Technical Committee ISO/TC 119 "Powder metallurgy" in collaboration with Technical Committee CEN/SS M11 "Powder metallurgy" the secretariat of which is held by CCMC.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2021, and conflicting national standards shall be withdrawn at the latest by February 2021.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 4499-2:2010.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 4499-2:2020 has been approved by CEN as EN ISO 4499-2:2020 without any modification.

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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 www.iso.org/directives).

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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 www.iso.org/iso/foreword.html.

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;
- [3.2](#) has been expanded;
- in [Clause 5](#), “Electron back scatter diffraction (EBSD)” has been added;
- in [7.2.1](#), the list has been revised;
- in [7.3.3](#), [Table 1](#), 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 www.iso.org/members.html.

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 (WC¹⁾) 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 [Annex A](#)).

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*

1) DE: Wolframcarbid, EN: tungsten carbide.

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 <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1.1

nano

with WC grain size $<0,2\ \mu\text{m}$

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

3.1.2

ultrafine

with WC grain size $0,2\ \mu\text{m}$ to $0,5\ \mu\text{m}$

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

3.1.3

submicron

with WC grain size $0,5\ \mu\text{m}$ to $0,8\ \mu\text{m}$

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

3.1.4

fine

with WC grain size $0,8\ \mu\text{m}$ to $1,3\ \mu\text{m}$

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

3.1.5

medium

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

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

3.1.6

coarse

with WC grain size $2,5\ \mu\text{m}$ to $6,0\ \mu\text{m}$

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

3.1.7

extra coarse

with WC grain size $>6,0\ \mu\text{m}$

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