

**Hardmetals - Metallographic determination of  
microstructure - Part 2: Measurement of WC grain size**

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## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN ISO 4499-2:2010 sisaldab Euroopa standardi EN ISO 4499-2:2010 ingliskeelset teksti.

Standard on kinnitatud Eesti Standardikeskuse 31.08.2010 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.

Euroopa standardimisorganisatsioonide poolt rahvuslikele liikmetele Euroopa standardi teksti kättesaadavaks tegemise kuupäev on 12.05.2010.

Standard on kättesaadav Eesti standardiorganisatsioonist.

This Estonian standard EVS-EN ISO 4499-2:2010 consists of the English text of the European standard EN ISO 4499-2:2010.

This standard is ratified with the order of Estonian Centre for Standardisation dated 31.08.2010 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.

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ICS 77.040.99, 77.160

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English Version

Hardmetals - Metallographic determination of microstructure -  
Part 2: Measurement of WC grain size (ISO 4499-2:2008)

Métaux-durs - Détermination métallographique de la  
microstructure - Partie 2: Mesurage de la taille des grains  
de WC (ISO 4499-2:2008)

Hartmetalle - Metallographische Bestimmung der  
Mikrostruktur - Teil 2: Messung der WC Korngröße (ISO  
4499-2:2008)

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## Foreword

The text of ISO 4499-2:2008 has been prepared by Technical Committee ISO/TC 119 "Powder metallurgy" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 4499-2:2010.

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of an identical text or by endorsement, at the latest by November 2010, and conflicting national standards shall be withdrawn at the latest by November 2010.

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

This document supersedes EN 24499:1993.

ISO 4499-2, together with ISO 4499-1, cancels and replaces ISO 4499:1978, which has been technically revised. A new section has been added for the quantitative measurement of the WC grain size of hardmetals.

ISO 4499 consists of the following parts, under the general title *Hardmetals — Metallographic determination of microstructure*:

- *Part 1: Photomicrographs and description*
- *Part 2: Measurement of WC grain size*

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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

### Endorsement notice

The text of ISO 4499-2:2008 has been approved by CEN as a EN ISO 4499-2:2010 without any modification.

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# Hardmetals — Metallographic determination of microstructure —

## Part 2: Measurement of WC grain size

### 1 Scope

This part of ISO 4499 gives guidelines for the measurement of hardmetal grain size by metallographic techniques only using optical or electron microscopy. It is intended for sintered WC/Co hardmetals (also called cemented carbides or cermets) containing primarily WC as the hard phase. It is also intended for measuring the grain size and distribution by the linear-intercept technique.

This part of ISO 4499 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.

The part of ISO 4499 is supported by a measurement case study to illustrate the recommended techniques (see Annex A).

The part of ISO 4499 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, but this current guide is concerned only with a metallographic measurement method. It is also written for sintered hardmetals and not for characterising powders. However, the method could, in principle, be used for measuring the average size of powders that are suitably mounted and sectioned.

## 2 Normative references

The following referenced documents are indispensable for the application 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 3326, *Hardmetals — Determination of (the magnetization) coercivity*

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 3878, *Hardmetals — Vickers hardness test*

ISO 4489:1978, *Sintered hardmetals — Sampling and testing*

ISO 4499-1, *Hardmetals — Metallographic determination of microstructure — Part 1: Photomicrographs and description*

ISO 4505, *Hardmetals — Metallographic determination of porosity and uncombined carbon*

## 3 Terms, definitions, abbreviations, symbols and units

### 3.1 General

A very wide range of terms are used to describe powders or sintered hardmetals of different sizes. For example, the following have been used in a variety of publications and reports.

Extra coarse	Fine	Microfine
Coarse	Very fine	Micrograin
Coarse/Medium	Ultra fine	Nanophase
Medium	Extra fine	Nanograin
Medium/Fine	Submicron	Super fine

None of these terms have commonly agreed or well-defined size ranges among users and producers of powders or sintered products.

Consequently, following discussion in the hardmetal community, the following terms for the sizes defined in 3.2 are recommended.

The uncertainty associated with the measurement of linear-intercept grain size is about 10 %, if typically 200 grains to 300 grains are counted. Thus, measurements on or close to the class boundaries should be treated carefully. It is recommended that measurements that fall within 10 % of any of the class boundaries should be classed as follows:

#### EXAMPLE

0,19 µm as Nano/Ultrafine	0,21 µm as Ultrafine/Nano
0,75 µm as Submicron/Fine	0,85 µm as Fine/Submicron
1,29 µm as Fine/Medium	1,31 µm as Medium/Fine
2,4 µm as Medium/Coarse	2,6 µm as Coarse/Medium