Testing of ceramic raw materials and ceramic materials - Direct determination of mass fractions of impurities in powders and granules of silicon carbide by optical emission spectrometry by direct current arc excitation (DCArc-OES)

EESTI STANDARDIMIS- JA AKREDITEERIMISKESKUS
ESTONIAN CENTRE FOR STANDARDISATION AND ACCREDITATION

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 15979:2025 sisaldab Euroopa standardi EN 15979:2025 ingliskeelset teksti.	This Estonian standard EVS-EN 15979:2025 consists of the English text of the European standard EN 15979:2025.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation and Accreditation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 24.09.2025.	Date of Availability of the European standard is 24.09.2025.
Standard on kättesaadav Eesti Standardimis-ja Akrediteerimiskeskusest.	The standard is available from the Estonian Centre for Standardisation and Accreditation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 81.060.10

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

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English Version

Testing of ceramic raw materials and ceramic materials - Direct determination of mass fractions of impurities in powders and granules of silicon carbide by optical emission spectrometry by direct current arc excitation (DCArc-OES)

Essai des matières premières et matériaux de base céramiques - Détermination directe des fractions massiques d'impuretés dans les poudres et granulés de carbure de silicium par OES à l'excitation d'arc DC (DCArc-OES)

Prüfung keramischer Roh- und Werkstoffe - Direkte Bestimmung der Massenanteile an Verunreinigungen in pulver- und kornförmigem Siliciumcarbid mittels optischer Emissionsspektrometrie und Anregung im Gleichstrombogen (DCArc-OES)

This European Standard was approved by CEN on 27 July 2025.

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

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Contents

Page

European foreword

This document (EN 15979:2025) has been prepared by Technical Committee CEN/TC 187 “Refractory products and materials”, the secretariat of which is held by BSI.

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 March 2026, and conflicting national standards shall be withdrawn at the latest by March 2026.

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 15979:2011.

EN 15979:2025 includes the following significant technical changes with respect to EN 15979:2011:

— Clause 2 and Clause 3 have been added, noting that they neither add any normative references nor terms and definitions to the document;

— Clause 9 adds more detail about calculation of the calibration functions;

— subclause 10.2 adds more detail about the procedure using addition of carrier;

— Clause 14 now provides the completeness of the information required by CEN/CENELEC Internal Regulations Part 3;

— Annex A, Tables A.1 to A.4 now provides the correct printing of variables required by CEN/CENELEC Internal Regulations Part 3;

— Annex B, Table B.1 provides additional information on the limits of determination.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organisations 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, Türkiye and the United Kingdom.

1 Scope

This document describes a method for the analysis of mass fractions of the impurities Al, B, Ca, Cr, Cu, Fe, Mg, Ni, Ti, V and Zr in powdered and grain-shaped silicon carbide of ceramic raw materials and ceramic materials. This application can also be extended to other metallic elements and other similar non-metallic powdered and grain-shaped materials such as carbides, nitrides, graphite, carbon blacks, cokes, carbon, as well as a number of further oxidic raw and basic materials after appropriate testing.

NOTE There is positive experience with materials such as, for example, graphite, boron carbide (B_4C), boron nitride (BN), tungsten carbide (WC) and several refractory metal oxides.

This testing procedure is applicable to mass fractions of the impurities mentioned above from approximately 1 mg/kg up to approximately 3 000 mg/kg, after verification. In some cases, it is possible to extend the range up to 5 000 mg/kg depending on element, emission lines, DCArc parameters, and sample mass.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Principle

With DCArc-OES, the impurities are measured directly from the powdered silicon carbide sample, thus avoiding the disadvantages of the usually applied wet-chemical digestion of silicon carbide such as high time-consumption, the use of hazardous chemicals, dilution of the sample and the possibility of systematic errors due to introduction of impurities as well as analyte losses. Compared to wet-chemical ICP-OES methods, DCArc-OES requires more effort for method development and is therefore particularly suitable when many samples of one matrix are to be measured. With DCArc-OES, impurities in silicon carbide can be measured cost-effective, with high sample throughput and with a detection sensitivity down to the lower mg/kg level.

In DCArc-OES, the powdered silicon carbide sample is evaporated and excited in the direct current arc-plasma of the DCArc-system. The combustion and evaporation of the powdered sample material takes place in the arc-plasma in an atmosphere of oxygen, mixed argon and oxygen or in air. The metallic traces in the silicon carbide sample are excited in the arc-plasma to emission of optical radiation. The optical radiation from the DCArc-system is guided into a simultaneous emission spectrometer by coupling via fibre-optics or directly. If the coupling takes place via fibre-optics, the simultaneous emission spectrometer can be a commercially available ICP-OES device, provided that the measurement can be started with the plasma switched off.

NOTE As the fibre-optics used for coupling is usually made of quartz, emission lines with wavelengths of less than around 220 nm can no longer be measured due to absorption.

Literature on DCArc-OES see [1], [3], [4], [5], [6], [8], [9] and [10].