



SLOVENSKI STANDARD
SIST EN 17289-2:2021

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Karakterizacija razsutih materialov - Določanje velikostno utežene fine frakcije in deleža kristaliničnega kremena - 2. del: Metoda izračuna

Characterization of bulk materials - Determination of a size-weighted fine fraction and crystalline silica content - Part 2: Calculation method

Charakterisierung von Schüttgütern - Bestimmung einer größengewichteten Feinfraktion und des Anteils an kristallinem Quarz - Teil 2: Sedimentationsverfahren

Caractérisation des matériaux en vrac - Détermination de la fraction fine pondérée par taille et de la teneur en silice cristalline - Partie 2 : Méthode par calcul

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EUROPEAN STANDARD

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Characterization of bulk materials - Determination of a size-weighted fine fraction and crystalline silica content - Part 2: Calculation method

Caractérisation des matériaux en vrac - Détermination de la fraction fine pondérée par taille et de la teneur en silice cristalline - Partie 2 : Méthode par calcul

Charakterisierung von Schüttgütern - Bestimmung einer größengewichteten Feinfraktion und des Anteils an kristallinem Quarz - Teil 2: Berechnungsverfahren

This European Standard was approved by CEN on 4 October 2020.

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European foreword

This document (EN 17289-2:2020) has been prepared by Technical Committee CEN/TC 137 “Assessment of workplace exposure to chemical and biological agents”, the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by June 2021, and conflicting national standards shall be withdrawn at the latest by June 2021.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.

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EN 17289-2:2020 (E)

Introduction

A method was developed in the industrial minerals industry for the purpose of determining the “size-weighted relevant fine fraction” within the bulk material. This document sets out the methods which can be used to measure and calculate the fine fraction of the bulk material and the fine fraction of the crystalline silica, in several types of bulk materials. This information provides additional information to users for their risk assessment and to compare bulk materials. It has been used in the industry and by institutes previously under the acronym SWeRF. EN 17289 (all parts) is based on that industrial method and specifies the analytical methods to determine the difference between materials with coarse quartz and fine quartz, for example, sands versus flour.

As further activities with the material (intentional or otherwise) can change the particle size distribution, the size-weighted fine fraction can also change. Therefore, the method reports (in terms of the mass fraction in the bulk material in percent) both, the total crystalline silica (CS) and the estimated size-weighted fine fraction of CS.

Conventions as specified in EN 481 can be used as input for this document. However, the output of this document is not related to the respirable fraction at the workplace and cannot be used to replace workplace exposure measurements.

EN 17289 (all parts) specifies two procedures that can be used to estimate the size-weighted fine fraction (SWFF) in bulk materials. It also specifies how the SWFF, once separated, can be further analysed to measure the content of crystalline silica (SWFFCS). The method can be used for comparing the fine fraction in different bulk samples. EN 17289 (all parts) uses the term fine fraction to indicate that it does not analyse airborne particles, but it evaluates the proportion of particles in a bulk material that, based on their particle size, have a potential to be respirable if they were to become airborne.

EN 17289 (all parts) also allows for the size-weighted fine fraction of crystalline silica (SWFFCS) particles in bulk materials to be evaluated in terms of mass fraction in percent, if the fraction separated is subsequently analysed by a suitable method.

In a comparison of similar bulk materials, in which the particle size distribution is the only variable, the SWFF can provide useful information to guide material selection. For example, leaving all other factors aside, a bulk material with a lower SWFF value can pose less of a risk in terms of potential occupational exposure. For the actual exposure at the workplace, the handling etc. of the material, will play a major role.

Concentrations of respirable dust, or respirable crystalline silica (RCS), in the workplace air, resulting from processing and handling of bulk materials, will depend on a wide variety of factors and these concentrations cannot be estimated using SWFF or SWFFCS values. SWFF and SWFFCS values are not intended for workplace exposure assessments as they have no direct relationship with occupational exposure.

The evaluation of bulk materials using SWFF is complementary to determining the dustiness according to EN 15051-1 [1].

The difference between EN 17289 (all parts) and EN 15051-1 is that SWFF quantifies the fine fraction in a bulk material while dustiness quantifies the respirable, thoracic and inhalable dust made airborne from the bulk material after a specific activity (dustiness characterizes the material with relation to the workplace atmosphere when working with the bulk material).

EN 17289 *Characterization of bulk materials — Determination of a size-weighted fine fraction and crystalline silica content* consists of the following parts:

- *Part 1: General information and choice of test methods;*
- *Part 2: Calculation method;*
- *Part 3: Sedimentation method.*

NOTE This document is intended for use by laboratory experts who are familiar with FT-IR, XRD methods, PSD measurements and other analytical procedures. It is not the intention of this document to provide instruction in the fundamental analytical techniques.

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EN 17289-2:2020 (E)**1 Scope**

This document specifies the determination of the size-weighted fine fraction (SWFF) and the size-weighted fine fraction of crystalline silica (SWFFCS) in bulk materials by calculation. The document also specifies the assumptions and preconditions to be fulfilled for this method to be valid.

The purpose of this document is to allow users to evaluate bulk materials regarding their size-weighted fine fraction and crystalline silica content.

NOTE For preparation of the sample and determination of crystalline silica by X-ray Powder Diffractometry (XRD) or Fourier Transform Infrared Spectroscopy (FT-IR), see EN 17289-1.

The calculation method is applicable only after experiments have shown that the results are accurate and consistently equal or higher than the results from sedimentation, as specified in EN 17289-3, for that particular bulk material.

A specific method for the evaluation of the SWFF for diatomaceous earth bulk materials is given in Annex A. Due to the internal porosity of diatomaceous earth, the general instructions given in this document are adapted in order to take into account the material's effective density.

This document is applicable for crystalline silica containing bulk materials which have been fully investigated and validated for the evaluation of the size-weighted fine fraction and crystalline silica.

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.

EN 481, *Workplace atmospheres — Size fraction definitions for measurement of airborne particles*

EN 1540, *Workplace exposure — Terminology*
<https://standards.iteh.ai/catalog/standards/sist/02b02a5e-fb0c-41bc-a930-70c26558a1d0/sist-en-17289-2-2021>

EN 17289-1:2020, *Characterization of bulk materials — Determination of a size-weighted fine fraction and crystalline silica content — Part 1: General information and choice of test methods*

ISO 1183-1, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pycnometer method and titration*

ISO 13317-1, *Determination of particle size distribution by gravitational liquid sedimentation methods — Part 1: General principles and guidelines*

ISO 13317-2, *Determination of particle size distribution by gravitational liquid sedimentation methods — Part 2: Fixed pipette method*

ISO 13320, *Particle size analysis — Laser diffraction methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1540 and EN 17289-1 apply.

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

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

4 Symbols and abbreviations

CS	crystalline silica
DE	diatomaceous earth
PSD	particle size distribution
SWFF	size-weighted fine fraction
SWFFCS	size-weighted fine fraction of crystalline silica

5 Assumptions

The calculation method is based on the following assumptions:

- the dynamic form factor is neglected in the determination of the particle size distribution with methods other than methods based on sedimentation;
- the precondition is that in a mixture the different materials have the same particle size distribution. If this is not the case a separation using the sedimentation method shall be used;
- the subsample is representative of the bulk material. An appropriate sub-sampling method (see EN 17289-1:2020, 6.1) has been used to ensure the subsample is representative of the bulk material.

6 Determination of SWFF and SWFFCS by calculation

The SWFF of a sample is calculated by first determining its particle size distribution by laser diffraction according to ISO 13320 or gravitational liquid sedimentation by X-ray method according to ISO 13317-1 and ISO 13317-2. <https://standards.iteh.ai/catalog/standards/sist/02b02a5e-fb0c-41bc-a930-7bde6558a1d0/sist-en-17289-2-2021>

A size weighting is then applied, based on the probability function given in EN 481, i.e. the probability function for particles reaching the alveoli when inhaled, see Formula (1).

$$w_{\text{SWFF}} = \int_{d_{\text{ae}}=0}^{d_{\text{ae}}=\infty} f(d_{\text{ae}}) \times P(d_{\text{ae}}) d(d_{\text{ae}}) \quad (1)$$

where

w_{SWFF} is the size-weighted fine fraction, in percent (%);

$f(d_{\text{ae}})$ is the density function describing the particle size distribution for aerodynamic diameter d_{ae} ;

$P(d_{\text{ae}})$ is the probability of reaching the alveoli for particles of aerodynamic diameter d_{ae} , according to EN 481;

d_{ae} is the aerodynamic diameter, in μm .

The aerodynamic diameter, d_{ae} , in μm , can be calculated according to Formula (2):

$$d_{\text{ae}} = d_{\text{eq}} \times \sqrt{\frac{\rho_p}{\rho_0}} \quad (2)$$