# SLOVENSKI STANDARD
# oSIST ISO/DIS 10312:2018

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**Zunanji zrak - Določevanje azbestnih vlaken - Metoda transmisijske elektronske mikroskopije z neposrednim prenosom**

Ambient air - Determination of asbestos fibres - Direct transfer transmission electron microscopy method



Air ambiant - Détermination des fibres d'amiante - Méthode de microscopie électronique à transmission directe



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# Ambient air — Determination of asbestos fibres — Direct transfer transmission electron microscopy method

*Air ambiant — Détermination des fibres d'amiante — Méthode de microscopie électronique à transmission directe*

ICS: 13.040.20





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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).

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 www.iso.org/patents).

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For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.



The committee responsible for this document is ISO/XXX

This second/third/... edition cancels and replaces the first/second/... edition (), [clause(s) / subclause(s) / table(s) / figure(s) / annex(es)] of which [has / have] been technically revised.

ISO XXXX consists of the following parts. [Add information as necessary.]

# Introduction

This International Standard is applicable to the determination of airborne asbestos in a wide range of ambient air situations, including the interior atmospheres of buildings, and for detailed evaluation of any atmosphere in which asbestos structures are likely to be present. Because the best available medical evidence indicates that the numerical fibre concentration and the fibre sizes are the relevant parameters for evaluation of the inhalation hazards, a fibre counting technique is the only logical approach. Most fibres in ambient atmospheres are not asbestos, and therefore there is a requirement for fibres to be identified. Many airborne asbestos fibres in ambient atmospheres have diameters below the resolution limit of the optical microscope. This International Standard is based on transmission electron microscopy, which has adequate resolution to allow detection of small fibres and is currently the only technique capable of unequivocal identification of the majority of individual fibres of asbestos. Airborne asbestos is often found as a mixture of single fibres and more complex, aggregated structures which may or may not be also aggregated with other particles. The fibres found suspended in an ambient atmosphere can often be identified unequivocally, if a sufficient measurement effort is expended. However, if each fibre were to be identified in this way, the analysis would become prohibitively expensive. Because of instrumental deficiencies or because of the nature of the particulate, some fibres cannot be positively identified as asbestos, even though the measurements all indicate that they could be asbestos. Subjective factors therefore contribute to this measurement, and consequently a very precise definition of the procedure for identification and enumeration of, asbestos fibres is required. The method specified in this International Standard is designed to provide the best description possible of the nature, numerical concentration, and sizes of asbestos-containing particles found in an air sample. This International Standard requires that a very detailed and logical procedure be used to reduce the subjective aspects of the measurement. The method of data recording specified in this International Standard is designed to allow re-evaluation of the structure counting data as new medical evidence becomes available. All of the feasible specimen preparation techniques result in some modification of the airborne particulate. Even the collection of particles from a three-dimensional airborne dispersion onto a two-dimensional filter surface can be considered a modification of the particulate, and some of the particles in most samples are modified by the specimen preparation procedures. However, the procedures specified in this International Standard are designed to minimize the disturbance of the collected particulate material, and the effect of those disturbances that do occur can be evaluated.

This International Standard describes the method of analysis for a single air filter. However, one of the largest potential errors in characterizing asbestos in ambient atmospheres is associated with the variability between filter samples. For this reason, it is necessary to design a replicate sampling scheme in order to determine this International Standard's accuracy and precision.

 

# Ambient air — Determination of asbestos fibres — Direct-transfer transmission electron microscopy method

## 1 Scope

This International Standard specifies a reference method using transmission electron microscopy for the determination of airborne asbestos fibres and structures in in a wide range of ambient air situations, including the interior atmospheres of buildings, and for a detailed evaluation for asbestos structures in any atmosphere. The method allows determination of the type(s) of asbestos fibres present and also includes measurement of the lengths, widths and aspect ratios of the asbestos structures. The method cannot discriminate between individual fibres of asbestos and elongate fragments from non-asbestos analogues of the same amphibole mineral.

## 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 4225:1994, *Air Quality — General aspects — Vocabulary*

ISO 4226:2007, *Air quality — General aspects — Units of measurement*



ISO 13794:1999, *Ambient air — Determination of asbestos fibres — Indirect-transfer transmission electron microscopy method*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply (see also ISO 4225).

**3.1**
**acicular**
shape shown by an extremely slender crystal with cross-sectional dimensions which are small relative to its length, i.e. needle-like. [SOURCE: ISO 10312:1995, definition 3.1]

**3,2**
**amphibole**
group of rock-forming ferromagnesium silicate minerals, closely related in crystal form and composition, and having the nominal formula:

$$A_{0\text{-}1}B_2C_5T_8O_{22}(OH,F,Cl)_2$$

where: A = K, Na;

B = $Fe^{2+}$, Mn, Mg, Ca, Na;

C = Al, Cr, Ti, $Fe^{3+}$, Mg, $Fe^{2+}$;

T = Si, Al, Cr, $Fe^{3+}$, Ti.

[SOURCE: ISO 10312:1995, definition 3.2

NOTE In some varieties of amphibole, these elements can be partially substituted by Li, Pb, or Zn. Amphibole is characterized by a cross-linked double chain of Si-O tetrahedra with a silicon:oxygen ratio of 4:11, by columnar or fibrous prismatic crystals and by good prismatic cleavage in two directions parallel to the crystal faces and intersecting at angles of about 56° and 124°.

**3.3**
**amphibole asbestos**
amphibole in an asbestiform habit. [SOURCE: ISO 10312:1995, definition 3.3]

**3.4**
**analytical sensitivity**
calculated airborne asbestos structure concentration in structures/litre, equivalent to counting of one asbestos structure in the analysis. [SOURCE: ISO 10312:1995, definition 3.4]

NOTE 1 It is expressed in structures/litre.

NOTE 2 This method does not specify a unique analytical sensitivity. The analytical sensitivity is determined by the needs of the measurement and the conditions found on the prepared sample.

**3.5**
**asbestiform**
specific type of mineral fibrosity in which the fibres and fibrils possess high tensile strength and flexibility. [SOURCE: ISO 10312:1995, definition 3.5]



**3.6**
**asbestos**
term applied to a group of silicate minerals belonging to the serpentine and amphibole groups which have crystallized in the asbestiform habit, causing them to be easily separated into long, thin, flexible, strong fibres when crushed or processed. [SOURCE: ISO 10312:1995, definition 3.6]



NOTE The Chemical Abstracts Service Registry Numbers of the **most common** asbestos varieties are: chrysotile (12001-29-5), crocidolite (12001-28-4), grunerite asbestos (Amosite) (12172-73-5), anthophyllite asbestos (77536-67-5), tremolite asbestos (77536-68-6) and actinolite asbestos (77536-66-4). Other varieties of asbestiform amphibole, such as richterite asbestos and winchite asbestos [12], are also found in some products such as vermiculite and talc.

**3.7**
**asbestos structure**
term applied to an individual fibre, or any connected or overlapping grouping of asbestos fibres or bundles, with or without other particles. [SOURCE: ISO 10312:1995, definition 3.7]

**3.8**
**aspect ratio**
ratio of length to width of a particle. [SOURCE: ISO 10312:1995, definition 3.8]

**3.9**
**blank**
structure count made on TEM specimens prepared from an unused filter, to determine the background measurement. [SOURCE: ISO 10312:1995, definition 3.9]

 

**3.10**
**camera length**
equivalent projection length between the specimen and its electron diffraction pattern, in the absence of lens action. [SOURCE: ISO 10312:1995, definition 3.10]

**3.11**
**chrysotile**
fibrous mineral of the serpentine group which has the nominal composition: $Mg_3Si_2O_5(OH)_4$ [SOURCE: ISO 10312:1995, definition 3.11]

NOTE Most natural chrysotile deviates little from this nominal composition. In some varieties of chrysotile, minor substitution of silicon by $Al^{3+}$ may occur. Minor substitution of magnesium by $Al^{3+}$, $Fe^{2+}$, $Fe^{3+}$, $Ni^{2+}$, $Mn^{2+}$ and $Co^{2+}$ may also be present. Chrysotile is the most prevalent type of asbestos.

**3.12**
**cleavage**
breaking of a mineral along one of its crystallographic directions. [SOURCE: ISO 10312:1995, definition 3.12]

**3.13**
**cleavage fragment**
fragment of a crystal that is bounded by cleavage faces. [SOURCE: ISO 10312:1995, definition 3.13]

NOTE Crushing of non-asbestiform amphibole generally yields elongated fragments that conform to the definition of a fibre, but rarely have aspect ratios exceeding 30:1.



**3.14**
**cluster**
structure in which two or more fibres, or fibre bundles, are randomly oriented in a connected grouping. [SOURCE: ISO 10312:1995, definition 3.14]



**3.15**
**d-spacing**
The distance between identical adjacent and parallel planes of atoms in a crystal. [SOURCE: ISO 10312:1995, definition 3.15]

**3.16**
**electron diffraction**
A technique in electron microscopy by which the crystal structure of a specimen is examined. [SOURCE: ISO 10312:1995, definition 3.16]

**3.17**
**electron scattering power**
The extent to which a thin layer of substance scatters electrons from their original directions. [SOURCE: ISO 10312:1995, definition 3.17]

**3.18**
**energy dispersive X-ray analysis**
Measurement of the energies and intensities of X-rays by use of a solid state detector and multi-channel analyzer system. [SOURCE: ISO 10312:1995, definition 3.18]