VDI 3492

Indoor air Measurement
Ambient Air Measurement

Measurement of inorganic fibrous particles Scanning electron microscopy method

Step by Step

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Introduction

Over time a number of issues and questions have arisen with regard to the practical application of guideline VDI 3492 which made revision necessary. For example, the term “analytic sensitivity” has been introduced. This supports the trend towards international standardization in metrology since this term is also used in the relevant ISO Standard (ISO 10312. ISO 13794, ISO 14966).

Furthermore, this term makes it possible to express measured values close to the detection limit in a harmonized way.

A further harmonization with an international standard (DIN EN ISO 16000-7) concerns the number of sampling points for measurement objectives, such as are formulated in, for example, TRGS 519 or the “Asbestos Guideline” of the German federal states.

Scope

This guideline specifies a method for determining the numerical concentration of inorganic fibrous particles in indoor air or in ambient air and the assignment of these particles to particular classes of fibres (chrysotile, amphibole asbestos, calcium sulphate, other inorganic fibres). The fibre counting and assignment are carried out by the SEM/EDXA method (scanning electron microscope/energy-dispersive X-ray analysis).

The limit of detection of the method for the fibre number concentration under the standard conditions specified in this guideline is 300 fibres/m³. Information on the differentiation of product fibres and the determination of organic fibres is provided.

Terms and Definitions (extract)

Analytical sensitivity

Calculated airborne fibre concentration equivalent to counting one fibre in the analysis of the filter sample.

Note: Under standard conditions one counted fibre corresponds to a fibre number concentration of 100 m^{-3}

Fibre

Elongated particle with a length $L > 5$ µm a width of $D < 3$ µm and a length/width ratio $L : D > 3 : 1$

Terms and Definitions (extract)

Simulation of usage

Procedure in which any invisibly deposited fibres present in a room are made airborne by generating air movement and/or vibrations in a manner comparable with usage

Magnification

Ratio of the size of an object in the microscopic im age to the actual size of the object

Note: The magnification value always refers to the screen on which the fibres are counted.

Principle

Sampling

A sample of airborne particulate is collected on a gold-coated capillary pore membrane filter. Before analysis, the organic constituents of the sample are removed, to the extent that is possible, directly on the surface of the gold-coated filter using oxygen plasma ashing.

Principle

Counting

The loaded filter is analysed directly in the scanning electron microscope (SEM) without any alteration of the particulate deposit: the individual fibres are then measured and counted in a randomly selected area of the filter according to defined fibre counting rules, and classified according to their fibre type.

Principle

Classification and Calculation

Classification is based on the X-ray spectra of the fibres which are taken with energy-dispersive X-ray analysis EDXA). The fibre numerical concentration of the airborne fibres is determined by the fibre count result, the examined filter area and the volume of sampled air which was drawn through this filter area.

The method specified in this guideline is a conventional method according to guideline VDI 2449 Part 2

Apparatus, consumables and accessories

The following apparatus is required for measurement:

- Sampling apparatus
- Plasma asher
- Scanning electron microscope with EDXA system
- Vacuum evaporator or sputter coater), if required

In addition, the equipment for the simulation of usage (for indoor air measurements) and consumables and accessories itemized in Section 4.2, Section 4.5 and Section 4.6 of VDI 3492 will be required.

Consumables and Accessories

Sample collection filter
Gold coated Polycarbonate track etched membrane filter
0,8 µm pore size

Backing Filter
e.g.filter, to be used as diffusing filter, for homogenizing the air flow and supporting the sample collection filter mechanically; pore size > 3 µm

Adhesive
e. g. colloidal carbon paint or double-coated adhesive tape, for fixing the sample collection filter (or part of it) on the SEM stub

Oxygen for operation of the plasma asher
(if required Gold for coating of the sample collection filter)

Accessories

Stereo Microscope

Scalpel, Scissors, Tweezers

Test samples
Chrysotile loaded filters (for resolution test)

Accessories

Reference materials

- Defined materials (e.g. asbestos, MMVF)

Note: Asbestos reference standards are e.g. available at the institute of Occupational Medicine (IOM), Edinburgh (Scotland).
The IOM provides seven asbestos reference standards with documented physical properties: two chrysotile standards (Canada/Zimbabwe)
amosite (South Africa), crocidolite (South Africa), tremolite (California, USA), actinolite (United Kingdom), anthophyllite (Finland).

- Reference samples for product fibre determination