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Air quality — Bulk materials —

Part 3: Quantitative determination of asbestos by X-ray diffraction method

Qualité de l'air — Matériaux solides —

Partie 3: Dosage quantitatif de l'amiante par la méthode de diffraction des rayons X

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Foreword

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The committee responsible for this document is ISO/TC 146, *Air quality*, Subcommittee SC 3, *Ambient atmospheres*.

ISO 22262 consists of the following parts, under the general title *Air quality — Bulk materials*:

— *Part 1: Sampling and qualitative determination of asbestos in commercial bulk materials*

— *Part 2: Quantitative determination of asbestos by gravimetric and microscopical methods*

— *Part 3: Quantitative determination of asbestos by X-ray diffraction method*

Introduction

In the past, asbestos was used in a wide range of products. Materials containing high proportions of asbestos were used in buildings and in industry for fireproofing, thermal insulation and acoustic insulation. Asbestos was also used to reinforce materials and to improve fracture and bending characteristics. A large proportion of the asbestos produced was used in asbestos-cement products. These include flat sheets, tiles and corrugated sheets for roofing, pipes and open troughs for collection of rainwater and pressure pipes for supply of potable water. Asbestos was also incorporated into products such as decorative coatings and plasters, glues, sealants and resins, floor tiles, gaskets and road paving. In some products, asbestos was incorporated to modify rheological properties, for example in the manufacture of ceiling tile panels and oil drilling muds.

While the asbestos concentration in some products can be very high and in some cases approaches 100 %, in other products the concentrations of asbestos used were significantly lower and often between 1 % and 15 %. In some ceiling tile panels, the concentration of asbestos used was close to 1 %. There are only a few known materials in which the asbestos concentration used was less than 1 %. Some adhesives, sealing compounds and fillers were manufactured in which asbestos concentrations were lower than 1 %. There are no known commercially manufactured materials in which any one of the common asbestos varieties (chrysotile, amosite, crocidolite or anthophyllite) was intentionally added at concentrations lower than 0,1 %.

ISO 22262-1 specifies the procedures for collection of samples and qualitative analysis of asbestos in commercial bulk materials using microscopical methods such as polarized light microscopy (PLM). ISO 22262-2 specifies the procedures for the determination of asbestos mass fractions in bulk materials by microscopical methods.

This part of ISO 22262 specifies the analytical procedures for the quantitative determination of asbestos by X-ray powder diffraction (XRD). The procedure employs a substrate standard mass absorption correction method to quantify asbestos that was previously identified by the microscopical method in ISO 22262-1. While the XRD method is useful for qualitative analysis of crystalline substances in powder samples by measurement of diffraction patterns that can be related to crystal structure, XRD analysis cannot distinguish between different morphological habits of the same mineral. Thus, XRD cannot discriminate between the asbestiform and non-asbestiform analogues of serpentine and the amphiboles. Furthermore, the primary diffraction peaks for different amphiboles lie within a very narrow range and it is not possible to quantify individual amphiboles when a mixture of amphiboles is present. Diffraction peaks appearing in XRD patterns of the asbestos-forming minerals are considered to be “possible peaks of asbestos”, assumed to represent the asbestos detected during analysis in ISO 22262-1. However, if non-asbestiform serpentine or non-asbestiform amphibole minerals are present in the sample matrix, the “possible peaks of asbestos” will represent them. Accordingly, this method is not intended for application to samples in which non-asbestiform serpentine or non-asbestiform amphibole minerals are present.

A conventional XRD method, which employs a powder sample mounted in a powder specimen holder and a scintillation counter, can quantify a crystalline material at a concentration of approximately 1 %. The XRD method using a substrate standard mass absorption correction method employed in this part of ISO 22262 can detect the diffraction peaks of chrysotile asbestos from quantities as low as 0,01 mg on a membrane filter of 2 cm^2 area [0,01 mg/filter (2 cm^2)] as shown in References [13] and [14]. The amount of sample on the filter is limited to 15 mg due to the limit of the X-ray absorption correction. In this method, gravimetric matrix reduction procedures are used to reduce the matrix constituents and interference minerals in a 100 mg comminuted sample. When the matrix reduction achieves a residual ratio of 10 % or lower, the XRD method can provide a limit of detection of 0,01 wt% and the limit of quantification can be as low as 0,03 wt%. When the matrix reduction is less effective and the residual ratio is over 10 % of the initial 100 mg sample, a sub-divided 10 mg to 15 mg sample is taken from the residual sample. In the case where none or very little of the matrix is reduced, the limit of detection can increase up to approximately 0,1 % and the limit of quantification can increase up to approximately 0,3 %. When matrix reduction achieves a residual ratio of approximately 30 % of the original weight, the limit of quantification is approximately 0,1 %. These limits of detection and quantification are further

degraded if interference X-ray peaks or high background X-ray intensities from matrix materials are present.

The XRD method specified in this part of ISO 22262 is based on NIOSH 9000-1/7[16], NIOSH 7500-1/10[17], EPA/600/R-93/116[18] and JIS A 1481-3.[19]