



JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS A 1481 : 2008

(JTCCM/JSA)

**Determination of asbestos in build-
ing material products**

ICS 91.100.01

Reference number : JIS A 1481 : 2008 (E)

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Date of Establishment: 2006-03-25
Date of Revision: 2008-06-20
Date of Public Notice in Official Gazette: 2008-06-20
Investigated by: Japanese Industrial Standards Committee
Standards Board
Technical Committee on Architecture

JIS A 1481 : 2008, First English edition published in 2009-02

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

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Printed in Japan

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry, through deliberations at the Japanese Industrial Standards Committee as the result of proposal of revision of Japanese Industrial Standard submitted by Japan Testing Center for Construction Materials (JTCCM)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS A 1481:2006** is replaced with this Standard.

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Determination of asbestos in building material products

1 Scope This Japanese Industrial Standard specifies the determination method of asbestos in building material products by dispersion staining phase-contrast microscopy and X-ray diffractometry. This standard consists of the preparation of primary analytical sample, the qualitative analytical method for primary analytical sample, the judgment of presence of asbestos, the preparation of secondary and tertiary samples for quantitative determination by X-ray diffraction method employing substrate standard mass absorption correction method.

The building material products to be measured with this method are: fire proofing spraying material and the like, spraying material made of vermiculite, interior finishing material (moulded board), floor tile, exterior material (moulded board, mortar), roofing material, chimney material, heat insulating material, textile goods (cloth), sealing compound and expansion joint.

However, this Standard shall not be applied to natural minerals which can contain asbestos or any products that are made of such natural mineral (excluding spraying material made of vermiculite).

2 Normative references The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS K 1522 *Isopropyl alcohol (Isopropanol)*

JIS K 3850-1 *Determination of airborne fibrous particles — Part 1 : Optical microscopy method and scanning electron microscopy method*

JIS K 8121 *Potassium chloride (Reagent)*

JIS K 8264 *Formic acid (Reagent)*

JIS R 3503 *Glass apparatus for chemical analysis*

JIS R 3702 *Cover glasses for microscopes*

JIS R 3703 *Slide glasses for microscope*

3 Terms and definitions, symbols and units

3.1 Terms and definitions

For the purpose of this Standard, the following terms and definitions apply.

3.1.1 asbestos

fibrous silicate minerals belonging to serpentine group (chrysotile) and amphibole group (amosite, crocidolite, tremolite, actinolite, and anthophyllite) among the minerals

which constitute rock

It is also called “ISIWATA” or “SEKIMEN” in Japanese.

3.1.2 vermiculite

a swelling type clay mineral showing mica-like form

It has a hydrated magnesium layer in its structural layer. Many generally include, in their structural layer, hydrobiotite which contains a comparatively large amount of potassium. Generically, vermiculite refers to these minerals as well. It can also be called “HIRUISI” in Japanese.

3.1.3 fibrous particles

particles that are three or more in aspect ratio (length/width)

3.1.4 sample

sample taken from building material products

3.1.5 primary analytical sample

sample prepared by pulverizing or heat-treating and passing through a sieve under certain conditions

3.1.6 secondary analytical sample

sample prepared by treating the primary sample with formic acid so that it can be used for quantitative analysis

3.1.7 tertiary analytical sample

sample prepared by conditioning the secondary sample whose rate of residue exceeds 0.15 so that it can be used for quantitative analysis

3.1.8 immersion liquid

liquid in which the sample used for microscopic qualitative analyzing method is immersed

3.1.9 dust-free water

water prepared by filtering purified water or distilled water through a membrane filter of 0.45 μm aperture

3.1.10 standard sample

vermiculite sample containing 0.5 % of tremolite and that containing 0.8 % of chrysotile, used for the analysis of spraying material made of vermiculite

3.1.11 residual ratio

the ratio of residue of primary analytical sample after treatment of formic acid

3.1.12 weight loss ratio

the ratio of weight loss after heated of primary analytical sample

3.1.13 integrated intensity

the area intensity (integrated value) of designated X-ray diffraction line (peak) after subtracted the background area

3.2 Symbols and units

The symbols and units shall be as shown in table 1.

Table 1 Symbols and units

Symbols	Designation	Units
$n_D^{25\text{ }^\circ\text{C}}$	Refractive index at 25 °C	—
M_1	Weighed value of primary analytical sample at the time of X-ray quantitative analysis	mg
M_2	Weighed value of secondary analytical sample at the time of X-ray quantitative analysis	mg
M_3	Weighed value of tertiary analytical sample at the time of X-ray quantitative analysis	mg
A_s	Asbestos mass of secondary analytical sample read out from working curve	mg
C_i	Asbestos content of one analytical sample	%
C_t	Asbestos content of one tertiary analytical sample	%
C	Asbestos content in building material products or other products	%
r	Ratio of weight loss (amount of primary analytical sample after heat-treatment/amount of sample)	—
V	Integrated intensity (limited to vermiculite)	Count
σ	Standard deviation of integral X-ray intensity of 10 times measurement	—
a	Inclination of working curve	—
C_k	Minimum limit value of detection of asbestos content	%
C_l	Minimum limit value of determination of asbestos content	%

4 Measuring method and principle

4.1 Summary of measuring method

The measurement of asbestos content in the building material products specified in this Standard is a method in which, after the presence of asbestos is determined by the qualitative analysis by X-ray diffraction and the qualitative analysis by microscope, the quantitative analysis of asbestos by means of X-ray diffraction method is carried out on the sample which has been judged to “containing asbestos” (excluding the spraying vermiculite). The measurement of presence of asbestos in spraying vermiculite is carried out by comparing the X-ray diffraction intensity of asbestos of a standard sample with that of the relevant sample. The summary of the measuring method is as follows (see figure 1).

- a) An appropriate amount of sample capable of being analyzed is taken from the building materials manufactured in manufactory, building materials constructed

into buildings or imported building materials.

- b) The primary analytical sample is prepared by pulverizing or heat-treating the above according to the matrix of the building material.
- c) Whether asbestos is found in the primary analytical sample or not is confirmed by the qualitative analysis according to the X-ray diffraction analysis and the dispersion staining method by using a phase-contrast microscope. When the primary analytical sample is spraying material in which vermiculite is found by X-ray diffraction analysis, the analysis for presence of asbestos is carried out according to the qualitative analytical method by spraying vermiculite [see figure 1a) and figure 1c)].
- d) When the asbestos is found (excluding the spraying vermiculite), prepare the secondary analytical sample by treating the primary analytical sample with formic acid specified in **JIS K 8264**.
- e) When the residual ratio is not more than 0.15, the asbestos content in the secondary analytical sample can be measured by the X-ray diffraction method employing a substrate standard mass absorption correction method, and the asbestos content is calculated.
- f) When the rate of residue exceeds 0.15, the tertiary analytical sample shall be prepared and then the asbestos content is measured by the X-ray diffraction method employing a substrate standard mass absorption correction method, and the asbestos content is calculated. [see figure 1 b)].

4.2 Principle of measuring method

4.2.1 Qualitative analytical method

The principle of qualitative analytical method shall be as follows.

- a) The dispersion staining method using a phase-contrast microscope is used for qualitative analysis of asbestos observing fibrous shape and specific colour change by the refractive index of fibrous particles in sample.
- b) The X-ray diffraction method used for the qualitative analysis is to discriminate the presence of asbestos detecting diffraction peaks at the peculiar angles corresponding to the kind of asbestos when X-ray is radiated on sample.

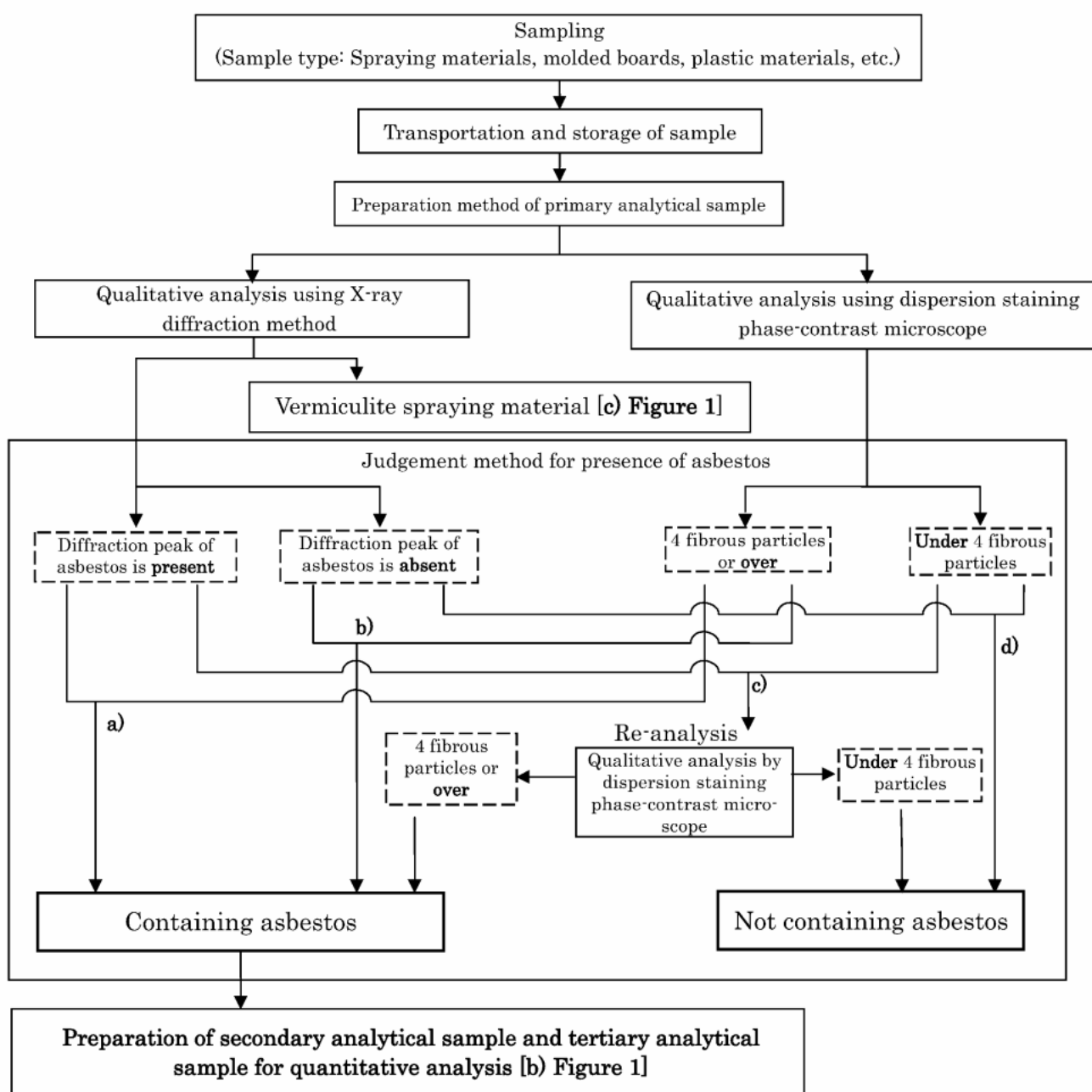
4.2.2 Quantitative analyzing method

Since the intensity of X-ray diffraction peak is dependent on the amount of crystalline substance in a sample, the amount of asbestos* in building material can be determined by comparing the intensity of X-ray diffraction of the analytical sample with that of the working curves prepared using mass-known asbestos samples. Further, as the intensity of X-ray diffraction is also influenced by the matrix of sample, the measured intensity is corrected the effect of matrix by mass absorption correction method.

* : X-ray diffraction analysis can not discriminate the particle shape in analytical sample and detects not only asbestos of fibrous form but also non-fibrous minerals related to asbestos such as serpentine minerals and/or amphibole minerals if they

coexist. However, within these minerals, asbestos is most probable in building materials in which asbestos is intentionally added. Moreover, the existence of asbestos is previously confirmed by qualitative analysis by dispersion staining phase contrast microscopy. Due to these phenomena, in this standard, the diffraction peaks at the peculiar angles corresponding to the kind of asbestos is presumed to be asbestos.

The quantitative analytical method by X-ray diffraction includes the internal standard method and the standard addition method. The analytical accuracy of these method is not high in the case of asbestos analysis. They can, however, give an approximate value of asbestos content.



a) Measuring method flow for asbestos content in building material products (qualitative analysis)

Figure 1 Summary of measuring method