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Standard Terminology for Asbestos and Asbestos–Cement Products¹

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1. Scope

1.1 This terminology covers terms and definitions, definitions of terms, and abbreviations of terms relating to asbestos and asbestos–cement products.

2. Referenced Documents

2.1 ASTM Standards:

- C 150 Specification for Portland Cement²
- C 296 Specification for Asbestos–Cement Pressure Pipe³
- C 428 Specification for Asbestos–Cement Nonpressure Sewer Pipe³
- C 458 Test Method for Organic Fiber Content of Asbestos–Cement Products³
- C 500 Test Methods for Asbestos–Cement Pipe³
- C 508 Specification for Asbestos–Cement Underdrain Pipe³
- C 541 Specification for Linings for Asbestos–Cement Pipe³
- C 618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete⁴
- C 663 Specification for Asbestos–Cement Storm Drain Pipe³
- C 668 Specification for Asbestos–Cement Transmission Pipe³
- C 875 Specification for Asbestos–Cement Conduit³
- C 966 Guide for Installing Asbestos–Cement Nonpressure Pipe³
- D 123 Terminology Relating to Textiles⁵
- D 1067 Test Methods for Acidity or Alkalinity of Water⁶
- D 1118 Test Method for Magnetic Rating of Asbestos Fibers and Asbestos Textiles³
- D 1126 Test Method for Hardness in Water⁶
- D 1918 Test Method for Asbestos Content of Asbestos Textiles³
- D 2589 Test Method for McNett Wet Classification of Dual Asbestos Fiber³

- D 2590 Test Method for Sampling Chrysotile Asbestos³
- D 2985 Test Method for Color of Asbestos³
- D 3879 Test Method for Sampling Amphibole Asbestos³
- E 284 Terminology of Appearance⁷
- E 308 Practice for Computing the Colors of Objects by Using the CIE System⁷
- E 849 Practice for Safety and Health Requirements Relating to Occupational Exposure to Asbestos⁸

3. Terminology

accessible bag, *n*—*for sampling*, a bag (in a pile of bags of asbestos fiber) of which at least one side or one end is fully exposed.

accessible surface, *n*—*for sampling*, in a pile of bags of asbestos fiber, a side (of the pile) in which all the bags are accessible bags.

accessories—subordinate material such as fasteners, backer strips, closure strips, ridge and corner rolls, roofing starters and finishing pieces, couplings, gaskets, pipe fittings or other supplementary material necessary for the proper application of primary asbestos–cement products.

actinolite asbestos—asbestiform variety of the monoclinic amphibole silicate minerals of the tremolite–actinolite series.

DISCUSSION—Its empirical formula is $\text{Ca}_2(\text{Mg}, \text{Fe}^{+2})_5\text{Si}_8\text{O}_{22}(\text{OH})_2$. Its Chemical Abstracts⁹ number is 77536-66-4 (see Table 1 and Table 2).

adhesion, *n*—*for asbestos*, see **fiber adhesion**.

aggressivity index, *n*—measure of the corrosiveness of water toward asbestos–cement defined as:

$$\text{pH} + \log (AH) \quad (1)$$

where:

pH = negative of the logarithm of the hydronium molarity (index of acidity of the water) pH units.

A = total alkalinity, ppm as CaCO_3 , as determined by Test Methods D 1067, and

H = calcium hardness, ppm as CaCO_3 , as determined by Test Method D 1126.

DISCUSSION—The aggressiveness of water toward asbestos–cement is classified as follows:

⁷ Annual Book of ASTM Standards, Vol 06.01.

⁸ Discontinued. See 1994 Book of ASTM Standards, Vol 11.03.

⁹ Taken from Practice E 849.

¹ This terminology is under the jurisdiction of ASTM Committee C17 on Fiber-Reinforced Cement Products and is the direct responsibility of Subcommittee C17.91 on Editorial and Terminology.

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² Annual Book of ASTM Standards, Vol 04.01.

³ Annual Book of ASTM Standards, Vol 04.05.

⁴ Annual Book of ASTM Standards, Vol 04.02.

⁵ Annual Book of ASTM Standards, Vol 07.01.

⁶ Annual Book of ASTM Standards, Vol 11.01.



Aggressivity Index

highly aggressive	<10
moderately aggressive	10 to 11.9
nonaggressive	≥12

American method—method of application for roofing shingles, generally rectangular in shape, to provide double coverage with head lap and no side lap.

amosite, *n*—the acronym assigned to **grunerite asbestos**, and derived from the name of the first developers of a major deposit of this mineral. See Table 1 and Table 2.

amphibole asbestos, *n*—asbestiform amphibole silicate minerals including the orthorhombic anthophyllite series and the monoclinic cummingtonite [grunerite asbestos (amosite)] series, the tremolite-actinolite series, and the alkali amphibole [riebeckite asbestos (crocidolite)] series, among others.

DISCUSSION—The amphiboles contain essential (OH) groups in the structure, and the Si:O ratio is 4:11. A considerable amount of elemental substitution can take place in these varieties of asbestos. The crystal structures are composed of strips or ribbons of linked polyhedra that join to form fibrils. The individual strips are made up from three components; these are two double chains of linked (Si, Al)O₄ tetrahedra and a strip of linked MgO₆, FeO₆, or AlO₆ octahedra. (See Table 1 and Table 2.)

anthophyllite asbestos, *n*—asbestiform variety of the orthorhombic amphibole silicate minerals of the anthophyllite series.

DISCUSSION—Its empirical formula is Mg₇Si₈O₂₂(OH)₂. Its Chemical Abstracts number⁹ is 77536-67-5 (see Table 1 and Table 2).

asbestiform—having an inherent fine-textured morphology, resulting from unequal relative development of the principal crystal axes in a silicate mineral, that predetermines subdivision into strong flexible fibers having microscopic to submicroscopic thickness and a high length to width ratio when the mineral is subjected to comminution.

DISCUSSION—Term derived from “asbestos.”

asbestos, *n*—the generic term for naturally occurring inorganic hydrated silicates, occurring in layered structures composed of chains of silicon and oxygen tetrahedra, that can subdivide into flexible fibers.

DISCUSSION—Refer to STP 834¹⁰, also, see Table 1 and Table 2.

asbestos fiber, *n*—acicular silicate mineral, with a structure based upon silicon-oxygen tetrahedra, that fits the definition of a fiber, and is composed of single crystals in predominantly parallel orientation.

DISCUSSION—Common usage also designates a collectivity of asbestos fibers as asbestos fiber.

asphalt felt, breather type—an underlayment sheet material, saturated with asphalt, which allows the transmission of water vapor.

DISCUSSION—This material is used with asbestos-cement products.

autoclave cure—means for accelerating the cure reaction at

TABLE 1 Asbestos Minerals, Characterized by their Mineralogy^A

Designation of Mineral	Type of Asbestos	Chemical Abstracts Number ^A
Serpentine	Chrysotile	12001-29-5
Reibeckite (glaucofane)	Crocidolite (blue asbestos)	12001-28-4
Grunerite (cummingtonite-grunerite)	Amosite (grunerite asbestos)	12172-73-5
Anthophyllite (Gederite)	Anthophyllite Asbestos	77536-67-5
Tremolite (Ferroactinolite)	Tremolite Asbestos	77536-68-6
Tremolite-actinolite	Actinolite asbestos	77536-66-4

^A Taken from Practice E 849.

TABLE 2 Chemical Formula for Typical Asbestos Structures

Mineral	Chemical Formula ^A
Chrysotile	Mg ₃ (Si ₂ O ₅)(OH) ₄
Amosite	(Mg,Fe) ₃ (Si ₈ O ₂₂)(OH) ₂
Crocidolite	Na ₂ Fe ₃ ²⁺ + (Si ₈ O ₂₂)(OH) ₂ (Mg,Fe)
Anthophyllite	Mg ₇ (Si ₈ O ₂₂)(OH) ₂ (Fe > Mg)
Cummingtonite	(Mg,Fe) ₇ (Si ₈ O ₂₂)(OH) ₂
Tremolite	Ca ₂ Mg ₅ (Si ₈ O ₂₂)(OH) ₂
Ferroactinolite	Ca ₂ Fe ₅ (Si ₈ O ₂₂)(OH) ₂
Actinolite	Ca ₂ (Mg,Fe ²⁺) ₅ (Si ₈ O ₂₂)(OH) ₂
Glaucofane	NaMg ₃ Al ₂ (Si ₈ O ₂₂)(OH) ₂

^A Taken from Deer, Howie, and Zussman, *Rock Forming Minerals*, Vol. 3, Longmans, London, 1967.

elevated temperature and pressure in saturated steam, where reactive siliceous material has been incorporated into the cementitious matrix, such that a hydrothermal reaction takes place between the cement and silica yielding calcium silicate.

autoclaved products, *n*—for **asbestos-cement**, those that have been treated in a saturated steam atmosphere at between 689 and 1517 MPa (100 and 200 psi) for at least 8 h, and that contain portland cement as defined in Specifications C 150 and C 618, together with silica in the ratio of 3:2, that can react to form calcium silicate reaction products.

backer strip—water-repellent strip of asphalt-coated felt applied behind each joint where the vertical edges of two shingles meet.

bag, *n*—for **sampling**, any quantity of asbestos fiber corresponding to one particular grade that is packed in a suitable container.

DISCUSSION—In the asbestos industry, the typical quantity contained in a bag is 45 kg (approximately 100 lb).

batten—long narrow strip of asbestos-cement, either flat or corrugated, used to conceal the joints in butt joint application of flat or corrugated sheets.

black, *adj*—color description applied to opaque objects that are highly light absorbing throughout the visible spectrum.

bloom, *n*—for **asbestos-cement**, see **efflorescence (bloom)**.

bundle—an assemblage of asbestos in which the fibers remain entirely in their original close-packed parallel configuration (or not appreciably displaced therefrom) and having a transverse dimension typically between 2 and 8 mm (see Table 3).

caulking—material ranging in physical characteristics from plastic, to solid, to preformed, used to seal and waterproof joints and overlaps in structures, other assemblages, and joints.

¹⁰ Definitions for Asbestos and Other Health-Related Silicates, ASTM STP 834, 1982.

TABLE 3 Relative Dimensions of Naturally Occurring Chrysotile Agglomerates in Increasing Order of Transverse Dimension

Order	Name	Approximate Transverse Dimension	
		min	max
1	Fibril	0.0 μm	0.1 μm
2	Fiber (single)	0.015 μm	0.1 μm
3	Spicule	...	...
4	Nonfibrous spicule	...	...
4	Fiber spicule	...	1 mm
5	Pencil	1 mm	8 mm
5	Spelk	1 mm	8 mm
6	Bundle	8 mm	...
6	Crudy bundle	8 mm	...

thereof where movement may occur.

chemical resistance—for *asbestos cement products*, the ability of the product to resist chemical attack, dissolution, decomposition or other chemical changes when in contact with liquid, gaseous, or solid media normally encountered in its service environment.

chrysotile, *n*—an asbestos mineral belonging to the serpentine group, having a chemical composition close to $\text{Mg}_3\text{Si}_2\text{O}_5(\text{OH})_4$.

DISCUSSION—Moderate amounts of aluminum may substitute for silicon and moderate amounts of iron may substitute for magnesium. Small amounts of MnO , CaO , K_2O , and Na_2O are also reported in the chemical analyses. The crystal structure of chrysotile asbestos consists of double layers, each consisting of a layer of linked SiO_4 tetrahedra that is coordinated to a second layer of linked $\text{MgO}_2(\text{OH})_4$ octahedra linked through the sharing of oxygen atoms; the composite double layer rolls up, like a scroll to form long hollow tubes. The outer diameters of the individual tubes are in the order of 25 nm; the length-to-diameter ratio can vary from 20 to well over 10 000. Chrysotile is characterized by a combination of a distinctive morphology, a chemical composition close to $\text{Mg}_3\text{Si}_2\text{O}_5(\text{OH})_4$, and characteristic X-ray and electron diffraction patterns. Its Chemical Abstracts number⁹ is 12001-29-5 (see Table 1 and Table 2).

chrysotile asbestos—see **chrysotile**.

CIE, *n*—abbreviation for International Commission on Illumination, which in French is Commission Internationale de l'Éclairage.¹¹

CIE observer, *n*—for *color determination*, see **standard observer**, CIE 1931 and **supplementary observer**, CIE 1964.

CIE source C, *n*—see **standard source**.

clip, *n*—for *shingles*, see **storm anchor (clip)**.

closure strip—asphalt or rubber preformed filler strip having the same shape and pitch as the asbestos-cement corrugated product and used to close openings in the corrugated sheets at window beads, eaves, lower edge of siding, and similar places.

cohesion, *n*—for *asbestos*, lateral force resisting separation of adjacent fibrous elements.

DISCUSSION—Asbestos may be described as having low to high cohesion.

color variation—for *asbestos-cement products*, property of nonuniform color exhibited before or after weathering.

compacted backfill, *n*—for *pipe laying*, backfill material that has been compacted to the density specified by the engineer.

composite sample, *n*—for *asbestos*, a set of unit samples of asbestos fiber (drawn systematically or at random) taken from a lot, comprising not less than two and not more than 200 bags, for use in the laboratory as a test sample, that is, as a source of test specimens.

conditioning, *n*—for *sampling*, the process by which the fiber is put into a consistent state to be tested.

conduit, *n*—for *asbestos-cement*, asbestos-cement pipe used to protect wires for electric-power or communication systems, for both underground and exposed situations.

constructor, *n*—for *pipe laying*, party that furnishes the work and materials for placement and installation.

contaminants, *n*—for *asbestos*, any foreign matter (other than associated minerals and fines) in a sample of asbestos fiber.

corner roll—half-round unit of asbestos cement used to trim and flash corners in asbestos-cement corrugated applications.

corrugated—denotes an asbestos-cement sheet product having a design of alternating ridges and valleys manufactured according to a specified pitch.

coupling, *n*—for *asbestos-cement conduit, sewer, underdrain, and storm drain pipe*, component made from a larger diameter pipe of the same type or type II and of the same class, or of a higher class, or produced otherwise to yield at least equal performance, for joining asbestos-cement pipe that when properly installed, forms a silt-tight joint, allows alignment corrections and slight changes in direction, and provides an assembled joint equivalent in serviceability and strength to the pipe sections.

DISCUSSION—Alternatively, for storm drain couplings, plastic sleeves that, when properly installed develop sufficient tightness to prevent the surrounding soil from entering the drain, may be used as couplings.

coupling, *n*—for *asbestos-cement nonpressure sewer pipe*, section for joining asbestos-cement nonpressure sewer pipe, that when properly installed with the proper accessories, develops an assemble joint equivalent in serviceability and strength to the pipe sections when tested in accordance with 8.3 of Specification C 428.

coupling, *n*—for *asbestos-cement pressure pipe*, section for joining asbestos-cement pipe that, when properly installed with the proper accessories, develops a joint equivalent in strength and serviceability to the pipe sections.

crenulations—multiple kinks that can increase the apparent fiber cohesion.

DISCUSSION—Asbestos may be described as free of crenulations or as highly crenulated.

crocidolite, *n*—common name for **riebeckite asbestos**.

DISCUSSION—Also known as blue asbestos (see Table 1 and Table 2).

cross-fiber—asbestos that is located in (or derives from) veins or seams in which the fibers are close-packed and are oriented at a large angle to the boundaries of the veins or seams.

¹¹ Commission Internationale de l'Éclairage (International Commission on Illumination). The CIE color-order system is the most important of those used in connection with instruments for color measurement. See Practice E 308.