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Standard Specification for Chemical-Resistant Sulfur Mortar[1]

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1. Scope

1.1 This specification covers the requirements for chemical-resistant sulfur mortar, which must be heated and molten to be used, for bonding chemical-resistant brick or tile. For the use of these materials, see Practice C386.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* See Section 7 for specific safety hazard.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C267 Test Methods for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacings and Polymer Concretes

C307 Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings

C321 Test Method for Bond Strength of Chemical-Resistant Mortars

C386 Practice for Use of Chemical-Resistant Sulfur Mortar

C413 Test Method for Absorption of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes

C579 Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes

C580 Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes

C904 Terminology Relating to Chemical-Resistant Nonmetallic Materials

3. Terminology

3.1 *Definitions*—For definitions of terms used in this specification, see Terminology C904.

4. Chemical Composition

4.1 The sulfur mortar shall conform to the following requirements for chemical composition:

Sulfur, %	55 to 70
Inert filler, %	45 to 30

Fillers are usually carbon or silica and can affect the chemical resistance of sulfur mortars.

5. Chemical Resistance

5.1 A general guide to chemical resistance of sulfur mortars may be found in Table 1.

5.2 The resistance of sulfur mortar to specific chemicals shall be determined by Test Method C267.

6. Physical Properties

6.1 The sulfur mortar shall conform to the following physical requirements:

Tendency of filler to settle, maximum variation from unity	0.6
Tensile strength, min, psi (MPa)	400 (2.8)
Compressive strength, min, psi (MPa)	4000 (28)
Flexural strength, min, psi (MPa)	1000 (6.9)
Strength retained after thermal shock test, min, psi (MPa)	150 (1.0)
Bond strength, min, psi (MPa)	150 (1.0)
Absorption, max, weight %	1.0

7. Test Methods

7.1 Sample the sulfur mortar and determine the properties enumerated in this specification in accordance with the following test methods:

7.1.1 *Sampling and Preparation of Sample*—Using a minimum of 5 lb (2.3 kg), melt the sample in less than 1 h. Then hold at a temperature of 265 to 290°F (129 to 143°C) for at least 15 min, while stirring with a laboratory-type mixer. This mixer shall be of such type and operate at a speed to lift the aggregate, but without beating air into the molten sample. Cast all test specimens from this sample.

[1] This specification is under the jurisdiction of ASTM Committee C03 on Chemical-Resistant Nonmetallic Materialsand is the direct responsibility of Subcommittee C03.02 on Monolithics, Grouts and Polymer Concretes.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

TABLE 1 General Guide to Chemical Resistance of Sulfur Mortars

NOTE 1—This table is intended for use as a general guide to the resistance of sulfur mortars in immersed service at ambient temperature, and may usually be upgraded for spillage only. Specific recommendations should be obtained from the manufacturer of the sulfur mortar.

Substance	Chemical Resistance[A]
Acids, mineral[B] (nonoxidizing)	R
Acids, mineral (oxidizing)	R[C]
Acids, organic	L
Alkalies, inorganic	N
Bleaches	N
Wet gases, oxidizing	R
Wet gases, reducing	R
Gases, nonoxidizing and nonreducing	R[D]
Organic solvents	L

[A] R = generally recommended.
L = limited use.
N = not recommended.
[B] Silica filler must be avoided for hydrofluoric acid service.
[C] N for chromic acid, sulfuric acid above 85 % and nitric acid above 40 %.
[D] N for ammonia gas.

7.1.2 *Storage of Test Specimens*—Store all test specimens at a temperature of 73 ± 4°F (23± 2°C).

7.1.3 *Filler Content:*

7.1.3.1 Determine the filler content of the sulfur mortar by extraction with carbon disulfide, (CS_2—see warning below) using Soxhlet-type equipment. Dry and weigh the filter thimble. Place 10 to 15 g of the sample in the thimble and place thimble in the extraction equipment. Pour 40 to 50 mL of carbon disulfide into the flask. Cautiously heat the flask in a water bath just enough to slowly reflux the carbon disulfide while circulating cold water through the condenser. Continue the extraction until the carbon disulfide is clear in the siphon tube.(**Warning—**Carbon disulfide is highly toxic and highly flammable with a flash point of -22°F (-30°C).)

7.1.3.2 Remove the filter. Dry carefully, first at a low temperature to prevent ignition of the carbon disulfide and then at 212°F (100°C), to constant weight. Final weight divided by original weight times 100 equals percent filler content.

7.1.4 *Tendency of Filler to Settle* —Fill a 1-in. (25-mm) diameter heat-resistant glass test tube to a depth of 8 in. (200 mm) with molten sulfur mortar and maintain at 285°F (141°C) for 30 min. Carefully remove test tube from hot environment and hold under tap water until mortar is completely solidified. Break and remove glass from sulfur specimen. A shrinkage cone will have formed at top of sample on cooling. Cut or machine off this shrinkage cone portion. Cut remaining mortar specimen into three sections of approximately equal length. Grind top and bottom thirds separately using a mortar and pestle. Perform extraction test on each sample using procedure outlined in 7.1.3 and calculate filler content of each. Calculate tendency of filler to settle by dividing filler content of bottom portion by filler content of top portion.

7.1.5 *Tensile Strength*— Test Method C307.

7.1.6 *Compressive Strength*—Test Method C579.

7.1.7 *Flexural Strength*—Test Method C580.

7.1.8 *Thermal Shock Test*—Cast at least five tensile briquets as described in Test Method C307 and store them for 48 h at ambient temperature. Provide two 5-gal pails, each filled approximately two-thirds full of water. Maintain the temperature in one pail between 50 and 60°F (10 and 15°C) as the cold bath, and the other pail between 175 and 185°F (80 and 85°C) as the hot bath. Place five briquet specimens in a wire cage constructed so as to hold the briquets spaced at least 1 in. (25.4 mm) from each other. Suspend the specimens in the middle of the hot bath for 5 min and immediately transfer to the cold bath for 5 min. After five such cycles, remove the five specimens and determine their tensile strength immediately in accordance with Test Method C307.

7.1.9 *Bond Strength*— Test Method C321.

7.1.10 *Absorption*—Test Method C413, except that the temperature in 6.2 shall be held at 190°F (88°C) instead of boiling.

8. Packaging and Package Marking

8.1 The sulfur mortar shall be packaged in suitable containers and marked to denote the type filler. Complete instructions for melting and pouring shall be included.

8.2 Packages may be marked at the discretion of the supplier and on his responsibility, indicating that the product satisfies this specification.

9. Keywords

9.1 brick; chemical resistant; hot melt; sulfur mortar; tile grout