



Standard Practice for Making and Conditioning Chemical-Resistant Sulfur Polymer Cement Concrete Test Specimens in the Laboratory¹

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1. Scope

1.1 This practice covers procedures for making and conditioning test specimens of chemical-resistant sulfur polymer cement concrete (SC) in the laboratory. The specimens are cast under accurate control of materials and test conditions using aggregate and sulfur polymer cement (SPC) to make SC that can be consolidated by rodding, as described in this practice.

1.2 Sulfur polymer cement may be furnished as a single or multiple component system.

1.3 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *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.*

2. Referenced Documents

2.1 ASTM Standards:²

C 470/C 470M Specification for Molds for Forming Concrete Test Cylinders Vertically

C 904 Terminology Relating to Chemical-Resistant, Non-metallic Materials

2.2 National Institute of Standards and Technology:

Handbook 44: Specifications, Tolerances and Other Technical Requirements for Weighing and Measuring Devices³

3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, refer to Terminology C 904.

¹ This practice is under the jurisdiction of ASTM Committee C03 on Chemical-Resistant Nonmetallic Materials and is the direct responsibility of Subcommittee C03.02 on Mortar and Monolithics.

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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.

³ Available from National Institute of Standards and Technology (NIST), 100 Bureau Dr., Stop 3460, Gaithersburg, MD 20899-3460.

4. Significance and Use

4.1 This practice is for making specimens of SC in a standard way so that comparative testing can be performed by various producers and users. Use of this practice to prepare specimens for laboratory testing will reduce variability that might be introduced by different methods of casting and by the use of a variety of specimen shapes and sizes.

5. Apparatus

5.1 Molds:

5.1.1 *Molds for Specimens or Fastenings Thereto in Contact with the SC* shall be made of steel, cast iron, or other nonabsorbent materials that are nonreactive with concretes containing either SPC, its components, or other polymer cements.

5.1.2 *Size of the Molds* shall conform to the dimensions and tolerances specified in the procedure for which the specimens are required. Molds shall hold their dimensions and shape under conditions of severe use.

5.1.3 *Condition of the Molds for Casting* shall be watertight. A suitable sealant, such as modeling clay, shall be used where necessary to prevent leakage through joints. Positive means shall be provided to hold base plates firmly to the molds. If cylinders are filled vertically and immediately stored horizontally for cooling, positive means also shall be provided to hold top plates firmly to the molds. Reusable molds shall be lightly coated with mineral oil or a suitable nonreactive release material before use.

5.2 Cylinder Molds:

5.2.1 *Molds for Casting Specimens Vertically* shall conform to the requirements of 5.1 and Specification C 470/C 470M.

5.2.2 *Molds for Casting Specimens Vertically and Storing Horizontally* shall conform to the requirements for symmetry and dimensional tolerances of Specification C 470/C 470M. Provision shall be made for fixing both end plates firmly to the mold.

5.3 *Beam and Prism Molds* shall be rectangular in cross section (unless otherwise specified) and of the dimensions required to produce the desired specimen size. The inside surfaces of the molds shall be smooth and free from indentations. The sides, bottom, and ends shall be at either equal or

right angles to each other and shall be straight, true, and free of warpage. Maximum variation from the nominal cross section shall not exceed $\frac{1}{8}$ in. (3.2 mm) for molds with depth or breadth of 6 in. (152 mm) or more, or $\frac{1}{16}$ in. (1.6 mm) for molds of smaller depth or breadth. Except for flexure specimens, molds shall not vary from the nominal length by more than $\frac{1}{16}$ in. Flexure molds shall not be shorter than the required specimen length but may exceed it.

5.4 *Consolidation, Mixing, and Other Miscellaneous Equipment* shall be specified by the manufacturer—see Appendix X1.

5.5 *Weighing Equipment* shall be capable of weighing materials or specimens to $\pm 0.3\%$ accuracy. The weighing equipment shall meet the National Institute of Standards and Technology requirements for sensitivity and tolerances.

5.6 *Concrete Mixer*—A power-driven revolving-paddle mixer or suitable equivalent capable of thoroughly mixing batches of the prescribed sizes at the required temperatures shall be used.

6. Test Specimens

6.1 *Cylindrical Specimens*—Cylinders for such tests as compressive strength, modulus of elasticity, creep, and splitting tensile strength may be of various sizes with a minimum of 1 in. (25 mm) diameter by 2 in. (50 mm) length. Otherwise, dimensions are governed in accordance with 6.4 and the test method concerned.

6.1.1 Cylindrical specimens for tests shall be molded with the axis of the cylinder vertical but may be allowed to harden in the horizontal position.

6.2 *Prismatic Specimens*—Beams for flexural strength, cubes for compressive strength, prisms for freezing and thawing, bond, length change, volume change, and so forth, shall be cast with their long axes vertical, unless otherwise required by the method of test in question, and shall conform in dimension to the requirements of the specific test method.

6.3 *Other Specimens*—Other shapes and sizes of specimens for particular tests may be molded as desired following the general procedures set forth in this practice.

6.4 *Specimen Size Versus Aggregate Size*—The diameter of a cylindrical specimen or minimum cross-sectional dimension of a rectangular section shall be at least three times the maximum size of the coarse aggregate in the SC (see Note). Occasional oversize aggregate particles (of a size not normally found in the average aggregate grading) shall be removed by hand picking during the molding of the specimens.

NOTE 1—The nominal maximum size of coarse aggregate is that size next larger than the largest sieve on which at least 15 % of the aggregate by weight is retained.

6.5 *Number of Specimens*—The number of specimens and the number of test batches are dependent on established practice and the nature of the test program. Guidance is usually given in the test method or specification for which the specimens are made. Usually, three or more specimens are molded for each test age and test condition unless otherwise specified.

7. Materials Preparation

7.1 *Sulfur Polymer Cement*—Store the SPC or its components in a dry location away from any sources of heat.

7.2 *Equipment and Materials Temperature*:

7.2.1 For casting SC specimens, heat the mold, hand tools, and mixing equipment to 240°F–295°F (115–145°C) unless otherwise specified by the manufacturer.

7.2.2 Until added to the coarse and fine aggregates, the SPC or its components and mineral filler shall remain at ambient room temperature and not exposed to any sources of heat.

7.3 *Aggregates*:

7.3.1 A sufficient amount of coarse aggregate and fine aggregate shall be combined for each batch in the proportions and in the manner specified by the manufacturer to produce the desired grading before drying and heating.

7.3.2 Before incorporating mineral filler and SPC or its components into the concrete mixer, make sure that the desired temperature has been reached and that the final mixture temperature can be maintained within the allowable range as specified by the manufacturer.

8. Procedure

8.1 *Mixing Sulfur Polymer Cement Concrete*:

8.1.1 *General*—Mix SC according to manufacturer's recommendations in a suitable mixer in batches of such size as to leave about 10 % excess after molding the test specimens. Mixing sequence and procedure from batch to batch should not vary unless the effect of such variation is under study.

8.2 *Making Specimens*:

8.2.1 *Casting Molds*—Cast specimens as near as practicable to the place where they are to be stored during the first 2 h. Place molds on a rigid surface free from vibration and other disturbances. Avoid jarring, tilting, or damaging of the surface when moving the specimens to the storage place.

8.2.2 *Casting*—Place SC in the molds using appropriate hand tools and ensure that it is representative of the batch.

8.2.2.1 *Number of Layers*—Make the specimens in two approximately equal layers of SC, making sure to overfill the mold with the second layer.

8.3 *Consolidation*—The method of consolidating shall be as recommended by the manufacturer.

8.4 *Finishing*:

8.4.1 *Vertically Cooled Cylinders*—After consolidation, finish the surface of the SC to produce a flat, even surface that is flush with the overfill rim or extended edge of the mold.

8.4.2 *Horizontally Cooled Cylinders Alternative*—After consolidation, strike off the specimen level with the top of the mold, secure the top cap on the mold, and immediately lay the filled mold in a horizontal position to cool.

9. Conditioning

9.1 Sulfur polymer cement concrete shall be conditioned at $73 \pm 4^\circ\text{F}$ ($23 \pm 2^\circ\text{C}$) before testing. The time between casting and testing the SC specimens is usually 24 h.

10. Keywords

10.1 conditioning; molds; sulfur polymer cement (SPC); sulfur polymer cement concrete or sulfur concrete (SC); test specimens

APPENDIX**(Nonmandatory Information)****X1. CONSOLIDATION, MIXING, AND OTHER MISCELLANEOUS EQUIPMENT**

X1.1 *Tamping Rods*—Two sizes are required for use in casting samples, depending on mold size. Each shall be a round, straight, steel rod with at least the tamping end rounded to a hemispherical tip of the same diameter as the rod. Both ends may be rounded if preferred, or an oak handle may be affixed to one end of the rod for convenience.

X1.1.1 *Larger Rod*, $\frac{5}{8}$ in. (16 mm) in diameter and approximately 24 in. (610 mm) long.

X1.1.2 *Smaller Rod*, $\frac{3}{8}$ in. (10 mm) in diameter and approximately 12 in. (305 mm) long for use on molds up to 6 in. high.

X1.2 *Mallets*—A mallet with a rubber or rawhide head weighing 1.25 ± 0.50 lb (0.57 ± 0.23 kg) may be required.

X1.3 *Small Tools*—Tools and items such as shovels, pails, trowels, oak wood float, blunted trowels, straightedge, feeler gage, scoops, rulers, rubber gloves, and metal mixing bowls may be required.

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