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Standard Test Method for FINISH CONTENT OF WOVEN GLASS FABRIC, CLEANED AND AFTER-FINISHED WITH ACRYLIC-SILANE-TYPE FINISHES, FOR PLASTIC LAMINATES[1]

This standard is issued under the fixed designation D 2660; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the measurement of the amount of acrylic-silane finish applied to various styles of woven glass fabric that have been suitably cleaned to remove the oils and binders present on the yarn to make them suitable for use in polyester laminates.

NOTE 1—Some typical acrylic-silane finishes are known as Z-6030 and A-174.

NOTE 2—This test method is based on the use of a Leco No. 515 Conductometric Carbon Determinator and Leco Induction Furnace, Laboratory Equipment Co., St. Joseph, Mich., but any test method giving comparable results may be used.

NOTE 3—The finish content may also be determined using automatic instruments not on the market when this test method was originally written. The results obtained by these instruments comply with the requirements of this test method, although the procedure may differ.

1.2 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Applicable Document

2.1 *ASTM Standard:*

D 4029 Specification for Finished Woven Glass Fabrics[2]

3. Summary of Method

3.1 Specimens are burned with iron and tin accelerators in the presence of oxygen. The carbon content is measured, which is a reliable indication of the amount of acrylic-silane finish on the glass fabric.

4. Significance and Use

4.1 The purpose of this test method is to provide a means for determining the amount of acrylic-silane finish on glass fabrics that have met the requirements of Specification D 4029 and whether it has been correctly applied. It is intended for use in specifications, product evaluation, and quality control.

4.2 The acrylic-silane finish enhances the handleability of the fabric and improves the mechanical properties of the glass fabric when used as a reinforcement in polyester laminates.

5. Apparatus

5.1 *Induction Furnace*, Leco Model 521, 522, or 523.

5.2 *Conductometric Carbon Determinator*, Leco No. 515.

5.3 *Combustion Tube*, Leco No. 550-120.

5.4 *Carbon Crucible, Quartz-Enclosed*, Leco No. 550-182.

5.5 *Tin Accelerator*, Leco No. 501-76.

[1] This test method is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D 20.18 on Reinforced Thermosetting Plastics.

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[2] *Annual Book of ASTM Standards*, Vol 07.02.

5.6 *Iron Accelerator*, Leco No. 501-77.

5.7 *Crucibles*, Leco No. 528-25. These crucibles are to be preignited at 1205°C (2200°F) in a tube furnace through which a stream of oxygen is flowing. After burning, the crucibles must be handled with tongs to prevent contamination with oil from the skin; the crucibles shall then be stored in a desiccator.

5.8 *Tube Furnace.*

5.9 *Variable Transformer.*

5.10 **Caution**—Before attempting this determination, the analyst must be thoroughly familiar with the "Instruction Manual for Operation of Leco No. 515 Conductometric Carbon Determinator" and the "Instruction Manual for Operation of Leco Induction Furnace." Principles of the method are explained in the manuals.

6. Reagents and Materials

6.1 *Barium Hydroxide Solution*—See "Instruction Manual for Operation of Leco No. 515 Conductometric Carbon Determinator."

6.2 *Mercury.*

6.3 *Oxygen*, cylinder.

6.4 *Standard Steel*, NBS 166A.

7. Procedure

7.1 Assemble the apparatus in accordance with Fig. V, "S" modification of the "Instruction Manual for Operation of Leco Induction Furnaces."

7.2 Using a quartz-enclosed carbon crucible, blank out the combustion tube until a resistance of 0.5 Ω or less is obtained. Use a variable transformer to adjust the plate current to 400 mA.

NOTE 4—See the "Instruction Manual for Operation of Leco No. 515 Conductometric Carbon Determinator."

7.3 Weigh 1.50 ± 0.02 g of iron accelerator and mix with one scoop (approximately 0.7 g) of tin accelerator.

NOTE 5—Iron accelerator contains carbon and therefore must be weighed quite accurately.

7.4 Determine a blank on the procedure by burning the iron and tin accelerators in an uncovered crucible for 5 min in a stream of oxygen (see Note 5.)

7.5 Continue the oxygen purge for an additional 2 min and record the resistance of the $Ba(OH)_2$ solution. Use this resistance for the first point in preparing a standard curve.

7.6 Run a duplicate blank. Results should agree within 0.5 Ω.

7.7 Obtain three additional points for the standard curve by burning iron and tin accelerators mixed with 0.2, 0.4, and 0.7 g of NBS standard steel 166A, following exactly the procedure used in 7.4 and 7.5. NBS standard steel 166A contains 0.027 % carbon. Plot the resistance of the $Ba(OH)_2$ solution in ohms versus milligrams of carbon.

7.8 Using only tweezers to handle the glass cloth, cut the sample into 13-mm (½-in.) pieces. Weigh 500 mg of the cloth to the nearest 1 mg and place in a preignited crucible.

NOTE 6—Care must be taken to prevent skin oils from contaminating glass cloth. All oil and grease must be absent from the scissors.

7.9 Cover the cloth with iron and tin accelerators, mix, and burn using the same technique as used in the determination of the blank and the points for the standard curve.

7.10 Measure the resistance of the $Ba(OH)_2$ solution and read from the standard curve the milligrams of carbon represented by this resistance.

7.11 Examine the melt in the crucible. An even melt must be obtained. Discard the results if pieces of unreacted glass cloth are present.

8. Calculations

8.1 Calculate the percentage carbon on heat cleaned or untreated glass fabric. Call this C_b.

8.2 Calculate the percentage carbon in the sample C_a, as follows:

$$C_a = ((W - C_b)/S) \times 100$$

where:

W = milligrams of carbon (from curve), and

S = milligrams of sample.

8.3 Calculate the actual finish in the fabric as follows:

$$\text{Z-6030, \%} = C_a \times (248/84)$$

$$\text{A-174, \%} = C_a \times (248/84)$$

9. Report

9.1 The report shall include the following:

9.1.1 Complete identification of the material