INTERNATIONAL

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Standard Test Method for Measuring Electrical Conductivity of Electrocoat Baths[1]

This standard is issued under the fixed designation D4399; 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 determination of the electrical conductivity of electrocoat baths or ultrafiltrate samples using commercially available equipment.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1125 Test Methods for Electrical Conductivity and Resistivity of Water

D1193 Specification for Reagent Water

3. Summary of Test Method

3.1 A specimen is placed in a conductivity cell, or conversely a conductivity cell is placed in an electrocoat material, and the cell is connected to a conductivity bridge. The electrical conductivity is read directly off the meter of the bridge as the instantaneous peak reading.

4. Significance and Use

4.1 The conductivity of electrocoat baths results from the presence of ionic species in the bath, which come from the vehicle and from the presence of impurities present as ionizable acids, bases, salts, or combinations of these. The presence of excessive amounts of ionic impurities is detrimental to the application and performance properties of electrocoating paints. The test is suitable for use in research, production, quality control and electrocoat bath process control.

4.2 Other related methods for determining the electrical conductivity of water are described in Test Methods D1125.

5. Apparatus

5.1 *Conductivity Bridge*—Battery, or AC/DC line-operated, capable of providing a conductivity reading almost instantaneously.

5.2 *Conductivity Cell*—Dip or fill type, cell constant of 1.0.

5.3 *Thermometer*—Any type capable of 0.5 °C accuracy with a −2 °C to 32 °C range.

5.4 *Measuring Vessel*—Any suitable cylindrical container capable of holding sufficient electrocoat sample to cover the electrodes of the conductivity cell, and allowing at least 25 mm between the conductivity cell and the sides of the vessel.

6. Reagents and Materials

6.1 *Purity of Water*—References to water shall be understood to mean water conforming to Type II of Specification D1193.

6.2 *Cleaning Solvent*—An appropriate solvent for the electrocoat material under measurement.

7. Sampling and Sample Preparation

7.1 The sample should be obtained while the electrocoat bath is under proper circulation so that a uniform sample is obtained. In the case of an ultrafiltrate, the material should be thoroughly mixed or stirred prior to sampling to ensure uniformity.

7.2 After sampling and prior to removing a test specimen, it is mandatory that the samples be shaken or stirred until they are homogeneous and free of any settled material. This is particularly important if there is a delay between sampling the bath and performing the test on the bath materials. The absence of settled material can be ascertained visually (in a transparent container) or by inserting a spatula, scraping the bottom of the container and making sure that there is no settled matter. Shake

[1] This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.21 on Chemical Analysis of Paints and Paint Materials.

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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.

or stir the sample until specimens are taken for measurement; THIS POINT IS VERY IMPORTANT.

8. Procedure

8.1 Calibrate the conductivity cell prior to use following the manufacturer's instructions.

8.2 Rinse the measuring container several times with portions of the electrocoat material under test.

8.3 Take a representative portion of the electrocoat bath or permeate sample and place it in the measuring container. Stir the specimen thoroughly to keep it from settling.

8.4 Adjust the temperature of the specimen to 25 °C ± 0.5 °C. This is very important, since temperature differences cause disagreements in results and are a major source of error in these measurements.

8.5 Immerse the cell in the specimen, and move the cell up and down several times to displace any air bubbles from inside the cell. Hold the cell in a slightly inclined position in the center of the container with the vents at the top of the cell housing beneath the surface of the liquid. If a fill-type cell is used, pour the specimen into the conductivity cell.

8.6 Read and record the conductivity as described in the manufacturer's instructions regarding the use of the instrument. Avoid measuring times longer than 15 s to prevent electrocoat sample deposition on the cell electrodes. Perform a second measurement on another specimen, repeating steps in 8.3 and 8.6. Calculate the mean of both measurements.

8.7 Take extreme care to prevent contamination of the sample and equipment. Rinse the cell with deionized water and an appropriate solvent immediately after use. Keep cell clean and do not allow the dry electrocoat sample to accumulate on the interior of the cell.

9. Report

9.1 Report the conductivity in terms of microsiemens (or microohms per centimetre) to the nearest 1 % of the determined conductivity.

10. Precision and Bias

10.1 *Precision*—In an interlaboratory study of this test method, with five laboratories measuring five electrocoat bath samples with conductivities ranging from 720 to 1750 µS/cm (microohms/cm), the intralaboratory coefficient of variation was found to be 2.6 % relative at 25 df, and the interlaboratory coefficient of variation 4.2 % relative at 20 df. Based on these coefficients, the following criteria should be used for judging the acceptability of results at the 95 % confidence level:

10.1.1 *Repeatability*—Two results, each the mean of duplicate determinations, obtained by the same operator on different days should be considered suspect if they differ by more than 7.6 % relative.

10.1.2 *Reproducibility*—Two results, each the mean of duplicate determinations, obtained by operators in different laboratories should be considered suspect if they differ by more than 16.5 % relative.

10.2 *Bias*—Bias cannot be determined for this method because there are no accepted standards for the electrical conductivity of electrocoat baths or ultrafiltrate samples.

11. Keywords

11.1 electrocoat bath; electroconductivity