



Designation: D8300 – 19 (Reapproved 2023)

Standard Test Method for Silica, Precipitated, Hydrated—Electrical Conductivity¹

This standard is issued under the fixed designation D8300; 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 is used to determine the electrical conductivity of silica and the electrical conductivity is suitable for characterizing rubber-grade silicas.

1.2 *Units*—The values stated in SI units are to be regarded as the 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. Summary of Test Method

2.1 The adsorption of water on the silica surface enhances its electrical conductivity. Different mechanisms, both electronic and ionic, can cause this effect.

2.2 This standard test method provides a procedure for the determination of the electrical conductivity in an aqueous suspension of silica.

3. Significance and Use

3.1 The electrical conductivity of silica is related to both the adsorbed water and the hydroxyl groups on the surface of the precipitated, hydrated silica. Since the electrical conductivity of distilled or de-ionized water is very low, high electrical conductivity values are associated with ionic sources due to impurities.

3.2 A specific quantity of the silica sample is boiled in distilled or deionized water. After cooling to room temperature,

the suspension is diluted to 4 % mass per volume (m/V) and its temperature is adjusted to 20 °C with a thermostat. The electrical conductivity is measured using a conductivity meter and a conductivity cell.

4. Apparatus

4.1 *Precision Balance*, 0.01 g sensitivity.

4.2 *Beaker*, glass, 50 cm³.

4.3 *Beaker*, glass, 150 cm³.

4.4 *Conductivity Meter*, equipped with a conductivity cell.

4.5 *Lab Thermostat*.

4.6 *Laboratory Grinder*, or, alternatively, mortar and pestle.

4.7 *Magnetic Stirrer*, with stir bar.

4.8 *Funnel*.

4.9 *Volumetric Flask*, 100 cm³.

4.10 *Watch Glass*.

4.11 *Graduated Cylinder*, glass, 100 cm³.

5. Reagents and Materials

5.1 *Purity of Reagents*—Reagent-grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available.² Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

5.2 *Specific Reagents:*

5.2.1 *Potassium chloride solution (0.0100 ± 0.0001) mol/L*—Dry an appropriate amount of KCl in an oven for approximately 1 h at (105 ± 2) °C and cool it to ambient temperature in a desiccator. Weigh (0.7455 ± 0.0005) g of the dried substance and transfer it with deionized water into a 1 L graduated flask. After dissolution of the salt, fill up the flask

¹ This test method is under the jurisdiction of ASTM Committee D11 on Rubber and Rubber-like Materials and is the direct responsibility of Subcommittee D11.20 on Compounding Materials and Procedures.

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² *ACS Reagent Chemicals, Specifications and Procedures for Reagents and Standard-Grade Reference Materials*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.

with deionized water. Ensure that the flask is filled up to the mark after adjusting the temperature to $(20.0 \pm 0.5)^\circ\text{C}$ and that the solution is well homogenized. KCl solutions with the concentration needed for this test method are commercially available.

5.2.2 Deionized or distilled water, conductivity $<4\ \mu\text{S}/\text{cm}$.

6. Procedure

6.1 Grind an appropriate quantity of silica sample in a laboratory grinder for 60 s.

6.2 Weigh, by means of a precision balance, 4.00 g of the silica sample to an accuracy of $\pm 0.01\ \text{g}$ into a previously tared 150 cm^3 beaker and add 50 cm^3 deionized water measured with a graduated cylinder.

6.3 Heat the silica/water suspension in a beaker under constant stirring with a magnetic stirrer and cover the beaker with a watch glass. Boil the suspension for 1 min ($\pm 10\ \text{s}$).

6.4 Transfer the suspension into a 100 cm^3 graduated flask by means of a funnel. Residues which adhere at the beaker wall are purged with de-ionized water into the flask. After allowing the suspension to cool down to ambient temperature, fill up the volumetric flask to the mark of 100 cm^3 with deionized water and homogenize the suspension.

6.5 Pour 40 cm^3 of the above suspension from the volumetric flask into a 50 cm^3 beaker and pre-rinse the conductivity cell by repeated dipping into this suspension.

6.6 Pour another 40 cm^3 of the suspension into a 50 cm^3 beaker and adjust its temperature to $(20.0 \pm 0.5)^\circ\text{C}$ using a

thermostat. Then immerse the conductivity cell into the temperature adjusted suspension.

6.7 Before testing, check the calibration of the conductivity cell constant at least once per day. Use for this purpose a KCl solution with a concentration of $(0.0100 \pm 0.0001)\ \text{mol/L}$ and a nominal electrical conductivity of $(1278 \pm 10)\ \mu\text{S}/\text{cm}$. In the case of a difference from the nominal value $>10\ \mu\text{S}/\text{cm}$, the cell constant must be adjusted to the nominal value.

7. Calculation of Results

7.1 The value displayed at the conductivity meter output is the electrical conductivity of the 4 % (m/V) silica/water suspension at 20°C .

8. Report

8.1 Identification of the silica sample.

8.2 Value of the electrical conductivity at 20°C in $\mu\text{S}/\text{cm}$.

8.3 In the case of values $\geq 100\ \mu\text{S}/\text{cm}$, the result is rounded to the nearest 10 $\mu\text{S}/\text{cm}$, if the conductivity is $<100\ \mu\text{S}/\text{cm}$, the result is rounded to the nearest 1 $\mu\text{S}/\text{cm}$.

9. Precision and Bias

9.1 Precision and bias statements have not been generated but will be available within five years of publication of the test method.

10. Keywords

10.1 electrical conductivity; silica

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