National Institute of Standards and Technology
U.S. Department of Commerce

European Commission

Date of Issue:
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Standard Reference Material® 1992

Zeta Potential – Colloidal Silica (Nominal Mass Fraction 0.15 %)

Identical to ERM®-FD305

CERTIFICATE

Purpose: This Standard Reference Material (SRM) is intended to assess the performance of instruments and/or methods that are used for measuring zeta potential and electrophoretic mobility. As with any reference material, it can be used for establishing control charts or validation studies.

Description: A unit of SRM 1992 consists of four pre-scored ampoules each containing approximately 5 mL of colloidal silica suspension in a borate buffer at pH 8.9. This material is a joint production of the European Commission Joint Research Centre (JRC) and NIST. SRM 1992 is materially identical to JRC ERM-FD305. Detailed information about the production and characterization of SRM 1992 are provided in NIST Special Publication 260-208 [1].

Certified Values: A certified value is the present best estimate of the true value [2]. Certified values reported below are based on measurements performed at NIST, JRC and qualified collaborating laboratories listed in Appendix B, and represent the unweighted mean value of the means of accepted sets of data based on the electrophoretic light scattering technique; each set being obtained in a different laboratory or with a different method of determination. These values are traceable to the International System of Units (SI) [1]. The values are reported on an as-received basis.

Measurand	Value[(a)]
Mean electrophoretic mobility [$\times 10^{-8}$ m^2 V^{-1} s^{-1}] [(b)]	–4.5 ± 0.4
Mean zeta potential [mV] [(c)]	–58 ± 5

[(a)] Values are expressed as $x \pm U_{95\%}(x)$, where x is the certified value and $U_{95\%}(x)$ is the expanded uncertainty of the certified value. The true value of the analyte lies within the interval $x \pm U_{95\%}(x)$ with 95 % confidence. To propagate this uncertainty, treat the certified value as a normally distributed random variable with mean x and standard deviation $U_{95\%}(x)/2$.

[(b)] Obtained by electrophoretic light scattering at a sample temperature of 25 °C according to ISO 13099-2:2012 [3].

[(c)] Calculated from the electrophoretic mobility certified value using the Smoluchowski approximation [1] (for a temperature of 25 °C, a dynamic viscosity of 0.89 mPa·s and a relative dielectric constant for water of 78.4).

Non-Certified Values: Non-certified values are provided in Appendix A.

Period of Validity: The certified values delivered by SRM 1992 are valid within the specified measurement uncertainty indefinitely, provided the SRM is handled and stored in accordance with instructions given in this certificate. Periodic recertification of this SRM is not required. The certifications are nullified if the SRM is damaged, contaminated, or otherwise modified.

Maintenance of Certified Values: NIST will monitor this SRM over the period of validity. If substantive technical changes occur that affect the certification, NIST will notify the purchaser. Registration (see attached sheet or register online) will facilitate notification.

R. David Holbrook, Chief
Materials Measurement Science Division

Steven J. Choquette, Director
Office of Reference Materials

Safety: Refer to the safety data sheet.

Storage: The original unopened ampoules of SRM 1992 should be stored at room temperature (20 °C ± 5 °C). SRM 1992 **must not be subjected to freezing temperatures**, as this can irreversibly compromise the integrity of the material.

Handling and Use: SRM 1992 is a colloidal suspension hermetically sealed in glass ampoules. Use appropriate care when handling these ampoules to avoid breakage. Before opening, the ampoule should be gently inverted several times to ensure the uniformity of the suspension. Remove any suspension that remains in the upper part (conical top) of the ampoule by gently flicking the conical part with the forefinger while tilting the ampoule. The ampoule is pre-scored and can be opened by applying gentle pressure with one's thumb to snap off the conical part. The content of the ampoule should be used the same day as opened and should be gently homogenized before every measurement without introducing air bubbles. The stability of SRM 1992 after opening has not been evaluated and therefore repeated use of the material over an extended period of time falls under the user's responsibility.

For electrophoretic light scattering, an aliquot of SRM 1992 should be measured as received (i.e., without dilution). Homogeneity of the material has not been evaluated for sample sizes smaller than those used in the certification study. Therefore, the certified values might not be valid for test quantities smaller than 400 µL. The measurement temperature is 25 °C ± 0.2 °C. Values to be used for the viscosity and refractive index of the dispersing medium (water) at 25 °C are 0.89 mPa·s and 1.332, respectively. The value of the viscosity must be adjusted when tests are not performed at 25 °C.

Production Information: All activities related to the development and production of this SRM were performed jointly with the JRC Directorate F – Health, Consumers and Reference Materials (Geel, Belgium). Collaborating laboratories are listed in Appendix B.

REFERENCES

[1] Ramaye, Y.; Kestens, V.; Charoud-Got, J.; Mazoua, S.; Auclair, G.; Cho, T.J.; Toman, B.; Hackley, V.A.; Linsinger, T.; *Certification of Standard Reference Material® 1992 / ERM®-FD305 Zeta Potential – Colloidal Silica (Nominal Mass Fraction 0.15 %)*; NIST Special Publication 260-208 (2020); available at https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.260-208.pdf (accessed Dec 2020).

[2] Beauchamp, C.R.; Camara, J.E.; Carney, J.; Choquette, S.J.; Cole, K.D.; DeRose, P.C.; Duewer, D.L.; Epstein, M.S.; Kline, M.C.; Lippa, K.A.; Lucon, E.; Phinney, K.W.; Polakoski, M.; Possolo, A.; Sharpless, K.E.; Sieber, J.R.; Toman, B.; Winchester, M.R.; Windover, D.; *Metrological Tools for the Reference Materials and Reference Instruments of the NIST Material Measurement Laboratory*; NIST Special Publication 260-136; U.S. Government Printing Office: Washington, DC (2020); available at https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.260-136-2020.pdf (accessed Dec 2020).

[3] ISO 13099-2:2012; *Colloidal systems — Methods for Zeta-Potential Determination — Part 2: Optical Methods*; International Organization for Standardization: Geneva, Switzerland (2012).

If you use this SRM in published work, please reference:

Ramaye Y, Kestens V, Charoud-Got J, Mazoua S, Auclair G, Cho TJ, Toman B, Hackley VA, Linsinger T (2020) Certification of Standard Reference Material® 1992 / ERM®-FD305 Zeta Potential – Colloidal Silica (Nominal Mass Fraction 0.15 %). (National Institute of Standards and Technology, Gaithersburg, MD), NIST Special Publication (SP) 260-208. https://doi.org/10.6028/NIST.SP.260-208

Certain commercial organizations, services, equipment, or materials may be identified in this Certificate to adequately specify the experimental procedure. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the organizations, services, materials, or equipment identified are necessarily the best available for the purpose.

Users of this SRM should ensure that the Certificate in their possession is current. This can be accomplished by contacting the Office of Reference Materials, 100 Bureau Drive, Stop 2300, Gaithersburg, Maryland 20899-2300; telephone (301) 975-2200; e-mail srminfo@nist.gov; or the Internet at https://www.nist.gov/srm.

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APPENDIX A

Non-certified values: Non-certified values are suitable for use in method development, method harmonization, and process control but do not provide metrological traceability to the International System of Units (SI) or other higher-order reference system. Non-certified conductivity value is provided below for informational purposes only. It is common for instruments that measure electrophoretic mobility and zeta potential to also measure solution conductivity. The value below represents an expectation to guide the user and serves only as a potential indicator of problems associated with the instrument or the test material. Extreme deviations from this value can be indicative of such problems.

Measurand	Value[(a)]
Conductivity [mS cm^{-1}]	0.39 ± 0.04

(a) Mean of conductivity measurements reported by the laboratories submitting accepted data sets. These values are expressed as $x \pm 2u(x)$, where x is a mean value and $u(x)$ is its associated standard uncertainty. While the best estimate of measurand conductivity lies within the interval $x \pm 2u(x)$, neither the purity nor the identity of the calibrants used have been determined by NIST.

Maintenance of Non-Certified Value: This value is for informational purposes only, therefore NIST will not support the maintenance of this value. Before making use of any of the values delivered by this material, users should obtain the most recent version of this documentation, available free of charge through the https://www.nist.gov/srm website.

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APPENDIX B

Collaborating Laboratories Contributing Data to Value Assignment of SRM 1992

Anton Paar GmbH (Graz, Austria)

European Commission, Joint Research Centre, Directorate F – Health, Consumers and Reference Materials (Geel, Belgium)

Fraunhofer Institut für Keramische Technologie and Systeme (IKTS) (Dresden, Germany)

Horiba (Palaiseau, France)

LGC Ltd. (Teddington, United Kingdom)

Malvern Panalytical Ltd (Malvern, United Kingdom).

Malvern Panalytical Inc. (Westborough, MA, USA)

Microtrac Inc. (Montgomeryville, PA, USA)

Moscow Institute of Physics and Technology (Moscow, Russia)

National Institute of Standards and Technology (NIST) (Gaithersburg, MD, USA)

National Measurement Institute Australia (NMIA) (West Lindfield, Australia)

National Metrology Institute of Japan (NMIJ) (Tsukuba, Japan)

National Physical Laboratory (NPL) (Teddington, United Kingdom)

Otsuka Electronics (Osaka, Japan)

Postnova Analytics GmbH (Landsberg, Germany)

Wyatt Technology (Santa Barbara, CA, USA)

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