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

Date of Issue:
24 February 2022

Standard Reference Material® 1882a
Calcium Aluminate Cement
CERTIFICATE OF ANALYSIS

Purpose: This Standard Reference Material (SRM) is intended primarily for use in evaluating chemical methods of analysis and in the calibration of instrumental methods for analysis of cements and materials of similar matrix.

Description: A unit of SRM 1882a consists of four sealed vials, each containing approximately 5 g of calcium aluminate cement ground to pass through a 75 μm (No. 200) sieve and sealed individually in a foil pouch.

Certified Values: The certified values for eight elements, expressed in their oxide forms as mass fractions [1] on an as-received basis, are provided in Table 1. These values are traceable to the International System of Units (SI) [2]. The certified values listed are based on the results of analyses using X-ray fluorescence spectrometry, atomic absorption spectrometry, and reference methods given in ASTM C 114-97 Standard Test Methods for Chemical Analysis of Hydraulic Cement [3]. Homogeneity testing was performed using X-ray fluorescence spectrometry.

Table 1. Certified Values for SRM 1882a Calcium Aluminate Cement[(a)]

Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
SiO_2	4.01 ± 0.22	MgO	0.51 ± 0.02
Al_2O_3	39.14 ± 0.64	Na_2O	0.021 ± 0.008
Fe_2O_3	14.67 ± 0.40	K_2O	0.051 ± 0.014
CaO	39.29 ± 1.22	TiO_2	1.786 ± 0.005

[(a)] The uncertainty listed with each certified value is an expanded uncertainty based on a 95 % confidence interval [4] calculated as $U = ku_c$ where u_c is the combined standard uncertainty and $k = 2$ is the coverage factor. The expanded uncertainty is calculated by combining a between-method variance [5] with a pooled, within-method variance in accordance with the ISO/JCGM and NIST Guides to the Expression of Uncertainty in Measurement [6].

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

Period of Validity: The certified values delivered by **SRM 1882a** are valid within the measurement uncertainty specified until **01 August 2024**. The certified values are nullified if the material is stored or used improperly, damaged, contaminated, or otherwise modified.

Maintenance of Certified Values: NIST will monitor this SRM over the period of its validity. If substantive technical changes occur that affect the certification, NIST will issue an amended certificate through the NIST SRM website (https://www.nist.gov/srm) and notify registered users. SRM users can register online from a link available on the NIST SRM website or fill out the user registration form that is supplied with the SRM at the time of purchase. Before making use of any of the values delivered by this material, users should verify they have the most recent version of this documentation, available free of charge through the NIST SRM website.

Carlos A. Gonzalez, Chief
Chemical Sciences Division

Steven J. Choquette, Director
Office of Reference Materials

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Safety: Please see the Safety Data Sheet for this material.

Storage: A vial of SRM 1882a is individually sealed in a foil pouch. The original, unopened pouches should be stored at room temperature (20 °C ± 5 °C).

Use: Cement powder is hygroscopic; samples should be used immediately after opening the vial. To relate analytical determinations to the certified value in this Certificate of Analysis, a minimum sample mass of 500 mg should be used. The vial should be recapped immediately and returned to the labeled aluminized pouch and stored in a desiccator.

When a sample is analyzed after storage in a previously opened vial, the total loss on ignition (LOI) at 950 °C for that sample should be determined in accordance with ASTM C114-97 [3] and the mass of the sample corrected for any increase above the LOI value reported in Appendix B.

Calibration of X-Ray Methods: To obtain the most accurate results by X-ray fluorescence methods of analysis, it is recommended that the user employ calibration procedures utilizing corrections for inter-element effects to minimize biases. Alternatively, the user may compare samples to the particular SRM that most closely matches the samples in overall chemical composition.

Reporting: Elements are reported as their oxide forms to conform with the practice set forth in ASTM C 114-97 Standard Test Methods for Chemical Analysis of Hydraulic Cement [3].

REFERENCES

[1] Thompson, A.; Taylor, B.N.; *Guide for the Use of the International System of Units* (*SI*); NIST Special Publication 811, U.S. Government Printing Office: Washington, DC (2008); available at https://www.nist.gov/pml/special-publication-811 (accessed Feb 2022).

[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.; Molloy, J.; Nelson, M.A.; Phinney, K.W.; Polakoski, M.; Possolo, A.; Sander, L.C.; Schiel, J.E.; Sharpless, K.E.; 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 (NIST SP) 260-136, 2021 edition; U.S. Government Printing Office: Washington, DC (2021); available at https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.260-136-2021.pdf (accessed Feb 2022).

[3] ASTM C 114-97; *Standard Test Methods for Chemical Analysis of Hydraulic Cement*; Annu. Book ASTM Stand., Vol. 04.01; ASTM: West Conshohocken, PA.

[4] Hahn, G.J.; Meeker, W.Q.; *Statistical Intervals: A Guide for Practitioners*; John Wiley & Sons, Inc.: New York (1991).

[5] Rukhin, A.L.; Vangel, M.G.; *Estimation of a Common Mean and Weighted Means Statistics*; J. Amer. Stat. Assoc. (JASA), Vol. 93(441), pp. 303–308 (1998).

[6] JCGM 100:2008; *Evaluation of Measurement Data — Guide to the Expression of Uncertainty in Measurement* (GUM 1995 with Minor Corrections); Joint Committee for Guides in Metrology (2008); available at https://www.bipm.org/en/publications/guides (accessed Feb 2022); see also Taylor, B.N.; Kuyatt, C.E.; *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*; NIST Technical Note 1297; U.S. Government Printing Office: Washington, DC (1994); available at https://www.nist.gov/pml/nist-technical-note-1297 (accessed Feb 2022).

Certificate Revision History: 24 February 2022 (Updated non-certified value for LOI at 950 °C; updated sum total of oxides plus LOI at 950 °C; updated format; editorial changes); 08 April 2014 (Extension of certification period; editorial changes); 19 November 1999 (Original certificate).

Certain commercial equipment, instruments, or materials may be identified in this Certificate of Analysis 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 materials or equipment identified are necessarily the best available for the purpose.

Users of this SRM should ensure that the Certificate of Analysis in their possession is current. This can be accomplished by contacting the Office of Reference Materials 100 Bureau Drive, Stop 2300, Gaithersburg, MD 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 [2]. Non-certified mass fraction values, expressed in their oxide forms as mass fractions on an as-received basis, are provided in Table A1.

Table A1. Non-Certified Values for SRM 1882a Calcium Aluminate Cement[(a)]

Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
P_2O_5	0.070 ± 0.001	SrO	0.024 ± 0.002
ZnO	0.004 ± 0.001	Cr_2O_3	0.113 ± 0.001
Mn_2O_3	0.060 ± 0.001		

(a) The uncertainty listed with each reference value is an expanded uncertainty based on a 95 % confidence interval [4], calculated as $U = ku_c$ where u_c is the combined standard uncertainty and $k = 2$ is the coverage factor. The combined standard uncertainty is derived by combining an ordinary precision uncertainty with an estimate including known sources of bias.

Period of Validity: The non-certified values delivered by **SRM 1882a** are valid within the measurement uncertainty specified until the same expiration date given in the certificate on page 1. The value assignments are nullified if the material is stored or used improperly, damaged, contaminated, or otherwise modified.

Maintenance of Non-Certified Values: NIST will monitor this material to the end of its period of validity. If substantive technical changes occur that affect the non-certified values during this period, NIST will update this Appendix. 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

Additional Information: The approximate value for LOI and total reported oxides plus LOI are provided in this appendix for informational purposes only. The total LOI at 950 °C is 0.49 %, reported as a mass fraction. The total of the reported oxides plus the LOI is 100.2 %, also reported as a mass fraction. This information is given to provide additional characterization of the material. It cannot be used to establish metrological traceability to the International System of Units or another higher-order reference system. Do not use these values to calibrate or to validate a test method.

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APPENDIX C

Coordination of technical measurements for certification was accomplished under the direction of J.R. Sieber, formerly of the NIST Chemical Sciences Division. Analytical measurements for certification of this SRM were performed by A.F. Marlow of the NIST Chemical Sciences Division; J.R. Sieber and P.R. Seo, formerly of the NIST Chemical Sciences Division; and by D. Broton, S. Nettles, M. Bharucha, and S. Padiyara of Construction Technology Laboratories, Skokie, IL.

Statistical consultation for this SRM was provided by S.D. Leigh, formerly of the NIST Statistical Engineering Division.

Support aspects involved with the certification and issuance of this SRM were coordinated through the NIST Office of Reference Materials.

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