



Certificate of Analysis

Standard Reference Material[®] 1883a

Calcium Aluminate Cement

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. A unit of SRM 1883a consists of four sealed vials, each containing approximately 5 g of calcium aluminate cement.

Certified Mass Fraction Values: The certified values for seven elements, expressed in their oxide forms as mass fractions [1] on an as-received basis, are provided in Table 1. A NIST certified value is a value for which NIST has the highest confidence in its accuracy, in that all known or suspected sources of bias have been investigated or accounted for by NIST. The certified values listed are based on the results of analyses performed at NIST and at Construction Technology Laboratories, Inc. (CTL Skokie, IL) 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* [2]. Homogeneity testing was performed using x-ray fluorescence spectrometry.

Reference Mass Fraction Values: Reference values for an additional three elements, expressed in their oxide forms as mass fractions on an as-received basis, are provided in Table 2. Reference values are noncertified values that represent a best estimate of the true value; however, the values, which are based on determinations done by a single reliable method, do not meet the NIST criteria for certification and are provided with associated uncertainties that may reflect only measurement precision and may not include all sources of uncertainty.

Information Mass Fraction Values: Information values for Loss on Ignition (LOI), P_2O_5 , and Mn_2O_3 , are provided in Table 3. These are non-certified values with no uncertainties reported as there is insufficient information to make an assessment of the uncertainties. The information values are given to provide additional characterization of the material. Information values cannot be used to establish metrological traceability.

Expiration of Certification: The certification of **SRM 1883a** is valid, within the uncertainty specified, until **01 August 2024**, provided the SRM is handled and stored in accordance with the instructions given in this certificate (see Instruction for Handling and Use). The certification will be nullified if the SRM is damaged, contaminated, or otherwise modified.

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

Coordination of technical measurements for certification was accomplished under the direction of J.R. Sieber of the NIST Chemical Sciences Division.

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

Analytical measurements for certification of this SRM were performed by J.R. Sieber, A.F. Marlow, and P.R. Seo of the NIST Chemical Sciences Division and by D. Broton, S. Nettles, M. Bharucha, and S. Padiyara of CTL, Skokie, IL.

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Gaithersburg, MD 20899
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Certificate Revision History on Last Page

Steven J. Choquette, Director
Office of Reference Materials

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

INSTRUCTIONS FOR STORAGE, HANDLING AND USE

Cement powder is hygroscopic; samples should be used immediately after opening. 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 over magnesium perchlorate or phosphorus pentoxide.

When a sample is taken from a vial, the LOI at 950 °C for that sample should be determined in accordance with ASTM C114 and the mass of the sample corrected for any gain or loss of moisture relative to the LOI value reported in Table 3. The samples for elemental analysis and LOI determination must come from the same vial, because LOI may differ from vial to vial. The correction calculation is shown as Equation 1, where m_{corr} = corrected mass of sample for elemental analysis, m_i = initial mass of sample for elemental analysis, and LOI_{lab} = loss on ignition at LOI at 950 °C determined in the laboratory and expressed in units of percent (%).

$$m_{corr} = m_i(1 - ((LOI_{lab} - 0.59)/100)) \quad (1)$$

Certified Mass Fraction Values: 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. The measurands are the mass fractions of the elements in cement listed in Table 1. Metrological traceability is to the SI derived unit for mass fraction (expressed as a percent). The uncertainty listed with each certified value is an expanded uncertainty based on a 95 % confidence interval [3] calculated as $U = ku_c$ where u_c is the combined standard uncertainty and $k = 2$ is a coverage factor. The expanded uncertainty is calculated by combining a between-method variance [4] with a pooled, within-method variance in accordance with the ISO/NIST Guide to the Expression of Uncertainty in Measurement [5].

Table 1. Certified Values for SRM 1883a Calcium Aluminate Cement

Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
SiO ₂	0.24 ± 0.09	MgO	0.19 ± 0.01
Al ₂ O ₃	70.04 ± 0.57	Na ₂ O	0.30 ± 0.01
Fe ₂ O ₃	0.078 ± 0.004	K ₂ O	0.014 ± 0.001
CaO	29.52 ± 0.86		

Reference Mass Fraction Values: The measurands are the mass fractions of the chemical constituents in cement listed in Table 2. Metrological traceability is to the SI derived unit for mass fraction (expressed as a percent). The uncertainty listed with each reference value is an expanded uncertainty based on a 95 % confidence interval [3], 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.

Table 2. Reference Values for SRM 1883a Calcium Aluminate Cement

Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
TiO ₂	0.020 ± 0.002	Cr ₂ O ₃	0.006 ± 0.001
SrO	0.019 ± 0.002		

Table 3. Information Values for SRM 1883a Calcium Aluminate Cement^(a)

Constituent	Mass Fraction (%)	Mass Fraction (%)
Mn ₂ O ₃	0.003	LOI at 950 °C
P ₂ O ₅	0.003	0.59

^(a) For this SRM, the total of the reported oxides plus the LOI is 100.78 %.

NOTICE TO USERS

NIST strives to maintain the SRM inventory supply, but NIST cannot guarantee the continued or continuous supply of any specific SRM. Accordingly, NIST encourages the use of this SRM as a primary benchmark for the quality and accuracy of the user's in-house reference materials and working standards. As such, the SRM should be used to validate the more routinely used reference materials in a laboratory. Comparisons between the SRM and in-house reference materials or working measurement standards should take place at intervals appropriate to the conservation of the SRM and the stability of relevant in-house materials. For further guidance on how this approach can be implemented, contact NIST by email at srms@nist.gov.

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/pubs/sp811/index.cfm> (accessed Sep 2019).
- [2] ASTM C 114-97, Standard Test Methods for Chemical Analysis of Hydraulic Cement, *Annu. Book ASTM Stand.* Vol. 04.01, West Conshohocken, PA.
- [3] Hahn, G.J., and Meeker, W.Q., "Statistical Intervals: A Guide for Practitioners," John Wiley & Sons, Inc., New York, (1991).
- [4] Rukhin, A.L. and Vangel, M.G., "Estimation of a Common Mean and Weighted Means Statistics," J. Amer. Stat. Assoc. (JASA), 93 (441), pp. 303-308, (1998).
- [5] 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/utis/common/documents/jcgm/JCGM_100_2008_E.pdf (accessed Sep 2019); 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/pubs/tn1297/index.cfm> (accessed Sep 2019).

Certificate Revision History: 06 September 2019 (Revision of Instructions for Storage, Handling and Use; editorial changes); 17 June 2019 (Change of expiration date; updated LOI value; editorial changes); 22 May 2014 (Extension of certification period; editorial changes); 19 November 1999 (Original certificate)

Users of this SRM should ensure that the Certificate of Analysis in their possession is current. This can be accomplished by contacting the SRM Program: Telephone (301) 975-2200; Fax (301) 948-3730; e-mail srminfo@nist.gov; or via the Internet <https://www.nist.gov/srm>.