National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 1882a

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 1882a consists of four sealed vials, each containing approximately 5 g of calcium aluminate cement.

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. 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 taken into account. The certified values listed are based on the results of analyses performed at NIST and at Construction Technology Laboratories, Inc. (CTL) 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 Values: The reference values for an additional five 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 Values: An information value for Loss on Ignition (LOI) is provided in Table 3. This is a noncertified value with no uncertainty reported as there is insufficient information to make an assessment of the uncertainty. The information value is given to provide additional characterization of the material.

Expiration of Certification: The certification of **SRM 1882a** 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 "Instructions for Handling and Use"). The certification will be nullified if the SRM is damaged, contaminated, or otherwise modified.

Maintenance of Certification: This material is considered to be stable during the period of 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) will facilitate notification.

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

Statistical consultation for this SRM was provided by S.D. Leigh 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.

Carlos A. Gonzalez, Chief
Chemical Sciences Division

Gaithersburg, MD 20899
Certificate Issue Date: 08 April 2014
Certificate Revision History on Last Page

Robert L. Watters, Jr., Director
Office of Reference Materials

INSTRUCTIONS FOR HANDLING AND USE

Because 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.

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.

Table 1. Certified Values for SRM 1882a Calcium Aluminate Cement

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

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 the 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/JCGM and NIST Guides to the Expression of Uncertainty in Measurement [5].

Table 2. Reference Values for SRM 1882a Calcium Aluminate Cement

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		

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 3. Information Value for SRM 1882a Calcium Aluminate Cement[(1)]

	Mass Fraction (%)
LOI at 950 °C	0.20

[(1)] For this SRM, the total of the reported oxides plus the LOI is 99.95 %.

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 http://physics.nist.gov/cuu/pdf/sp811.pdf (accessed April 2014).

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

[4] 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).

[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 http://www.bipm.org/utils/common/documents/jcgm/JCGM_100_2008_E.pdf (accessed April 2014); 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 http://www.nist.gov/pml/pubs/tn1297/index.cfm (accessed April 2014).

Certificate Revision History: 08 April 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 at http://www.nist.gov/srm