National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 342a

Nodular Cast Iron
(chip form)

This Standard Reference Material (SRM) is intended primarily for use in validation of chemical and instrumental methods of analysis for element contents of cast iron and materials of similar matrix. It can be used to validate value assignment of a laboratory's in-house reference materials. A unit of SRM 342a consists of one bottle containing approximately 150 g of chips produced by a milling machine.

Certified Mass Fraction Values: Certified values for constituents of SRM 342a are reported in Table 1 as mass fractions of the elements in an iron matrix [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 taken into account [2]. A certified value is the present best estimate of the true value. The certified values are metrologically traceable to the SI derived unit of mass fraction (expressed as percent). The expanded uncertainty estimates are expressed at a coverage level of approximately 95 %, calculated following the ISO/JCGM Guide [3−10].

Table 1. Certified Mass Fraction Values for SRM 342a Nodular Cast Iron (chip form)

Constituent	Mass Fraction (%)	Expanded Uncertainty (%)
Carbon, Graphitic (C)	1.377	0.018
Carbon, Total (C)	1.863	0.021
Chromium (Cr)	0.0335	0.0035
Copper (Cu)	0.1347	0.0060
Magnesium (Mg)	0.0700	0.0049
Manganese (Mn)	0.2740	0.0085
Molybdenum (Mo)	0.0057	0.0013
Nickel (Ni)	0.0583	0.0040
Phosphorus (P)	0.0187	0.0023
Silicon (Si)	2.733	0.025
Sulfur (S)	0.002141	0.000096
Titanium (Ti)	0.0200	0.0027

Expiration of Certification: The certification of **SRM 342a** is valid indefinitely within the measurement uncertainty specified, provided the SRM is handled and stored in accordance with instructions given in this certificate (see "Instructions for Handling, Storage and Use"). Periodic recertification of this SRM is not required. The certification is nullified if the SRM is damaged, contaminated, or otherwise modified.

Maintenance of SRM 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.

Carlos A. Gonzalez, Chief
Chemical Sciences Division

Gaithersburg, MD 20899
Certificate Issue Date: 25 October 2019
Certificate Revision History on Last Page

Steven J. Choquette, Director
Office of Reference Materials

Coordination of technical measurements for certification was performed by O. Menis and J.I. Shultz, formerly of NIST. Review and revision of values and uncertainty estimates was coordinated by J.R. Sieber of the NIST Chemical Sciences Division.

Statistical consultation for this SRM was provided by A. Possolo of the NIST Statistical Engineering Division.

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

INSTRUCTIONS FOR HANDLING, STORAGE AND USE

Nodular Cast Iron chips may be analyzed in the as-received form. Test methods used to characterize the material used sample quantities of 0.2 g or more. Before sampling, it is recommended to mix bottle contents by inverting and rotating the bottle by hand for at least one minute. A bottle containing unused material should be recapped immediately and stored at room temperature away from light.

To use the uncertainty estimates given in this certificate, divide the expanded uncertainty by a coverage factor of $k = 2$ to obtain the combined standard uncertainty. The effective degrees of freedom of the combined standard uncertainty are ≥ 60. Sulfur is an exception, because it has $k = 2.23$ with 10 degrees of freedom.

PREPARATION AND ANALYSIS[(1)]

The material for this SRM was furnished by the American Cast Iron Pipe Company (Birmingham, AL). The material was packaged at NIST by the Office of Reference Materials.

Analyses for certification were performed at NIST by J.R. Baldwin, D.A. Becker, B.B. Bendigo, E.R. Deardorff, W.R. Kelly, P.D. LaFleur, G. Lutz, E.J Maienthal, J.L. Mann, T.C. Rains, T.A. Rush, and R.D. Vocke, Jr. of the NIST Chemical Sciences Division. Additional analyses were performed by R.E. Deas, R.N. Smith and J.B. Hobby of the American Cast Iron Pipe Company (Birmingham, AL), and J.R. Boyd, R. Mast and D. Jones, of Clow Corporation (Coshocton, OH).

The test methods used at NIST and collaborating laboratories to determine the values for SRM 342a are listed in Table 2.

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 a laboratory's 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.

[(1)] Certain commercial equipment, instruments or materials are 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 materials or equipment identified are necessarily the best available for the purpose.

Table 2. Test Methods Employed in the Certification of SRM 342a Nodular Cast Iron (chip form)

Element	Test Methods Used at NIST and Collaborating Laboratories
Carbon (Total and Graphitic)	• Combustion/gravimetric • Combustion/volumetric
Chromium	• Redox/titrimetric after chromium separation • Redox/titrimetric
Copper	• Isotope dilution thermal ionization mass spectrometry • Molecular absorption spectrometry using diethyldithiocarbamate • Molecular absorption spectrometry using neocuproine
Magnesium	• Atomic absorption spectrometry • Activation analysis • Optical emission spectrometry using solution and rotating disk
Manganese	• Peroxydisulfate arsenite titration
Molybdenum	• Activation analysis • Molecular absorption spectrometry using thiocyanate
Nickel	• Molecular absorption spectrometry using dimethylglyoxime • Gravimetry
Phosphorus	• Molecular absorption spectrometry using molybdenum blue • Separation/titration of ammonium phosphomolybdate
Silicon	• Gravimetry, double perchloric acid dehydration • Gravimetry, perchloric acid dehydration • Gravimetry, sulfuric acid dehydration
Sulfur	• Isotope dilution thermal ionization mass spectrometry
Titanium	• Polarography • Molecular absorption spectrometry using H_2O_2 (vanadium separated by Na_2CO_3 fusion)

REFERENCES

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Certificate Revision History: 25 October 2019 (Update to certified values and uncertainty estimates for all constituents, except sulfur, editorial changes); 01 September 1999 (revision of the certified sulfur value and editorial changes); 25 March 1992 (editorial changes); 27 April 1970 (original certificate date); 06 December 1968 (provisional certificate date).

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 https://www.nist.gov/srm.