

CERTIFICATE OF ANALYSIS

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1.0 INORGANIC VENTURES is an ISO Guide 34 "General Requirements for the Competence of Reference Material Producers" and ISO 9001:2000 registered manufacturer. Our manufacturing laboratory is accredited to ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories."





2.0 **DESCRIPTION OF CRM** 1000 µg/mL Aluminum in 3% (v/v) HNO3

> Catalog Number: CGAL1-1, CGAL1-2, and CGAL1-5

Lot Number: C2-AL04078

Starting Material: Al ingot

99.998788 Starting Material Purity (%):

C14S012 Starting Material Lot No:

Matrix: 3% (v/v) HNO3

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: $1003 \pm 5 \mu g/mL$

1.017 g/mL (measured at 22° C) **Certified Density:**

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Certified Value (\square) = $\Sigma \underline{\mathbf{x}}_i$ (<u>¬</u>) = mean

x = individual results

n = number of measurements

Uncertainty (±) = $\frac{2[(\Sigma s_i)^2]^{1/2}}{(n)^{1/2}}$ Σs_i = The summation of all significant estimated errors

(Most common are the errors from instrumental measurement,

weighing, dilution to volume, and the fixed error reported on

the NIST SRM certificate of analysis.)

TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS 4.0

· "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

· This product is Traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

1003 ± 5 µg/mL 4.1 Assay Method #1

ICP Assay NIST SRM 3101a Lot Number: 060502

Assay Method #2 1002 ± 8 µg/mL

EDTA NIST SRM 928 Lot Number: 928

- **4.2 BALANCE CALIBRATION** All analytical balances are calibrated yearly by an A2LA accredited calibration laboratory and are traceable to a class E 2 analytical weight set with NIST Traceability No. 822/269558-04. All balances are checked daily using an in-house procedure. The weights used for testing are annually compared to master weights and are traceable to the National Institute of Standards and Technology (NIST).
- **4.3 THERMOMETER CALIBRATION** All thermometers are NIST traceable through thermometers that are calibrated by an A2LA accredited calibration laboratory.
- 4.4 GLASSWARE CALIBRATION An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM's.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN μg/mL

CRM's solutions are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

<u>s</u> Al	<u>M</u> Dy < _{0.03285}	<u>O</u> Li < 0.00020	<u>M</u> Pr < 0.00164	<u>M</u> Te < 0.16423
<u>M</u> Sb < _{0.00274}	<u>M</u> Er < _{0.02737}	<u>M</u> Lu < _{0.00219}	<u>M</u> Re < _{0.00547}	<u>M</u> Tb < 0.00164
<u>M</u> As < _{0.05474}	<u>M</u> Eu < 0.01642	<u>O</u> Mg 0.00029	<u>M</u> Rh < 0.00547	<u>M</u> TI < _{0.00547}
<u>M</u> Ba < _{0.05474}	<u>M</u> Gd < _{0.00547}	<u>O</u> Mn < _{0.00003}	<u>M</u> Rb < _{0.00547}	<u>M</u> Th < _{0.00547}
<u>O</u> Be < 0.00017	<u>M</u> Ga < _{0.00547}	<u>O</u> Hg < _{0.00700}	<u>M</u> Ru < 0.01095	<u>M</u> Tm < _{0.00219}
<u>M</u> Bi < _{0.00219}	<u>M</u> Ge < _{0.03285}	<u>M</u> Mo < _{0.01095}	<u>M</u> Sm < _{0.00547}	<u>M</u> Sn < _{0.02737}
<u>O</u> B < 0.01000	<u>M</u> Au < 0.01642	<u>M</u> Nd < 0.01095	<u>M</u> Sc < _{0.05474}	<u>O</u> Ti < _{0.00070}
<u>M</u> Cd < _{0.01642}	<u>M</u> Hf < 0.01095	<u>O</u> Ni < _{0.00600}	<u>M</u> Se < _{0.04380}	<u>M</u> W < 0.05474
<u>O</u> Ca 0.00216	<u>M</u> Ho < _{0.00274}	<u>M</u> Nb < 0.00274	<u>O</u> Si < 0.02000	<u>M</u> U < 0.01095
<u>M</u> Ce < _{0.02737}	<u>M</u> In < _{0.05474}	<u>n</u> Os	<u>M</u> Ag < 0.01095	<u>M</u> V < 0.01095
<u>M</u> Cs < _{0.00164}	<u>M</u> Ir < _{0.02737}	<u>M</u> Pd < _{0.02737}	<u>O</u> Na < _{0.10000}	<u>M</u> Yb < _{0.00547}
<u>O</u> Cr < _{0.00150}	<u>O</u> Fe < _{0.00200}	<u>O</u> P < _{0.03000}	<u>M</u> Sr < _{0.00274}	<u>M</u> Y < _{0.21898}
<u>M</u> Co < _{0.01642}	<u>M</u> La < _{0.00274}	<u>M</u> Pt < 0.01095	<u>O</u> S < _{0.10000}	<u>M</u> Zn 0.00818
<u>M</u> Cu < _{0.03285}	<u>M</u> Pb < 0.01642	<u>о</u> к _{0.00180}	<u>M</u> Ta < _{0.03832}	<u>M</u> Zr < _{0.02737}
M - Checked by ICP-MS	O - Checked by ICP-OES	i - Spectral Interference	n - Not Checked For	s - Solution Standard Element

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:

HPLC, IC, TLC, ISE, IR, NMR, UV/VIS, MS, Capillary Eletrophoresis, Potentiometry, Wet Chemistry and Voltammetry

For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact Technical Staff

This CRM was manufactured using 18 megohn doubly deionized water that has been filtered through a 0.2 micron filter.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4 °C. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 26.98154; +3; 6;Al(H2O)6+3

Chemical Compatibility - Soluble in HCl, HNO3, HF and H2SO4. Avoid neutral media. Soluble in strongly basic NaOH forming the Al(OH)4(H2O)21- species. Stable with most metals and inorganic anions. The phosphate is insoluble in water and only slightly soluble in acid.

Stability - 2-100 ppb levels stable for months in 1% HNO3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 2-5% HNO3 / LDPE container.

Al Containing Samples (Preparation and Solution) - Metal (Best dissolved in HCl / HNO3); α- Al2O3 (Na2CO3 fusion in Pt0); γ- Al2O3 (Soluble in acids such as HCl); Ores (Carbonate fusion in Pt0 followed by HCl dissolution); Organic Matrices (sulfuric/peroxide digestion or nitric / sulfuric / perchloric acid decomposition, or dry ash and dissolution in dilute HCl.

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	Estimated D.L.	Order	Type	Interferences (underlined indicates severe)
ICP-OES394.401 nm	0.05 / 0.006 μg/m	ıL 1	atom	U, Ce
ICP-OES396.152 nm	0.03 / 0.006 μg/m	ıL 1	atom	Mo, Zr, Ce
ICP-OES167.078 nm	0.1 / 0.009 μg/mL	. 1	ion	Fe
ICP-MS27 amu	30 ppt	n/a	M+	12C15N, 13C14N, 1H12C14N, 11B16O, 54Cr2+, 54Fe2+

Uranium Note: If uranium is present in this standard, it is natural abundance unless specified in Section 3.0.

- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Safety Data sheet for information regarding this CRM.
- **9.0 HOMOGENEITY** This solution was mixed according to an in house procedure and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

- 10.1 ISO 9001:2000 Quality Management System Registration
 - QMI Certificate Number 010105
- 10.2 ISO/IEC 17025:2005 "General Requirements for the Competence of Testing and Calibration"
 - Chemical Testing Accredited A2LA Certificate Number 883.01
- 10.3 ISO/IEC Guide 34 2000 "General Requirements for the Competence of Reference Material Producers"
 - Reference Materials Production Accredited A2LA Certificate Number 883.02
- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission
 - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission
 - Reporting Defects and Non-Compliance

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

- 11.1 Shelf Life The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies of chemically-stable solutions performed at the manufacturer's facility show a CRM shelf-life of twenty one months for solutions packaged in 125-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Manufacturer concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.
- 11.3 Chemical Stability Studies have been conducted on this or similar CRMs and it has been demonstrated that this CRM is chemically stable for a period of not less than two years provided the "Storage & Handling" conditions are followed that are described in section 7.0.

Certification Date: June 22, 2009 Expiration Date:

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Danny Feeny, Product

Documentation Technician

Certificate Approved By: Madeline Gozzi, Quality Control

Supervisor

Certifying Officer: Paul Gaines, PhD., Senior Technical

Director

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