INORGANIC VENTURES
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

tel: 800.669.6799 · 540.585.3030
fax: 540.585.3012
info@inorganicventures.com

1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO Guide 34, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (SAI Global File Number 010105).

ACCREDITED
Testing Laboratory
Certificate 883.01

ACCREDITED
Reference Material Producer
Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Mass Spec Solution
Catalog Number:	MSCO-10PPM
Lot Number:	D2-CO02035
Matrix:	3% (v/v) HNO3
Value/Analyte(s):	10 µg/mL Cobalt
Starting Material:	Co powder
Starting Material Lot#:	KW809COA1
Starting Material Purity:	99.9975%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 10.011 ± 0.062 µg/mL

Certified Density: 1.013 g/mL (measured at 20 ± 1 ºC)

Assay Information:

Assay Method #1

ICP Assay NIST SRM 3113 Lot Number: 00630

Assay Method #2

EDTA NIST SRM 928 Lot Number: 928

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

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.

$$\text{Certified Value } (\bar{x}) = \frac{\Sigma x_i}{n}$$

$$\text{Uncertainty } (\pm) = \frac{2\,[(\Sigma s_i)^2]^{\frac{1}{2}}}{(n)^{\frac{1}{2}}}$$

($\bar{x}$) = mean
x_i = individual results
n = number of measurements
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)

4.0 TRACEABILITY TO NIST

- 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/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

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

CRM/RMs 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.

M	Ag	<	0.007651	M	Eu	<	0.011476	O	Na		0.000016	i	Se	<	0.030603	O	Zn		0.000054
O	Al		0.000031	O	Fe	<	0.004000	M	Nb	<	0.001913	O	Si		0.000060	M	Zr	<	0.019127
i	As	<		M	Ga	<	0.003825	M	Nd	<	0.007651	M	Sm	<	0.003825				
M	Au	<	0.011476	M	Gd	<	0.003825	O	Ni		0.000011	M	Sn	<	0.019127				
O	B	<	0.040000	M	Ge	<	0.022952	n	Os	<		M	Sr	<	0.001913				
M	Ba	<	0.038254	M	Hf	<	0.007651	n	P	<		M	Ta	<	0.026778				
M	Be	<	0.001913	O	Hg	<	0.050000	M	Pb	<	0.011476	M	Tb	<	0.001148				
M	Bi	<	0.001530	M	Ho	<	0.001913	M	Pd	<	0.019127	M	Te	<	0.114761				
O	Ca		0.000041	M	In	<	0.038254	M	Pr	<	0.001148	M	Th	<	0.003825				
M	Cd	<	0.011476	M	Ir	<	0.019127	M	Pt	<	0.007651	M	Ti	<	0.191269				
M	Ce	<	0.019127	O	K		0.000019	M	Rb	<	0.003825	M	Tl	<	0.003825				
s	Co	<		M	La	<	0.001913	M	Re	<	0.003825	M	Tm	<	0.001530				
M	Cr	<	0.019127	O	Li		0.000003	M	Rh	<	0.003825	M	U	<	0.007651				
M	Cs	<	0.001148	M	Lu	<	0.001530	M	Ru	<	0.007651	M	V	<	0.007651				
M	Cu	<	0.022952	O	Mg		0.000024	n	S	<		M	W	<	0.038254				
M	Dy	<	0.022952	O	Mn		0.000009	M	Sb	<	0.001913	M	Y	<	0.153015				
M	Er	<	0.019127	M	Mo	<	0.007651	M	Sc	<	0.038254	M	Yb	<	0.003825				

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 and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Keep cap tightly sealed when not in use. Store and use at 20 ± 4° C. Do not pipette from the container. Do not return removed aliquots to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 58.93 +2 6 $Co(H_2O)_6^{2+}$

Chemical Compatibility -Stable in HCl, HNO_3, H_2SO_4 ,HF, H_3PO_4. Avoid basic media. Stable with most metals and inorganic anions

Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years

Co Containing Samples (Preparation and Solution) - Metal (soluble in HNO_3); Oxides (Soluble in HCl); Ores

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

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 59 amu	2 ppt	n/a	42Ca16O1H , 40Ar18O1H , 36Ar23Na, 43Ca16O, 24Mg35Cl
ICP-OES 228.616 nm	0.01/0.001 µg/mL	1	
ICP-OES 237.862 nm	0.01/0.002 µg/mL	1	W, Re, Al, Ta
ICP-OES 238.892 nm	0.01/0.002 µg/mL	1	Fe, W, Ta

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 10CFR50 Appendix B - Nuclear Regulatory Commission

- Domestic Licensing of Production and Utilization Facilities

10.2 10CFR21 - Nuclear Regulatory Commission

- Reporting defects and Non-Compliance

10.3 ISO 9001 Quality Management System Registration

- SAI Global File Number 010105

10.4 ISO/IEC Guide 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.5 ISO/IEC Guide 34 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

11.0 CERTIFICATION, EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

January 10, 2011

11.2 Expiration Date

11.3 Period of Validity

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is handled and stored in accordance with instructions given in Sec 7.0 and used prior to the date given in Sec 11.2. This certification is nullified if the CRM/RM is damaged, contaminated, or otherwise modified.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:

Danny Feeny
Product Documentation Technician

Certificate Approved By:

Madeline Gozzi
Technical Support

Certifying Officer:

Paul Gaines
PhD., Senior Technical Director