

**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).



**2.0 PRODUCT DESCRIPTION**

Product Code: Single Analyte Mass Spec Solution  
 Catalog Number: MSBE-100PPM  
 Lot Number: J2-BE02042  
 Matrix: 3% (v/v) HNO3  
 Value / Analyte(s): 100 µg/mL ea:  
 Be  
 Starting Material: Be Acetate  
 Starting Material Lot#: 1858  
 Starting Material Purity: 99.9998%

**3.0 CERTIFIED VALUES AND UNCERTAINTIES**

**Certified Value:** 100.06 ± 0.55 µg/mL  
**Certified Density:** 1.015 g/mL (measured at 20 ± 1 °C)

**Assay Information:**

ANALYTE	METHOD	NIST SRM#	SRM LOT#
Be	ICP Assay	3105a	090514

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.

**Characterization of CRM/RM by Two Methods**

Certified Value,  $X_{CRM/RM}$ , where two methods of characterization are used is the weighted mean of the two results:

$$X_{CRM/RM} = [(w_a)(X_a) + (w_b)(X_b)]$$

$X_a$  = mean of Assay Method A with standard uncertainty  $u_{char a}$

$X_b$  = mean of Assay Method B with standard uncertainty  $u_{char b}$

$w_a$  and  $w_b$  = the weighting factors for each method calculated using the inverse square of the variance:

$$w_a = (1/u_{char a})^2 / ((1/u_{char a})^2 + (1/u_{char b})^2)$$

$$w_b = (1/u_{char b})^2 / ((1/u_{char a})^2 + (1/u_{char b})^2)$$

$$CRM/RM \text{ Expanded Uncertainty } (\pm) = U_{CRM/RM} = k (u_{char a\&b}^2 + u_{bb}^2 + u_{lts}^2 + u_{sts}^2)^{1/2}$$

k = coverage factor = 2 in all cases at Inorganic Ventures

$u_{char a\&b} = [(w_a)^2 (u_{char a})^2 + (w_b)^2 (u_{char b})^2]^{1/2}$  where  $u_{char a}$  and  $u_{char b}$  are the square root of the sum of the squares of errors from characterization which include instrument measurement, density, NIST SRM uncertainty, weighing, and volume

$u_{bb}$  = bottle to bottle homogeneity standard uncertainty

$u_{lts}$  = long term stability standard uncertainty (storage)

$u_{sts}$  = short term stability standard uncertainty (transportation)

**Characterization of CRM/RM by One Method**

Certified Value,  $X_{CRM/RM}$ , where one method of characterization is used is the mean of individual results:

$$X_{CRM/RM} = \text{mean of Assay Method A with standard uncertainty } u_{char a}$$

$$CRM/RM \text{ Expanded Uncertainty } (\pm) = U_{CRM/RM} = k (u_{char a}^2 + u_{bb}^2 + u_{lts}^2 + u_{sts}^2)^{1/2}$$

k = coverage factor = 2 in all cases at Inorganic Ventures

$u_{char a}$  = square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume

$u_{bb}$  = bottle to bottle homogeneity standard uncertainty

$u_{lts}$  = long term stability standard uncertainty (storage)

$u_{sts}$  = short term stability standard uncertainty (transportation)

**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 < 0.001190	M Eu < 0.000238	O Na 0.000760	M Se < 0.002379	O Zn 0.000362
O Al 0.000086	O Fe 0.000233	M Nb < 0.000476	O Si 0.000307	M Zr < 0.000714
M As < 0.007137	M Ga < 0.000238	M Nd < 0.000238	M Sm < 0.000238	
M Au < 0.000238	M Gd < 0.000238	O Ni < 0.002426	M Sn < 0.001190	
M B < 0.004758	M Ge < 0.000238	n Os <	O Sr 0.000002	
O Ba < 0.004852	M Hf < 0.000238	O P < 0.060650	M Ta < 0.000238	
s Be <	O Hg < 0.011281	M Pb < 0.001190	M Tb < 0.000238	
M Bi < 0.000238	M Ho < 0.000238	M Pd < 0.004758	M Te < 0.011895	
O Ca 0.000208	M In < 0.000238	M Pr < 0.000238	M Th < 0.000238	
O Cd < 0.000607	M Ir < 0.000238	M Pt < 0.000238	M Ti < 0.007137	
M Ce < 0.000238	O K 0.000613	M Rb < 0.000238	M Tl < 0.000238	
O Co < 0.000728	M La < 0.000238	M Re < 0.000238	M Tm < 0.000238	
O Cr 0.000031	O Li < 0.001213	M Rh < 0.000238	M U < 0.001190	
M Cs < 0.000476	M Lu < 0.000238	M Ru < 0.000238	M V < 0.000476	
O Cu < 0.003033	O Mg 0.000037	i S <	M W < 0.000714	
M Dy < 0.000238	O Mn < 0.000121	M Sb < 0.000238	M Y < 0.000238	
M Er < 0.000238	M Mo < 0.000714	O Sc < 0.000121	M Yb < 0.000238	

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** - 9.01 +2 4 Be+(H2O)4+2

**Chemical Compatibility** -Soluble in HCl, HNO3, H2SO4 and HF aqueous matrices. Stable with all metals and inorganic anions.

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

**Be Containing Samples (Preparation and Solution)** - Meta I(is best dissolved in diluted H2SO4 ); BeO (boiling nitric, hydrochloric, or sulfuric acids or KHSO4 fusion); Ores (H2SO4/HF digestion or carbonate fusion in Pt0); Organic Matrices (sulfuric/peroxide digestion or nitric/sulfuric/perchloric acid decomposition, or dry ash and dissolution according to the BeO procedure above).

**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 9 amu	4 ppt	N/A	
ICP-OES 234.861 nm	0.0003/0.00016 µg/mL	1	Fe, Ta, Mo
ICP-OES 313.042 nm	0.0003/0.00009 µg/mL	1	V, Ce, U
ICP-OES 313.107 nm	0.0007/0.0005 µg/mL	1	Ce, Th, Tm

**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**

August 18, 2015

**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:**

James King Jr  
Product Documentation Supervisor



**Certificate Approved By:**

Michael Booth  
QC Supervisor



**Certifying Officer:**

Paul Gaines  
PhD., Senior Technical Director

