

### 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: Multi Analyte Custom Grade Solution

Catalog Number: IV-STOCK-28

Lot Number: J2-MEB603034

Matrix: 1% (v/v) HNO<sub>3</sub>  
10% (v/v) HCl

Value / Analyte(s): 10 µg/mL ea:  
Gold, Hafnium, Iridium,  
Palladium, Platinum, Rhodium,  
Ruthenium, Antimony, Tin,  
Tellurium

### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

ANALYTE	CERTIFIED VALUE	ANALYTE	CERTIFIED VALUE
Antimony, Sb	10.00 ± 0.07 µg/mL	Gold, Au	10.00 ± 0.04 µg/mL
Hafnium, Hf	10.00 ± 0.06 µg/mL	Iridium, Ir	10.01 ± 0.05 µg/mL
Palladium, Pd	10.00 ± 0.05 µg/mL	Platinum, Pt	10.00 ± 0.05 µg/mL
Rhodium, Rh	10.00 ± 0.06 µg/mL	Ruthenium, Ru	10.00 ± 0.06 µg/mL
Tellurium, Te	10.00 ± 0.06 µg/mL	Tin, Sn	10.00 ± 0.05 µg/mL

**Certified Density:** 1.022 g/mL (measured at 20 ± 1 °C)

**Assay Information:**

ANALYTE	METHOD	NIST SRM#	SRM LOT#
Au	ICP Assay	3121	991806
Au	Calculated		See Sec. 4.2
Hf	ICP Assay	3122	080430
Hf	Calculated		See Sec. 4.2
Ir	ICP Assay		in - house std
Pd	ICP Assay	3138	090629
Pt	ICP Assay	3140	000615
Pt	Calculated		See Sec. 4.2
Rh	ICP Assay	3144	070619
Ru	ICP Assay		in-house std
Sb	ICP Assay	3102A	061229
Sb	Calculated		See Sec. 4.2
Sn	ICP Assay	3161a	070330
Te	ICP Assay	3156	892901
Te	Calculated		See Sec. 4.2

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 by two independent methods

#### Characterization of CRM by one method

##### 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)

N/A

## **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  $20 \pm 4^{\circ}$  C. Do not pipette from the container. Do not return removed aliquots to container.

## **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**

November 19, 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:**

Joseph Burns  
TSG Technician



**Certificate Approved By:**

Michael Booth  
QC Supervisor



**Certifying Officer:**

Paul Gaines  
PhD., Senior Technical Director

