Certificate of Analysis

ISO Guide 34 Certified Reference Material

Product Number: ICUS-5094
Lot Number: AU-01049
Lot Issue Date: 20-Jul-2016
Expiration Date: 31-Aug-2023

Product Name: ULTRAgold™ Cerium Standard

Description:
This Certified Reference Material (CRM) was gravimetrically prepared in accordance with ISO Guide 34 and under ULTRA Scientific's ISO 9001 registered quality system. The neat materials used for this product have been verified by ULTRA's ISO 17025 laboratory and under ULTRA's ISO Guide 34 accreditation. The analyte concentrations were verified by ULTRA's ISO 17025 accredited laboratory. For each analyte, the certified value is reported with its uncertainty value calculated as the expanded uncertainty, in accordance with ISO Guide 35.

Analyte	Starting Material	Lot Number	Purity (%)	Calculated Value	Certified Value	Traceability & Method
cerium	cerium (III) nitrate	RM07893	99.99%	1001 µg/mL	1001 ± 20 µg/mL	NIST 3110; ICP-OES

Solvent: water with dilute nitric acid

Non-Certified Values:

Trace Metallic Impurities in Solution Standard in µg/mL

*___	Ag	<0.005 ND	n___	Ga		*___	Nb	<0.005 ND	n___	S				
*___	Al	<0.028 D	*___	Ge	<0.005 D	n___	Os		*___	Sb	<0.005 ND			
*___	As	<0.005 ND	*___	Au	<0.005 ND	*___	Pd	<0.005 ND	*___	Sr	<0.02 D			
*___	Ba	<0.005 D	*___	Hf	<0.005 ND	n___	P		*___	Tb	<0.006 ND			
*___	Be	<0.005 ND	*___	Ho	<0.005 ND	*___	Pt	<0.005 ND	*___	Tl	<0.005 ND			
*___	Bi	<0.005 ND	*___	In	<0.005 ND	*___	K	<0.006 ND	*___	Th	<0.005 ND			
*___	B	<0.005 D	n___	Ir		*___	Pr	<0.028 D	*___	Tm	<0.005 ND			
*___	Cd	<0.005 ND	*___	Fe	<0.005 D	*___	Re	<0.005 ND	*___	Sn	<0.005 ND			
*___	Cs	<0.005 ND	*___	La	<0.01 D	*___	Rh	<0.005 ND	*___	Ti	<0.005 ND			
*___	Ca	<0.02 D	*___	Pb	<0.005 D	*___	Rb	<0.005 ND	*___	W	<0.005 ND			
s___	Ce		*___	Li	<0.005 ND	*___	Ru	<0.005 ND	*___	U	<0.005 ND			
*___	Cr	<0.005 D	*___	Lu	<0.005 ND	*___	Sm	<0.005 D	*___	V	<0.005 ND			
*___	Co	<0.005 ND	*___	Mg	<0.005 D	*___	Sc	<0.005 ND	*___	Yb	<0.005 ND			
*___	Cu	<0.005 ND	*___	Mn	<0.005 ND	n___	Se		*___	Y	<0.005 ND			
*___	Dy	<0.005 ND	n___	Hg		*___	Si	<0.005 ND	*___	Zn	<0.01 D			
*___	Er	<0.005 ND	*___	Mo	<0.005 ND	*___	Na	<0.01 D	*___	Zr	<0.006 D			
*___	Eu	<0.005 ND	*___	Nd	<0.006 D									
*___	Gd	<0.02 ND	*___	Ni	<0.005D									

* - element checked; i - spectral interference; n – element not checked; D – element detected; ND – element not detected; s - standard element

Storage: Store at Room Temperature (15° to 30°C).

ANAB ACCREDITED ISO GUIDE 34 REFERENCE MATERIAL PRODUCER
ANAB ACCREDITED ISO/IEC 17025 TESTING LABORATORY

250 Smith Street North Kingstown, Rhode Island 02852 **www.agilent.com/quality**

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Traceability:
Traceability has been established through an unbroken chain of comparisons, each having stated uncertainties. Comparisons are based on appropriate physical or chemical measurements, including gravimetric or volumetric dilution, where the mass or volume of a solution before and after dilution is measured. The balances used for these measurements are calibrated with weights traceable to NIST in compliance with ANSI/NCSL Z-540-1, ISO 9001, ISO 17025, and ISO Guide 34. Calibrated Class A glassware is used for volumetric measurements. Thermometers are calibrated against a NIST traceable thermometer in accordance with NIST Special Publication 819.

Estimation of Uncertainties:
Uncertainties in certified values are estimated in accordance with ISO Guides 34 and 35, and include assessments of the uncertainty contributions resulting from the gravimetric characterization of the reference material (u_{char}), the packaging of the reference material into individual units (u_{bb}), the transportation of the reference material to the end user (u_{sts}), and the long term storage of the reference material (u_{lts}). The uncertainty (U) is reported as an expanded uncertainty, calculated as:

$$U = \mathrm{k}\sqrt{u_{char}^2 + u_{bb}^2 + u_{sts}^2 + u_{lts}^2}$$

using the coverage factor k =2, which gives a level of confidence of approximately 95%.

Homogeneity:
This CRM was formulated and unitized according to an in-house procedure. The component of uncertainty for homogeneity is derived from within-unit and between-unit variability resulting from statistical analyses on 10 samples tested in triplicate. The resulting standard uncertainty (u_{bb}) is used to calculate the total expanded uncertainty (U) as described above. There is no minimum sub-sample size required.

Intended Use:
This CRM is intended as a calibration standard for the quantitative determination of the analytes listed, and for the preparation of working reference samples for use in routine laboratory analyses, calibration of instruments, validation of analytical methods, assessments of measurement methods and continuing calibration verification.

Instructions for Use:
Sample aliquots for analysis should be withdrawn at 20°C to 25°C immediately after opening and should be processed without delay for the certified value to be valid within the stated uncertainties. Do not pipet from the bottle. Do not return any material removed for pipetting to the bottle. Tightly cap the bottle after removing any material and store according to the instructions noted above.

Hazards:
Refer to the Safety Data Sheet for information regarding this CRM.

Expiration of Certification:
The certification of this CRM is valid, within the measurement uncertainty specified, until the expiration date specified above, provided the CRM is handled and stored in accordance with the instructions given in this certificate. This certification is nullified if the CRM is damaged, contaminated, or otherwise modified.

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Maintenance of Certification:
The real-time, long term stability of the CRM may be monitored over the lifetime of the certification. If substantive changes occur that affect the certification before the expiration of this certificate, ULTRA Scientific will notify the purchaser.

John Russo
President

Peter A. King, Ph.D.
VP, Technical Operations

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