Certificate of Analysis

ISO Guide 34 Reference Material

Product Number: ICP-172
Lot Number: CS-1546

Lot Issue Date: 02-Apr 2018
Expiration Date: 30-Apr 2025

Product Name: Hafnium Standard

Description:
This Reference Material (RM) 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 true value, with its uncertainty value calculated at the 95% confidence level, is reported below.

Analyte	Starting Material	Lot Number	Purity (%)	Analyte Concentration	Traceability & Method
hafnium	hafnium oxide	RM13777	99.999%	10000 ± 20 µg/mL	NIST SRM 3122; ICP-OES

Solvent: water with trace hydrofluoric acid in low TOC water (< 50 ppb)

Non-Certified Values:

Density: 1.0129 g/mL @ 20.00 ± 0.05°C

Trace Metallic Impurities in Solution Standard in µg/mL

*___	Al	<0.250 D	*___	Ga	<0.005 ND	n___	Nb		n___	S	
*___	Sb	<0.005 ND	n___	Ge		n___	Os		n___	Ta	
*___	As	<0.005 ND	n___	Au		*___	Pd	<0.005 ND	n___	Te	
*___	Ba	<0.005 ND	s___	Hf		*___	P	<0.005 ND	n___	Tb	
*___	Be	<0.005 ND	n___	Ho		*___	Pt	<0.005 ND	*___	Tl	<0.005 ND
*___	Bi	<0.005 ND	*___	In	<0.005 ND	*__	K	<0.005 ND	n___	Th	
*___	B	<0.005 ND	n___	Ir		n___	Pr		n___	Tm	
*___	Cd	<0.005 ND	*___	Fe	<0.005 ND	n___	Re		*___	Sn	<0.005 ND
n___	Cs		n___	La		n___	Rh		*___	Ti	<0.250 D
*___	Ca	<0.005 ND	*___	Pb	<0.005 ND	n___	Rb		n___	W	
n___	Ce		*___	Li	<0.005 ND	n___	Ru		n___	U	
*___	Cr	<0.005 ND	n___	Lu		n___	Sm		*___	V	<0.005 ND
*___	Co	<0.005 ND	*___	Mg	<0.005 ND	n___	Sc		n___	Yb	
*___	Cu	<0.005 ND	*___	Mn	<0.005 ND	*___	Se	<0.005 ND	n___	Y	
n___	Dy		*___	Hg	<0.005 ND	*___	Si	<0.250 D	*___	Zn	<0.005 ND
*___	Er	<0.005 ND	*___	Mo	<0.005 ND	*___	Ag	<0.005 ND	n___	Zr	<0.750 D
*___	Eu	<0.005 ND	*___	Nd		*___	Na	<0.005 ND			
n___	Gd		*___	Ni	<0.005 ND	*___	Sr	<0.005 ND			

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

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

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:
The true value is reported, with its uncertainty value calculated at the 95% confidence level.

Homogeneity:
This RM was formulated and unitized according to an in-house procedure and is guaranteed to be homogeneous. There is no minimum sub-sample size required.

Intended Use:
This RM is intended 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 true 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 RM.

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

Maintenance of Certification:
The real-time, long term stability of the RM 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

Monica Bourgeois
Director of QA/RA

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