



Certificate of Analysis

AR 651

TITANIUM REFERENCE CRM

LOT # 1018C

% OXYGEN

MEAN = 0.1262

Standard Deviation = +/- 0.0021

Expanded Uncertainty = +/- 0.0053

(k=2, @ 95% confidence) (n=40)

% NITROGEN

MEAN = 0.0065

Standard Deviation = +/- 0.0011

Expanded Uncertainty = +/- 0.0025

(k=2, @ 95% confidence) (n=54)

% HYDROGEN

MEAN = 0.0029

Standard Deviation = +/- 0.0002

Expanded Uncertainty = +/- 0.0004

(k=2, @ 95% confidence) (n=31)

Method of Analysis is ASTM E 1409-13, E 1447-09, ARI 034, and ARI 036

Primary (NMI) Standards used for traceability:

| | |
|----------|------------|
| NIST SRM | 360b, 2452 |
| BCR CRM | 24c, 276 |
| BCS CRM | 356 |
| NCS | NS57101 |

ALPHA - AR651-1213A, AR647-917A, AR650-718A, AR651-316C, AR648-217E, AR650-1116B, AR650-615C, AR635-1017A, AR631-1216B

The intended use of this reference standard is for the calibration and validation of inert gas fusion, InfraRed (Oxygen), and Thermal Conductivity (Nitrogen, Hydrogen) detection analyzers as described in the above ASTM methods. The mean analytical values were derived by separate data sets showing traceability to the above-mentioned reference standards and reported in mass fraction. Metrological traceability is to the SI derived unit of mass fraction expressed as percent. The precision values represent the estimated mean value and uncertainty derived from the data sets utilizing ANOVA, ISO Guide 35, and the Guide to Uncertainty Measurement. Refer to your test method for the expanded method derived uncertainty if needed. When necessary, professional judgment is applied toward consideration of data and statistical information. The statistical analysis and the overall direction and coordination of the analytical measurements leading to certification were performed by K.E. Dyer, Chief Chemist, at Alpha Resources.

The material used in production of this reference standard was identified in accordance with ARI 032. The samples for round robin testing were selected in accordance with ARI 014. The above values relate only to the material used to produce this standard. This bottle consists of 10g material in .1g (nominal) pins and is to be used directly from the bottle without preparation. Multiple pins may be used per test method requirements, with a minimum sample size of 1 pin. While unable to determine a definite shelf life, this reference should be reviewed every 25 years from the date of certification. Keep sealed and store under normal laboratory conditions. This reference material was produced in accordance to ISO 17034 and ISO Guide 31.

This is a Certified Reference Material and is traceable to the above-mentioned standards. For good laboratory practice, it is recommended that all standards be verified as fit for purpose prior to use. These test results are accredited under the Alpha Resources LLC laboratory ISO/IEC 17025 and ISO 17034 accreditation (RMP) issued by ANSI-ASQ/ANAB. Refer to certificate and scope of accreditation(s) AT-1200 and AR-1920. Remedies for any claimed defect in this product will be limited to product replacement or refund of the purchase price. In no event, shall Alpha Resources be liable for incidental or consequential damages. This certificate cannot be reproduced except in full.

Certified October 1, 2019

Kent Dyer, Chief Chemist