



Certificate of Analysis

AR 148

OXYGEN & SULFUR IN COPPER PIN STANDARD

LOT # 518B

% OXYGEN

MEAN = 0.0493

Standard Deviation = ± 0.0009

Expanded Uncertainty = ± 0.0020

(k=2, @ 95% confidence, n=37)

% SULFUR

MEAN = 0.0013

Standard Deviation = ± 0.0002

Expanded Uncertainty = ± 0.0005

(k=2, @ 95% confidence, n=45)

ASTM METHODS: E2575-08, E1019-18

ALPHA: ARI033 and ARI034

Primary (NMI/17034) Reference Standards Employed:

| | |
|------|--------------------------|
| NIST | 885, 495, 1034 |
| NCS | NS11035 |
| INFM | Cu S-20, Cu 600, Cu600/1 |
| EURO | CRM 17b, CRM 222 |

ALPHA - AR149-1116C, AR149-517E, AR149-715B, AR149-534985510

This copper pin reference standard is intended to be a calibration or QC validation of Oxygen and Sulfur by the ASTM test methods listed. The analytical sample and minimum size used for testing was 1 pin (1g nominal). The precision values represent the estimated mean, standard deviation, and expanded uncertainty derived from data sets using ISO Guide 35, ANOVA, and the Guide to Uncertainty Measurement for guidance of calculations. Refer to your test method and or your instrument manufacturer for the expanded method derived uncertainty. 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 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 reference standard. This reference contains 100g, 1g pins (nominal), to be used directly from the bottle with no preparation. 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 Guide 31. 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.

This is a CRM and is traceable to the above-mentioned reference materials. 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's 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.

Certified January 7, 2019

Chief Chemist