

## Titanium Pin Certified Reference Material

Product No: AR588

Lot No: 240531

### Material and Intended Use

AR588 is a titanium pin certified reference material (CRM). The intended use of this CRM is for the verification and calibration of combustion and inert gas fusion for the determination of carbon and hydrogen, respectively. This CRM can also be used to validate value assignment of in-house reference materials. A unit consists of one bottle containing 25 g of pins of nominal mass 0.25 g. All reference materials should be verified as fit for purpose prior to use.

### Reported Values

Certified values for AR588 are given in Table 1. The values for the elements indicate the amount of the element in the material matrix as determined using combustion and inert gas fusion (1) and are metrologically traceable to the International System of Units (SI) derived unit of mass fraction expressed as percent (%). Certified values are reported as  $x \pm U_{95\%}$ , where  $U_{95\%}$  is half the 95 % coverage interval around the certified value. The expanded uncertainty is  $U_{95\%} = ku_c$ , with the combined standard uncertainty,  $u_c$ , multiplied by the expansion factor  $k = 2$ . The true value of the analyte is believed to lie within the interval  $x \pm U_{95\%}(x)$  with approximately 95 % confidence. The estimation of combined standard uncertainty ( $u_c$ ) includes contributions from material heterogeneity, calibration, measurement, and other factors (2-3). Sampling and calculation of reported values for each measurand were performed using practices consistent with ISO 17034:2016 (4) and ISO 33405:2024 (5).

**Table 1. Certified values for AR588, Lot 240531.**

| Property   | Value  | $U_{95\%}$ |
|------------|--------|------------|
| % Carbon   | 0.0091 | 0.0030     |
| % Hydrogen | 0.0178 | 0.0019     |

Chemical measurement processes used in development of this CRM were validated using the following reference materials: NIST 2432, NIST 649, NIST 2431, AR588-121b, WHRM-TJa, NIST 2453a.

### Instructions for Use

This product requires no preparation prior to use. Bottles of pins should be kept sealed tight and stored in a cool, dry location.

For propagation of uncertainty, an estimate of the combined standard uncertainty can be obtained as  $u_c = U_{95\%}(x)/k$ , where  $k = 2$  is the approximate coverage factor associated with the 95 % coverage level. The resulting value for  $u_c$  is at the level of one standard deviation, and it can be combined with a laboratory's standard uncertainty estimates for their own sources of error to calculate estimates of uncertainty for test results from methods with which this CRM was used. A laboratory uncertainty estimate that includes the uncertainty of the CRM value is the basis for a link of metrological traceability from the test result for a sample to the CRM value.

### Minimum Sample Size

It is recommended that no less than 1 pin of CRM material be used for destructive test methods.

### Period of Validity

This certification is valid for 20 years from the initial certification date, within the measurement uncertainties specified, provided the CRM is handled and stored in accordance with the instructions given in this certificate (see "Instructions for Use"). Accordingly, periodic recalibration or recertification of this CRM is not required. The certification is nullified if the CRM is damaged, contaminated, or otherwise modified.

### Homogeneity

This product was manufactured from a single heat lot of commercial wire. Samples were randomly selected using practices consistent with ISO 33405:2024. Homogeneity was evaluated by replicate analysis. Within- and between-sample variance was evaluated using Analysis of Variance (ANOVA).

**Maintenance of the Reference Material Certificate**

Alpha Resources will monitor this CRM throughout the period of its availability. If substantive technical changes occur that affect the value assignment, AR will notify the purchaser via the information available on the included registration form (see attached sheet or register online).

*Users of this CRM should ensure the Reference Material Certificate in their possession is current. This can be accomplished by contacting Alpha Resources at the following: Telephone - (269) 465-5559; Email - [info@alpharesources.com](mailto:info@alpharesources.com); or via the Internet - <https://www.alpharesources.com>.*

**Methods and References**

- (1) ARI-LAB-621 – Alpha Resources Method, Carbon and Sulfur Determination by Induction Furnace Combustion/IR Detection; ARI-LAB-623 – Alpha Resources Method, Hydrogen Analysis.
- (2) JCGM 100:2008; Evaluation of Measurement Data – Guide to the Expression of Uncertainty in Measurement; (GUM 1995 with Minor Corrections), Joint Committee for Guides in Metrology (JCGM) (2008); available at [https://www.bipm.org/utis/common/documents/jcgm/JCGM\\_100\\_2008\\_E.pdf](https://www.bipm.org/utis/common/documents/jcgm/JCGM_100_2008_E.pdf) (accessed February 2025)
- (3) JCGM 101:2008; Evaluation of Measurement Data – Supplement 1 to the Guide for the Expression of Uncertainty in Measurement; Propagation Distributions Using a Monte Carlo Method; Joint Committee for guides in Metrology (JCGM) (2008); available at [https://www.bipm.org/utis/common/documents/jcgm/JCGM\\_100\\_2008.pdf](https://www.bipm.org/utis/common/documents/jcgm/JCGM_100_2008.pdf) (accessed February 2025).
- (4) ISO 17034:2016 – General requirements for the competence of reference material producers.
- (5) ISO33405:2024 – Reference materials – Approaches for characterization and assessment of homogeneity and stability.



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**Certification Date:** March 06, 2025



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