



Certificate of Analysis

AR-4022

CARBON AND SULFUR IN LIMESTONE CRM

LOT # 519E

% CARBON

MEAN = 7.15

Expanded Uncertainty = ± 0.47
(k=2, 95% confidence) (n=57)

% SULFUR

MEAN = 0.052

Expanded Uncertainty = ± 0.014
(k=2, 95% confidence) (n=41)

The intended use is for Carbon and Sulfur determination in limestone or other similar materials using induction and resistance type oxygen combustion furnaces with infrared detection. Accelerants like Tungsten Tri-oxide (WO₃) were used in the resistance furnace. Tungsten metal and iron chip accelerators were used in the induction analysis.

Method of analysis ASTM E1915-13 and ARI-033.

Standards Employed for traceability:

| | |
|------|-------------------------------------|
| NIST | 1d |
| NCS | DC28009, DC28234b, DC14019, DC28011 |
| ECRM | 701-1, 702-1 |

ALPHA - AR4012-52199, AR4019-61499, AR4014-42899, AR4022-101102, AR4023-100902

The mean analytical values were derived by data sets showing traceability to the above-mentioned reference standards and reported in mass fraction. The precision values are derived using ISO Guide 35, the Guide to Uncertainty Measurement, and ANOVA. Metrological traceability is to the SI derived unit of mass fraction expressed as percent. Refer to your test method or instrument manufacturer 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.

Sample size and minimum sample size for this data was 150-300mg nominal. Refer to your instrument manufacturer for typical sample analysis size. This bottle contains 25g of fine powder to be used directly from the bottle without preparation. Keep sealed and store under normal laboratory conditions. While unable to determine a definite shelf life this reference should be reviewed 20 years from certification.

The material used in production of this standard was sampled 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. 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 its entirety.

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. This CRM was produced in accordance to ISO Guide 31, and ISO 17034 see certificate AR-1920.

Certified October 17, 2019

Chief Chemist