Application Note EDXRF1419

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EDXRF1419 - Sulfur, Chlorine, and Ash in Coal

Scope

This application note demonstrates the measurement of sulfur (S), chlorine (Cl), and predicted ash content in unburned coal using NEX QC+.

Background

Ash consists of the metal oxides and heavier elements that remain after combustion removes the organic, gaseous, and volatile components. Coal quality and pricing depends on sulfur, chlorine, and ash content of the coal. These parameters also indicate the origin and type of coal, as well as combustion properties in the furnace, kiln, or boiler. EDXRF offers a fast, simple, and affordable method of measuring the sulfur and chlorine content and predicting the % ash content, without the need for radioisotopes or long combustion analytical methods.

Calibration

To create calibration standards, two homogeneous splits are taken from a homogeneous bulk sample. One split is ashed to determine the % ash content. This % ash number is then assigned to the unburned split as an assay for use as an XRF calibration standard and the unburned split is assayed for S and Cl content.

Calibration is performed only once, and then refreshed once a year. Daily operation measuring unknowns is then fast and simple, requiring no special technical knowledge.

To demonstrate a mixed calibration, 15 assayed standards were acquired from various regions in Europe, Russia, and the Americas and used for the empirical calibrations. % Ash measurements were automatically optimized based on the measurement of other major and minor elements present in the coal, such as Si, P, Ca, Ti, Fe, Br, and Sr. For optimum

results, separate calibrations may be required for each different coal type of interest. For example, separate calibrations for lignite and bituminous coal.

Standard ID	Type/Region
0136	Blended coal
0202	English
0205	English (with pyrite)
0203	English
0213	Blended coal
0218	Blended coal
0226	USA
0220	USA/Scottish blend
0225	USA/Russian blend
0212	Colombian
0249	Russian
0250	Ukrainian
0248	English
0239	Scottish
0111	USA

Calibration range

Element	Concentration range
S	0.30 – 2.11 %
Cl	0.03 – 0.26 %
Ash	6.03 – 12.05 %

Repeatability

To demonstrate repeatability, five calibration standards were selected to show the lower and higher levels of S, Cl, and, % ash concentration ranges. Each was measured in 10 repeat analyses without moving the sample between measurements to determine an average value for precision.

Standard	% S assay value	% S average value	Standard dev	% Relative dev
0205	1.60	1.58	0.010	0.6

0203	1.92	1.94	0.012	0.6
0248	1.20	1.21	0.005	0.4

Standard	% Cl assay value	% Cl average value	Standard dev	% Relative dev
0205	0.01	0.019	0.0005	5.0
0203	0.50	0.506	0.0009	0.2
0248	0.03	0.028	0.0004	1.3

Standard	% Ash assay value	% Ash average value	Standard dev	% Relative dev
0205	7.54	7.48	0.299	3.4
0203	8.62	8.94	0.432	5.0
0248	12.14	12.31	0.353	2.9

Conclusion

The NEX QC+ offers the lab analyst or field operator at the site a simple and fast tool for measuring sulfur and chlorine and predicting % ash content in coal quickly and easily without the use of radioisotopes. The versatility of the NEX QC+ EDXRF analyzer also allows for report of elemental and oxide concentrations as well, provided element and oxide assay values are available for the set of calibration standards.

Related products

NEX QC II Series

Compact, intuitive benchtop EDXRF for everyday elemental testing