Application Note EDXRF1286

View on rigaku.com

EDXRF1286 - Iron in Ore

Scope

The analysis of iron in ore, concentrates and tails is demonstrated.

Background

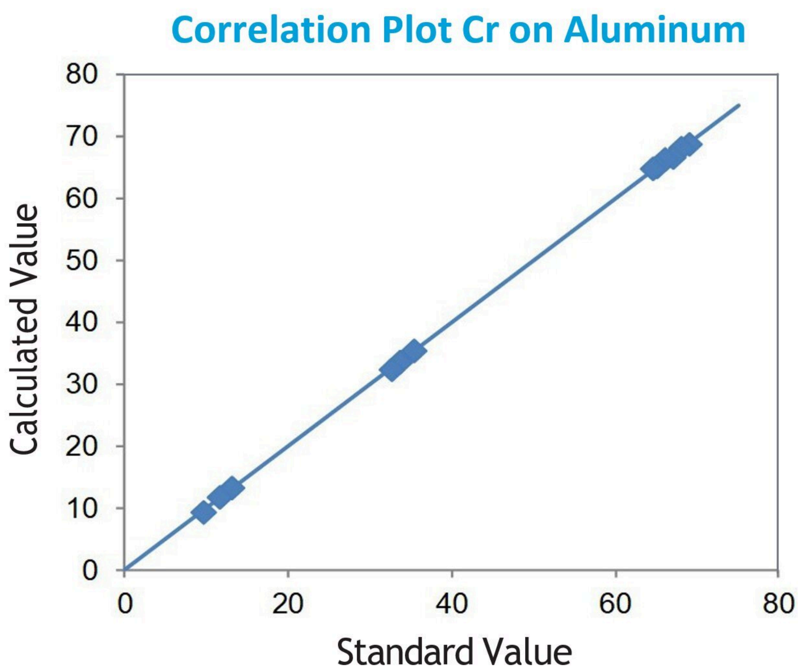
Elemental analysis is crucial for screening samples at the mine site as well as throughout the processing of ores. During smelting, major and minor elements are also closely monitored in the ore, concentrates, slags and tails. Rigaku offers the NEX QC analyzer to meet these analytical needs of the mining industry. Simple yet versatile, the NEX QC is transportable for mine site screening, rugged enough for the smelting operations, and powerful enough for work in a central lab. The NEX QC utilizes 50 kV direct excitation and a high performance semiconductor detector to provide excellent sensitivity in a low cost tool ideal for the analysis of ore materials.

Calibration

Empirical calibration gives the most accurate means of analysis. A typical calibration plot is provided here using 12 assayed standards showing a single calibration that includes tails (<15% Fe), ores (30 – 35% Fe) and concentrates (60 – 70% Fe). Alpha corrections are employed to automatically compensate for variations in X-ray absorption and enhancement effects within the sample due to the independent variations in silicon and calcium. Note that optimum accuracy can only be achieved by creating a separate calibration for each material, with each calibration using 8 – 12 assayed calibration standards of the particular material.

Element: Fe
Units: %

Sample I.D.	Assay value	Calculated value
1.1	69.00	68.80
1.2	67.90	68.08
1.3	66.90	66.62
1.4	66.00	66.25
1.5	65.10	65.16
1.6	64.60	64.61
1.7	33.60	33.59
1.8	32.60	32.30
1.9	13.05	13.36
1.10	11.50	11.66
1.11	9.53	9.17
1.12	35.29	35.48



Repeatability

To demonstrate repeatability (precision), one sample of each type was chosen from the set of calibration standards. Samples were each measured in static position. Typical results are shown below.

Sample	Material	Fe standard value (mass %)	Fe average value (mass %)	Standard deviation	RSD (%)
1.1	Concentrate	69.00	68.92	0.151	0.2
1.7	Ore	33.60	33.47	0.129	0.4
1.11	Tails	9.53	9.15	0.054	0.6

Discussion

Iron fluorescent X-rays emanating from the transition metals are fairly energetic not attenuated by air. Therefore the analytical method was developed without the need for a helium purge gas. For applications that require optimum sensitivity for light elements, like aluminum and silicon, helium purge is recommended.

Matrix absorption and enhancement corrections (often called alpha corrections) were applied to model the independent variations of Si and Ca in the ore samples. Calibrations over large concentration ranges, such as in this (9 – 70%) example, typically yield a curved response, thus a quadratic fit equation was used to model the relationship between concentration and intensity. Given assay values for Si and Ca, these elements can also be quantified by empirical calibration, as well as other major and minor elements in the materials.

Conclusion

The Rigaku NEX QC offers the iron industry a simple yet powerful and versatile system for identifying and quantifying elemental composition of a wide variety of iron materials. The NEX QC is an excellent tool for screening and quantifying iron ore from the mine, as well as for process control through the beneficiation, sintering, blending, and throughout the smelting process. With a small footprint and modern touch screen interface, the modern Rigaku NEX QC analyzer is transportable, rugged and reliable, and ideal for use in iron production.

Related products

NEX QC Series

Combines quality, affordability, and performance for a wide range of applications