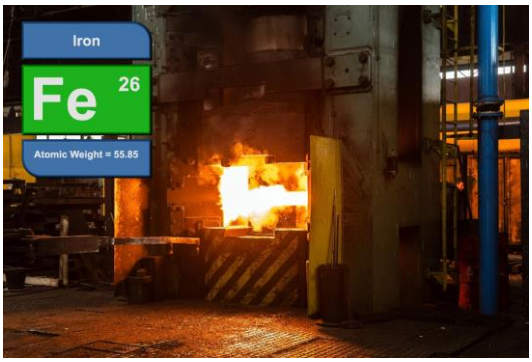
EDXRF APPLICATION NOTE

ANALYSIS OF IRON CONCENTRATES

#1480



SCOPE

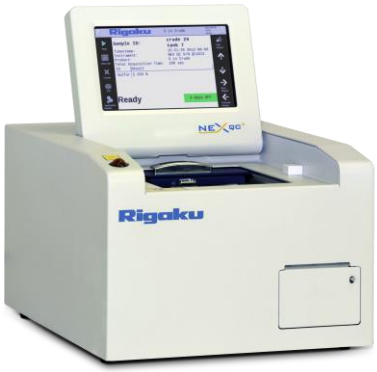
The measurement of iron, silicon dioxide and sulfur in magnetite ore concentrate is demonstrated.

BACKGROUND

Ore is ground, cleaned, separated and concentrated in preparation for smelting. Impurities such as silicon dioxide and sulfur are considered penalty elements as they can adversely affect the quality of the beneficiation, concentrating and smelting processes, as well as the final properties of the iron or steel being produced. Rigaku NEX QC+ offers technicians a fast and simple means of monitoring elemental composition of ores and concentrates, and is a tool that can be used for quality checks throughout the entire smelting process.

INSTRUMENTATION

Model:	Rigaku NEX QC^{+}
X-ray tube:	4W Ag-anode
Detector:	Semiconductor
Sample Type:	Magnetite Concentrate
Film:	Prolene 4um
Analysis Time:	300 sec
Environment:	Helium
Sample Prep:	Grinder or mill, hydraulic press
Optional:	6-position Autosampler



SAMPLE PREPARATION

Concentrate is typically a powder. If not, grind to a dry, homogeneous powder <200 mesh (<75um particle size). Each sample is then prepared as a hydraulically pressed pellet. 1g of binder is homogeneously mixed with 10g of concentrate powder and pressed using 20 tons pressure for 5 sec.

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CALIBRATION SUMMARY

21 standards were used to build an empirical calibration. Empirical regression returns the highest degree of accuracy. Fewer standards can be used, a minimum of 10 standards are required to achieve the minimum number of degrees of freedom required. More standards gives more degrees of freedom and a higher degree of accuracy. A summary of the calibration is shown here.

Element	Concentration Range	RMS Deviation	R^2 Confidence
Fe	64-72%	0.33	0.98079
SiO2	0.20 – 8.77%	0.196	0.99399
S	0.002 – 0.074%	0.0017	0.99465

REPEATABILITY (Precision)

To demonstrate repeatability, three calibration standards were selected to show the lower and higher levels of SiO2 and S. Each was measured in 10 repeat analyses using an analysis time of 300 sec per sample without moving the sample between measurements to determine and average value for precision. If desired, repeatability can be enhanced by using longer measurement times.

Standard	% Fe Assay Value	% Fe Average Value	Std Dev	% Relative Dev
3	71.13	71.04	0.06	0.1
2	71.52	71.47	0.02	0.1
21	64.19	64.08	0.06	0.1

Standard	% SiO2 Assay Value	% SiO2 Average Value	Std Dev	% Relative Dev		Standard	% S Assay Value	% S Average Value	Std Dev	% Relative Dev
3	1.18	1.17	0.02	1.7		3	0.010	0.011	0.0004	4.0
2	0.65	0.67	0.008	1.2		2	0.005	0.007	0.0001	2.0
21	8.77	8.69	0.10	1.1		21	0.074	0.079	0.0007	0.9

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DETECTION LIMITS

To determine SiO2 and S detection limits a sample of Fe2O3 was used to simulate iron concentrates. The Fe2O3 is "blank" for SiO2 and S. Ten repeat analyses of this blank sample were taken in static position and the standard deviation was determined. The Lower Limit of Detection (LLD) is defined as three times the standard deviation. An LLD represents the detection limit based on the calibration model of the concentrate composition and may be somewhat higher or lower depending on the iron concentration. The following typical LLDs are reported here using an analysis time of 300 per measurement.

Oxide	LLD
SiO2	55 ppm
S	10 ppm

CONCLUSION

The NEX QC$^+$ offers the lab analyst or field operator at the mine site or smelter a simple and fast tool for measuring Fe, SiO2 and S content of concentrates, vital for smelting control and ensuring product grade, minimizing penalties. Given proper reference standards for calibration, the NEX QC$^+$ can be used for measuring ores and is an excellent tool throughout the smelting process for monitoring feeds, filter cakes, mattes, tailings and slags, as well as concentrates.

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