



Quantitative elemental analysis of cement samples

EDXRF Analyzer: **Genius IF**

Equipped with Silicon Drift Detector (SDD)



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Abstract

A set of cement samples were quantitatively analyzed by Xenometrix Genius IF bench top EDXRF analyzer equipped with Silicon Drift Detector. The quantification of the different oxides composition was performed using an advanced Fundamental Parameter method with one cement commercial reference standard.

Objective

To develop quick and robust method for quantify elements content in different mixture samples

Background

EDXRF is a fast and non-destructive technique that can quantify any type of sample solid, powder or liquid from within a few minutes and is the method of choice. Energy Dispersive X-ray Fluorescence (EDXRF) spectrometers play an important role in assuring that consistent quality of samples is retained throughout a manufacturing process.

EDXRF is an ideal method for a quick and simple elemental analysis for industrial control purposes offering the following advantages: 1) Fast and minimal sample preparation, 2) An automated analysis process, 3) Limited or no exposure to corrosive reagents used by other analytical techniques, 4) Ease of use for operation by non-technical or non-specialized personnel.

Analytical Configuration

Table 1: Instrumental analytical configuration

Instrument	Genius IF
Anode	Rh-Anode X-ray Tube, 50kV,50W
Detector	Silicon Drift Detector (SDD)
Environment	Vacuum
Excitation mode	Direct excitation
Type of analysis	Quantitative analysis
Analysis time	90 sec

Experimental

Three different cement samples in powder form were received for elemental quantitative analysis.

The spectrum of each sample was acquired in vacuum environment to avoid the air absorption of low energy fluorescence signal of low molecular weight elements. Typical spectrum of cement sample is shown in figure 1.

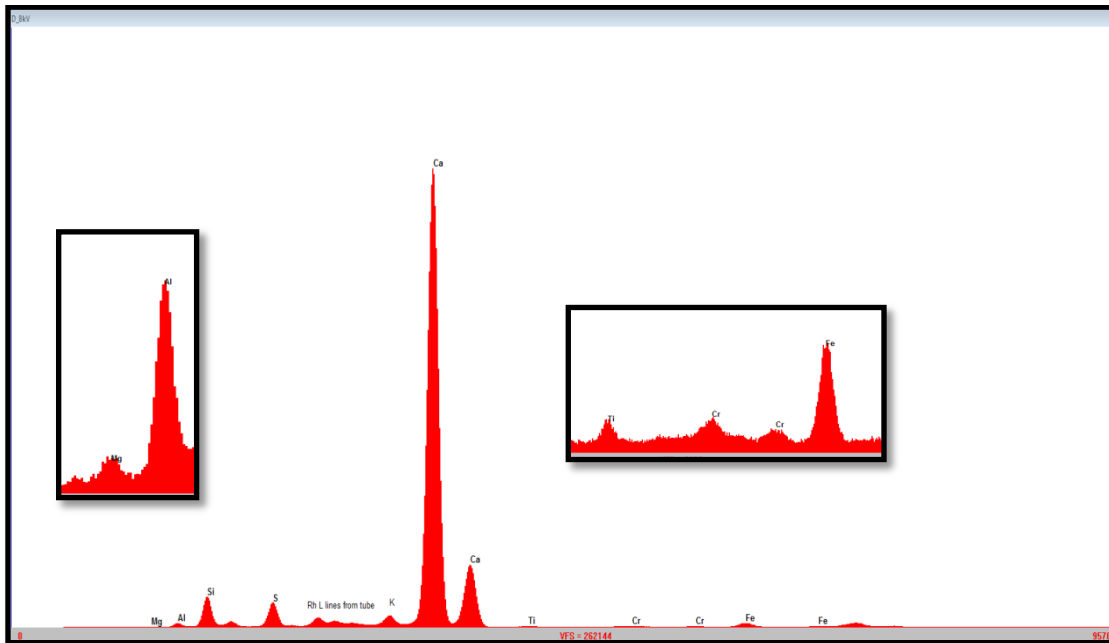
The detected elements by qualitative analysis were quantitatively analyzed in "oxide" form using special Fundamental Parameter software for the type of samples where 100% of the elements are not detected in the XRF spectrum such as for example, C and H.

Cement certified reference standard from NIST was used to calculate theoretical calibration coefficient used in the Fundamental Parameter software. The quantitative results are shown in table 2.

Results

Qualitative analysis results

Figure 1: Typical spectrum of cement



Quantitative results

Table 2: Quantitative results

Sample ID	Oxides Conc. [%w/w]							
	MgO	Al ₂ O ₃	SiO ₂	SO ₃	CaO	K ₂ O	TiO ₂	Fe ₂ O ₃
A	1.109	4.298	10.378	2.175	49.304	0.185	0.196	1.65
B	0.509	8.115	6.633	3.404	42.814	0.111	0.315	2.755
D	2.040	4.554	20.576	2.975	63.001	0.366	0.265	2.643

Conclusions

This application report shows how simple and rapid an elemental quantitative analysis of cement samples can be performed using Xenometrix Genius IF SDD analyzer combined with Fundamental Parameter software. In the absence of calibration standards, fundamental parameter software with one commercial NIST standard provides good results.