

# S4 EXPLORER

## THE ANALYSIS OF TRACE AND MINOR ELEMENTS IN ALUMINIUM

### Introduction

For many years X-ray fluorescence spectrometry (XRF) has been used as a process control tool in the manufacture and processing of aluminium. The advantage of rapid measurement coupled with extremely high precision has made XRF the preferred quality control tool in sectors such as smelting, refining and semi-fabrication. This report outlines the analysis of trace and minor elements in aluminium metal.



Figure 1. The plug 'n analyse S4 EXPLORER

collimators and up to eight analysing crystals. Scintillation and sealed gas-proportional counters

### Instrumental

The Bruker AXS S4 EXPLORER (Figure 1.) is a revolutionary step forward in the development of Sequential Wavelength Dispersive XRF spectrometers. It comprises all of the usual components - a 1 kW end-window Rhodium X-ray tube, up to ten primary beam filters, up to four

are both available. All of this is coupled with Bruker AXS' superb high precision goniometer technology. With both vacuum and helium systems available, the analysis of solid and liquid samples is possible.

However the S4 EXPLORER is unique amongst XRF spectrometers with features such as:

- An incredibly small footprint of less than 0.8m<sup>2</sup>
- No requirement for flow counter gas!
- No requirement for cooling water!
- No requirement for compressed air!

### Calibration

A set of sixteen Certified Reference Standards was used to calibrate the instrument. The standards were in the form of metal discs of varying diameter. All of these were presented to the spectrometer using sample cups with a 34mm aperture. An analytical method was developed to measure twelve minor and trace elements in the aluminium metal. The calibration curves were constructed using the Variable Alphas matrix correction routine of SPECTRA<sup>plus</sup>. The calibration details are given in Table 1 and the curve for copper is shown in Figure 2.

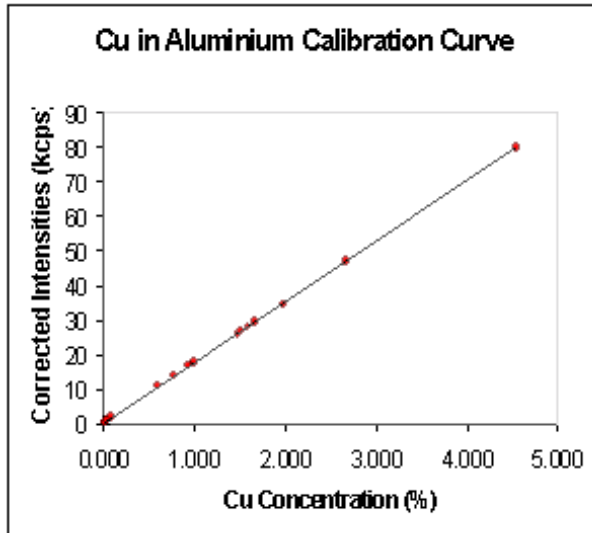


Figure 2. Copper calibration curve

The total analysis time for the method was less than seven minutes. The three-sigma detection limits reported in Table 1 are based on 100 seconds counting time per analyte.

Analyte	Calibration Range (%)	Calibration Accuracy	Detection Limit (ppm)
Mg	0.31-4.90	0.05	17.3
Al	balance	-	-
Si	0.15-13.50	0.007	5.2
Ca	0.01-0.03	0.001	2.2
Ti	0.008-0.120	0.003	3.5
Cr	0.010-0.180	0.003	1.3
Mn	0.025-1.200	0.009	1.3
Fe	0.110-1.210	0.007	1.2
Ni	0.020-2.500	0.011	1.8
Cu	0.026-4.550	0.017	1.4
Zn	0.020-6.100	0.022	0.9
Sr	0.003-0.094	0.003	0.3

Table 1. Calibration Data

## Conclusion

This application note summarises the outstanding performance of the S4 EXPLORER for the analysis of trace and minor elements in aluminium at minimal operation costs. The innovative 1.000W X-ray tube technology (not requiring external cooling water) and the Pro4 sealed proportional detector (not requiring detector gas, no periodical replacement of detector window and detector wire) are the prerequisites for the S4 EXPLORER "plug 'n analyse" high precision X-ray spectrometer with the full analytical performance of traditional high power 3 to 4 kW X-ray instruments.

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