

SX Five

Electron Microprobe

Application Note:

Accuracy of Quantitative
analysis on major elements



Quantitative Analysis of the major elements

Introduction

A set of steel specimens containing various Phosphorus content has been analyzed using the CAMECA SXFive Electron Probe equipped with a High Sensitivity spectrometer (WDSV2H). The aim of the analysis is to compare the measured concentrations and the concentrations given by the analysis certificates.

Specimen description

The specimens are of a set of various steels certified by the **Japanese Standards of Iron and Steel**.

They are mounted in a 1" diameter block. They are polished with 1 μ m diamond paste and rinsed in ethanol in an ultrasonic cleaner.

The concentrations of the analysed specimen are listed below:

Specimen	Si in (wt%)	Mo in (wt%)	Ni in (wt%)	Mn in (wt%)	Cr in (wt%)
150-1	0.20	0.20	4.10	0.12	0.30
153-1	0.30	1.00	1.00	0.79	1.00
155-1	0.51	0.69	0.12	0.23	3.08

The balance is Iron.

Experimental conditions

Accelerating voltage: 20kV

Beam intensity: 200nA

Defocused beam: 5 μ m in diameter

Analysed elements: Si, Mo, Ni, Mn and Cr

Used crystal and spectrometers:

TAP and inclined spectrometer for Si

LPET and vertical spectrometer for Mo

LLiF and vertical spectrometer for Ni and Mn

LiF and vertical spectrometer for Cr

Counting time: 20 seconds on all elements, 10 seconds on positive background and 10 seconds on negative background.

20 measurement points have been averaged for each specimen.

Quantitative Analysis results

All elements are quantitatively analyzed using the Cameca quantitative analysis package. The raw data are corrected with a $\phi(\rho z)$ correction program (available in the standard package). The results are summarized in the tables shown below:

Specimen 150-1

Measured Elements	Certified concentrations (wt%)	Measured concentrations (wt%)
Si	0.20	0.19 ± 0.02
Mo	0.20	0.21 ± 0.05
Ni	4.10	3.96 ± 0.12
Mn	0.12	0.09± 0.02
Cr	0.30	0.34± 0.05

Specimen 153-1

Measured Elements	Certified concentrations (wt%)	Measured concentrations (wt%)
Si	0.30	0.28± 0.02
Mo	1.00	1.34 ± 0.23
Ni	1.00	0.98 ± 0.06
Mn	0.79	0.82± 0.06
Cr	1.00	1.03 ± 0.07

Specimen 155-1

Measured Elements	Certified concentrations (wt%)	Measured concentrations (wt%)
Si	0.51	0.48 ± 0.02
Mo	0.69	0.68± 0.07
Ni	0.12	0.12± 0.02
Mn	0.23	0.24 ± 0.02
Cr	3.08	3.16± 0.08

Conclusion

For elements whose concentrations is in the range of slightly above or slightly below 1 wt%, the SXFive reproduces the certified values with an accuracy **better than 5%**.