

S4 PIONEER

ANALYSIS OF BERYLLIUM IN BRONZE

Introduction

The fast and reliable determination of light elements is possible today with modern X-ray fluorescence spectrometers. Even Beryllium can be analysed in heavy matrices such as metals. The aim of this report is to show the analytical performance of the S4 PIONEER (Figure 1) using the determination of Beryllium in copper bronze as an example.

Instrument

The innovative concept of the S4 PIONEER features, even for very light elements like Beryllium, higher sensitivity than in the past. The S4 PIONEER offers excitation with the power of 4kW from the Rh-end-window X-ray tube with an ultrathin Be-window combined with the flexibility of a modern spectrometer with up to 10 primary beam filters, up to 4 collimators and up to 8 analyzer crystals.



Figure :1 S4 PIONEER

Sample Preparation

For the determination of light elements in heavy matrices, the quality of the sample surface is critical. For metals - following abrasion with grinding paper - the flat surface must be polished thoroughly. Subsequent residuals from the polishing paste must also be removed, for example with acetone in an ultrasonic bath for approximately two minutes.

Calibration

During the measuring method, the Beryllium K α -Line was carefully adjusted. The calibration was performed by measuring 6 bronze samples with Beryllium concentrations from 0 to 3.2 %. The evaluation of the calibration was done with the unique comprehensive calibration tools of SPEC-TRA^{plus}. A total measuring time of 130 s. was chosen.

Table 1: Details of the Beryllium Calibration

Std.	Chem. Conc.(%)	XRF Conc.(%)	A.S.D. (%)	R.S.D. (%)
Be Cu 0	0.00	0.06	0.06	—
Be Cu 1	1.71	1.77	0.06	3.2
Be Cu 2	1.92	1.78	- 0.14	7.5
Be Cu 3	2.44	2.50	0.06	2.6
Be Cu 4	2.64	2.52	- 0.12	4.7
Be Cu 5	3.20	3.30	0.10	2.9

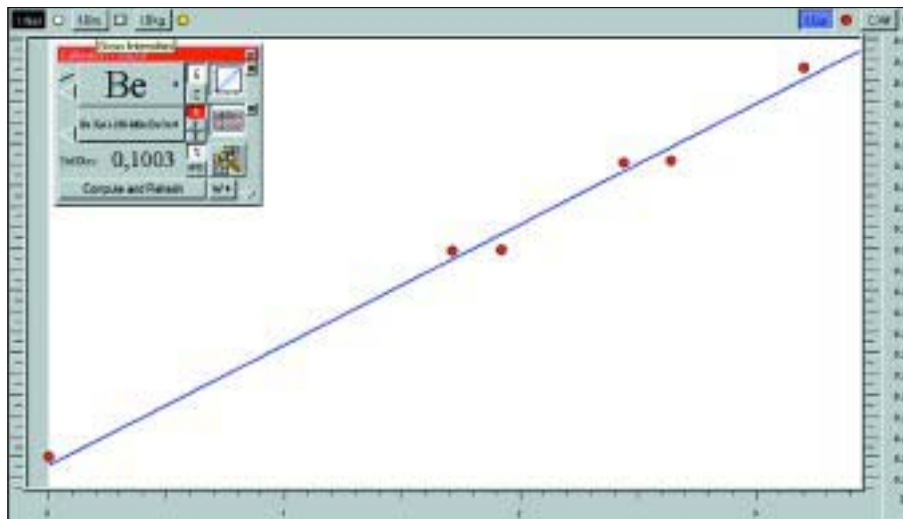


Figure 2: Calibration Curve for Beryllium K α

Results

Details of the calibration "Beryllium in copper bronze" are shown in Table 1. For the evaluation, the uncorrected gross intensities were used. Figure 2 presents the regression curve, whereby the corrected intensities are displayed with red dots. The Lower Limit of Detection (LLD) is 830 ppm (3σ , 100 s.). The high reproducibility, even for the light element Be, is shown in Table 2.

Conclusions

The S4 PIONEER provides an outstanding analytical performance, even for an ultralight element such as Beryllium, with high accuracy, lower LLD and high reproducibility.

Table 2: Short term reproducibility of the Beryllium analysis in one bronze sample

Std.	Be Cu 3 Conc. (%)
Repetition 1	2.47
Repetition 2	2.45
Repetition 3	2.43
Repetition 4	2.32
Repetition 5	2.45
Repetition 6	2.33
Repetition 7	2.46
Repetition 8	2.39
Repetition 9	2.39
Repetition 10	2.34
Average	2.40
Std. Dev. Abs.	0.06
Std. Dev. Rel.	2.42

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