Application Note

ComPact 5/PIN

Standardless Analysis of Silver Alloys by X-Ray Fluorescence

Introduction

There are not much traditional methods determining Silver in precious metal alloys, that are besides destructive and time consuming. Therefore since many years the X-ray Fluorescence Spectrometry has been introduced to solve this problem.

In absence of certified reference samples the no standard analysis based on fundamental parameter model is the power means for sufficiently precise determination of alloy composition and concentrations of Ag.

Alloy system Ag-Cu-Zn-Cd

The analytical instrument

The instrument ***Xray ComPact 5/PIN*** offered by Röntgenanalytik Messtechnik GmbH has been especially developed for the analysis of jewellery alloys made of gold, silver or platinum.

A low power tube is used in either instrument in excitation mode. A special collimator reduces the exciting beam down to 0.6 mm in diameter. In this way a local analysis of several parts of the jewellery object and its filigree zones with irregular geometry, as usual for jewellery manufacturing, can be achieved.

Energy dispersive measurement is made with a PIN-diode. Thanks to the high resolution of this type of detector, the small amount of elements in complex composition can be determined. Good statistical measurement guarantees high repro-ducibility.

The following figure 1 shows a typical spectrum of AgCu alloy.

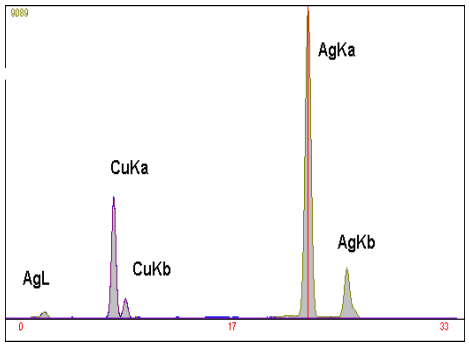

Figure 1: spectrum of AgCu alloy

Sample preparation

The surface of the samples should be thoroughly cleaned free of contaminants. This will enable the irradiated area to be representative of the whole.
Further preparation is not necessary as the very small excited area and the use of normalized intensities reduce the geometric influence of the signal.

Excitation conditions

Tube	W-Microfocus-glass-window
Voltage	40 kV
Power	approx. 30 W
Collimator	0.4 mm in diameter
Measuring time for analysis	60-120 s

Program Parameters

Program	XMaster Vers. 2.0.2.3

Analytical Features

Limits of detection

Traces in alloys higher than 0.1% can be analysed. In most cases this sensitivity is more than sufficient for jewellery analysis.

Application Note

Accuracy of analysis

The accuracy of the X-ray spectrometric determination of Silver shall be validated by standard samples of jewellery alloy.

The following table 1 enables to compare X-ray measured values with these of Silver standards.

Silver alloy	Ag		Cu		Zn		Cd	
	given	is	given	is	given	is	given	is
1	97.2	97.3	2.4	2.1	0	0	0.8	0.5
2	95.9	95.8	2.7	2.5	1.0	1.0	0.4	0.8
3	88.9	88.5	3.8	3.0	2.8	2.8	4.5	5.5
4	72.3	72.1	4.8	5.1	1.9	1.9	21.0	20.4
5	49.1	48.6	41.8	42.0	7.5	7.0	1.5	1.9

Table 1: Analysis results

Reproducibility

For determination of reproducibility repeated measurements with a measuring time of 120 s have been realised within 25 min on a AgCu alloy sample with approximately 96.5% silver.

The following table 2 present the measurement results.

No of meas.	Ag	Cu
1	96.08	3.91
2	96.09	9.31
3	96.21	3.80
4	96.24	3.76
5	96.17	3.83
6	96.22	3.78
7	96.24	3.76
8	96.18	3.78
9	96.26	3.73
10	96.16	3.81
Mean	96.19	3.81
Error rel [%]	0.06	1,61
SD [%]	0.06	0.06

Table 2: Reproducibility of measurement Concentration in [%]

These results are showing the performance of the spectrometer delivering sufficiently accurate values of Silver.

Conclusion

The analytical results demonstrate that the standardless X-Ray fluorescence analysis is a most important alternative method for the analyis of jewellery alloys. The X-ray spectrometer ***Compact 5/PIN*** allows the determination of Silver in jewellery alloys with high accuracy and high precision. Other present precious and non-precious metals can be determined as well, such as Pd, Cd Zn, Ni. The elemental range is limited for elements with Z > 22.

Application

ROENALTIC GmbH

Georg – Ohm – Strasse 6, D - 65232 Taunusstein – Neuhof, Tel. (49)6128-95350 Fax (49)6128-73601
info@roenalytic.com www.roenalytic.com