AN APPLICATION REPORT FROM
SPECTRO ANALYTICAL INSTRUMENTS

SMA-84/1

SPECTROLAB S LAS02

The Analysis of High-Purity Gold

Introduction

The SPECTROLAB S represents the next generation of stationary metal analyzer equipped with advanced semiconductor detector technology combined with additional time resolved measurement capabilities (CMOS+T). This innovative step improves the analytical performance and also offers the ability of TRS (time resolved spectroscopy) and SSE (single spark evaluation). These two options were the remaining two advantages of PMT (photo multiplier tube) detectors. Modifications regarding read out and excitation system in combination with improved CMOS detector capabilities have overcome these final technical / analytical limitations.

2 SPECTROLAB S – The Analysis of High-Purity Gold

The SPECTROLAB S combines best analytical performance, stability, flexibility, speed and extended maintenance intervals.

This analyzer allows the accurate analysis of trace elements in high-purity gold. The identification of unknown / unspecified elements via the spectra scan option is also possible.

Instrumentation

SPECTROLAB S Features

Optical Systems

Optic I:

- Wavelength range 120 nm – 240 nm
- Focal length 750 mm, Holographic grating with 3600 gr./mm
- CMOS detectors

Optic II:

- Wavelength range 210 nm – 770 nm
- Focal length 750 mm, Holographic grating 2400 gr./mm
- CMOS detectors

The applicable and configured wavelength range is based on the customer's application requirements. Both optics are temperature stabilized and pressure compensated.

CMOS+T

The SPECTROLAB S has the world's first CMOS-based (complementary metal oxide semiconductor) detector system that's perfected for high-end metal analysis — thanks to SPECTRO's proprietary CMOS+T technology. From trace elements to multimatrix applications, it provides extremely fast, highly accurate, exceptionally flexible analysis.

Plasma Generator

The benefit of this full digitalization with high fidelity is the guarantee that the spark pulse created is the spark pulse desired, every time.
Precision is improved and so is the similarity of the generated spark signals (unit uniformity).
With our off-line digital control, we ensure that each plasma generator delivers identical spark signals, with a negligible deviation between any two plasma generators.
Every plasma generator has a programmable output power waveform for application specific optimization.

Online drift correction and background correction

- Permanent control of the peak position of each line and readjustment if needed (iCAL 2.0)
- Recalculation of the background signal wherever it is possible

Optimized Measurement Times

- Dynamic pre-burn time, reflecting the sample quality
- Minimized delay between measurement sequences
- Optimized number of excitation parameters

Time Resolved Spectroscopy

A time delayed integration to reduce the background and ionic radiation observation:

- Improved detection limits
- Reduction of line interferences caused by interfering ion lines

Single Spark Evaluation (SSE)

- Tool for fast detection of inclusion complexity dependent, soluble and insoluble components
- Detection of inclusions
- Recognition of correlation between elements in inclusions

Intelligent Calibration Logic (iCAL 2.0)

- Profile position control and standardization with only one sample

Tunable Argon System

- Uses up to 50% less argon in auto standby and 13% less during measurement, compared to the LAS01

Accuracy of Analysis

It is the aim of modern OES spectrometers to greatly reduce the influence of the structure and composition (matrix) effects. The SPECTROLAB S combines traditional technologies like HEPS-High Energy Pre Spark to reach the stationary phase by “remelting” a small portion of the sample, resulting in a reduced structure effect.

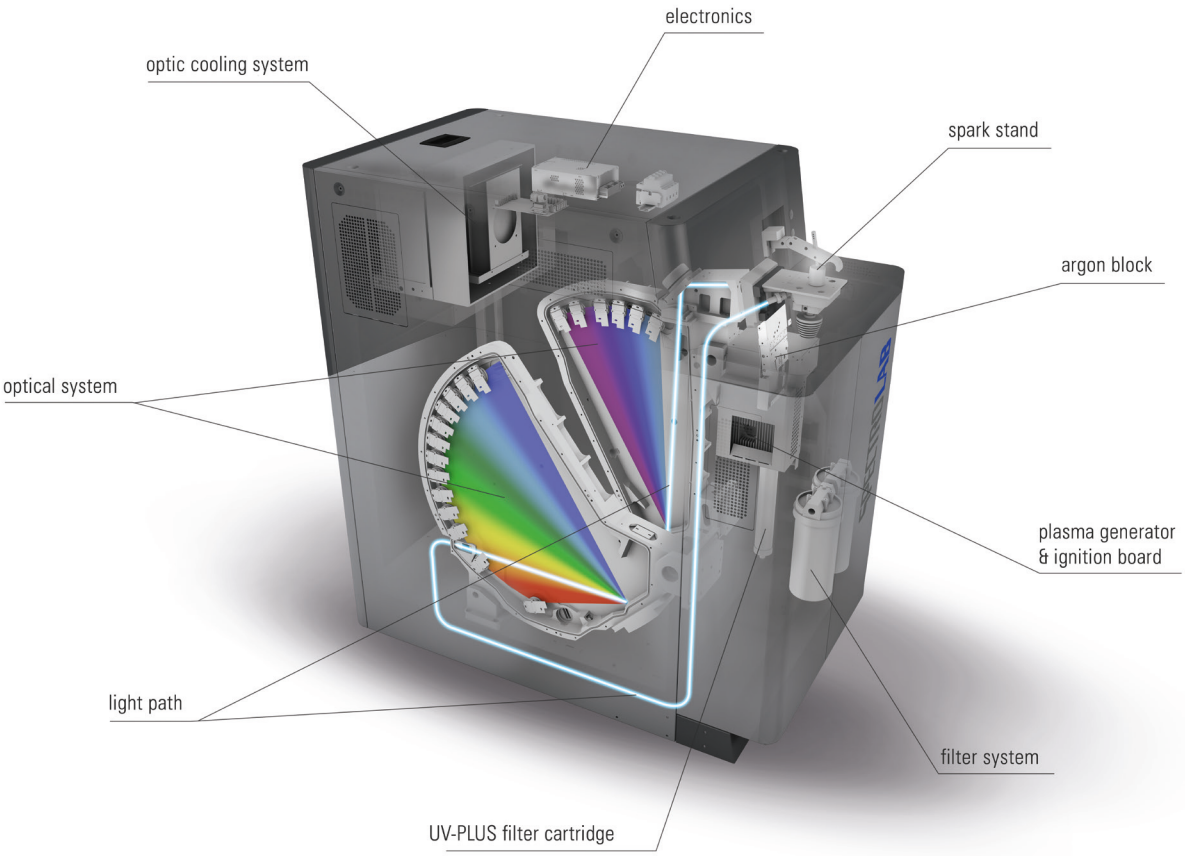

Table 1: Calculation of detection limit (DL) according to DIN 32645:2008-11 with a confidence limit of 99.7% (3 sigma), recorded on a production series device, using a PIN electrode with 2.5 mm electrode gap

Element	Ag	Al	As	Bi	Ca	Cd	Co	Cr
Calibration range (ppm)	0.1 - 250	0.06 - 50	0.5 - 70	0.5 - 70	0.1 - 100	0.03 - 30	0.05 - 35	0.07 - 70
Detection Limit (ppm)	0.1	0.06	0.5	0.5	0.1	0.03	0.05	0.07

Element	Cu	Fe	Mg	Mn	Ni	Pb	Pd	Pt
Calibration range (ppm)	0.1 - 750	0.2 - 160	0.05 - 100	0.05 - 75	0.1 - 110	0.3 - 110	0.1 - 160	0.3 - 210
Detection Limit (ppm)	0.1	0.2	0.05	0.05	0.1	0.3	0.1	0.3

Element	Rh	Sb	Se	Si	Sn	Te	Ti	Zn
Calibration range (ppm)	0.2 - 35	0.3 - 100	0.3 - 30	0.3 - 70	0.2 - 110	0.4 - 35	0.05 - 30	0.05 - 110
Detection Limit (ppm)	0.2	0.3	0.3	0.3	0.2	0.4	0.05	0.05

Table 2: Au9999

Element	Ag	Al	As	Bi	Ca	Cd	Co	Cr	Cu
1	17.71	0.10	0.50	0.33	0.25	0.17	0.09	0.25	3.18
2	17.90	0.11	0.49	0.27	0.22	0.17	0.09	0.25	3.57
3	18.24	0.10	0.54	0.30	0.21	0.17	0.13	0.26	3.07
4	18.32	0.15	0.33	0.39	0.24	0.17	0.11	0.31	3.86
5	18.33	0.11	0.50	0.74	0.21	0.17	0.10	0.26	3.43
6	18.29	0.08	0.65	0.41	0.22	0.17	0.10	0.26	3.47
7	17.47	0.09	0.67	0.45	0.21	0.17	0.11	0.27	3.39
8	17.30	0.09	0.89	0.43	0.22	0.18	0.11	0.24	3.42
9	17.55	0.09	0.69	0.23	0.24	0.17	0.10	0.29	3.15
10	17.69	0.08	0.49	0.39	0.22	0.17	0.10	0.29	3.45
<x>	17.88	0.10	0.58	0.40	0.22	0.17	0.10	0.27	3.40
SD	0.390	0.019	0.155	0.139	0.014	0.004	0.011	0.022	0.227

Element	Fe	Mg	Mn	Ni	Pb	Pd	Pt	Rh	Sb
1	0.55	0.12	0.10	0.35	0.17	0.07	0.25	0.58	0.43
2	0.58	0.14	0.10	0.26	0.16	0.06	0.23	0.39	0.21
3	0.78	0.11	0.09	0.33	0.16	0.06	0.24	0.47	0.52
4	0.55	0.11	0.09	0.32	0.41	0.08	0.30	0.48	0.49
5	0.59	0.08	0.10	0.38	0.41	0.16	0.35	0.51	0.42
6	0.57	0.12	0.08	0.31	0.28	0.07	0.22	0.42	0.40
7	0.57	0.07	0.09	0.32	0.20	0.11	0.10	0.46	0.19
8	0.62	0.08	0.09	0.36	0.40	0.12	0.11	0.40	0.60
9	0.53	0.10	0.09	0.30	0.42	0.06	0.39	0.43	0.50
10	0.55	0.10	0.10	0.29	0.24	0.11	0.27	0.39	0.41
<x>	0.59	0.10	0.09	0.32	0.29	0.09	0.25	0.45	0.42
SD	0.072	0.021	0.005	0.036	0.114	0.035	0.092	0.060	0.130

Table 2: Au9999

Element	Se	Si	Sn	Te	Ti	Zn	Au
1	0.22	0.18	0.79	0.55	0.08	0.53	99.9972
2	0.58	0.09	0.85	0.31	0.11	0.55	99.9972
3	0.53	0.39	0.79	0.55	0.09	0.52	99.9971
4	0.48	0.10	0.80	0.60	0.09	0.54	99.9971
5	0.39	0.20	0.75	0.49	0.10	0.52	99.9971
6	0.39	0.29	0.85	0.52	0.11	0.51	99.9972
7	0.30	0.10	0.77	0.19	0.11	0.51	99.9974
8	0.40	0.12	0.78	0.52	0.11	0.54	99.9972
9	0.48	0.17	0.82	0.70	0.08	0.51	99.9972
10	0.38	0.20	0.75	0.45	0.09	0.53	99.9972
<x>	0.42	0.18	0.79	0.49	0.10	0.53	99.9972
SD	0.108	0.095	0.037	0.144	0.012	0.013	0.00010

All values in ppm except matrix element.

Summary

This report shows the capabilities of the SPECTROLAB S for the analysis of high-purity gold.

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