

Redefining quality standards for elemental analysis of solid samples

Benefits

- Ultimate performance for trace and ultra-trace analysis of bulk metals and non-conductive powders
- High mass resolution allowing interference removal in complex matrices
- High sample throughput due to high sensitivity and simple vacuum requirements
- Ease of use due to intelligent software package

Introduction

The Thermo Scientific™ Element™ GD Plus GD-MS has been developed as a combination of a microsecond-pulsed fast flow glow discharge source with a high-resolution mass spectrometer. The fast flow source with pulsed discharge combines the advantages of short pump downtimes for fast flow sources with the ionization coming close to theoretically predicted calibration factors. Pulsed mode enables the analysis of a variety of non-conducting ceramic powders pressed into a secondary electrode material. Combined with high mass resolution capabilities, the Element GD Plus GD-MS allows for fast interference-free analysis complex matrices, such as valuable metals, alloys, composites and ceramics. Depth profiling provides simple quantification of nanometer to micrometer thick layers, from matrix to sub-ppm concentrations. With typical sample turn-around times of 10 to 15 minutes, a stringent production control is made possible even when the QC limits are set at the ppb level.



Features

The Element GD Plus GD-MS fast flow source concept provides:

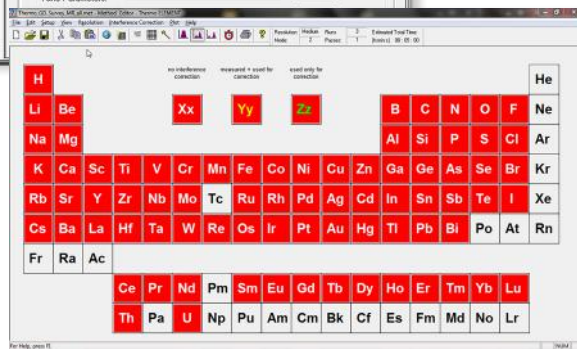
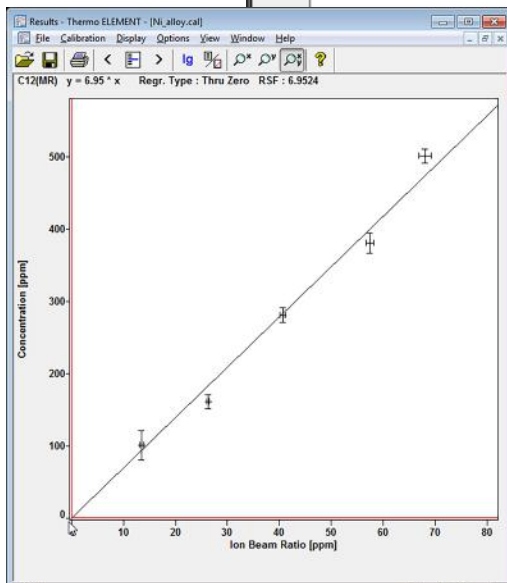
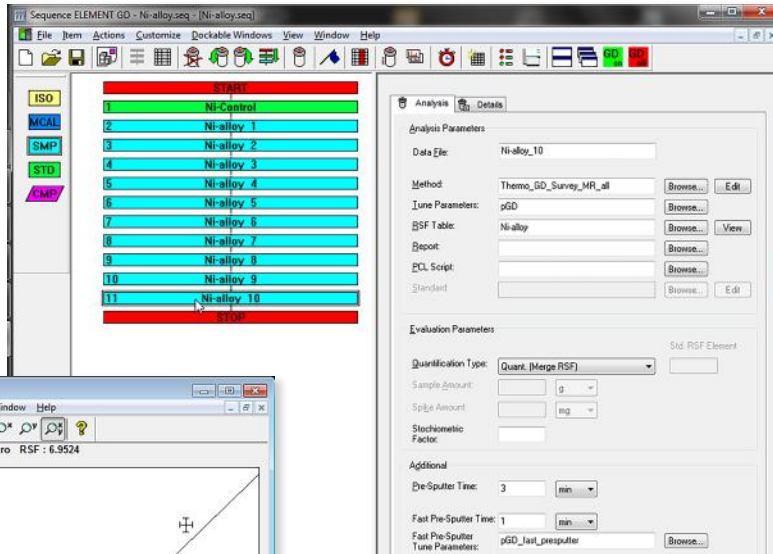
- High sensitivity: shorter analysis times
- High sputter rate: less pre-sputter time, less sample preparation
- Pulsed discharge: high sensitivity at reduced sputter rates yields excellent depth profiling capabilities
- Simple vacuum requirements speed up pumping times to < 10 seconds

- Standard Relative Sensitivity Factors (RSF) concept for semi-quantitative analysis
- Peltier-cooling enabling analysis of low-melting point metals, such as Ga

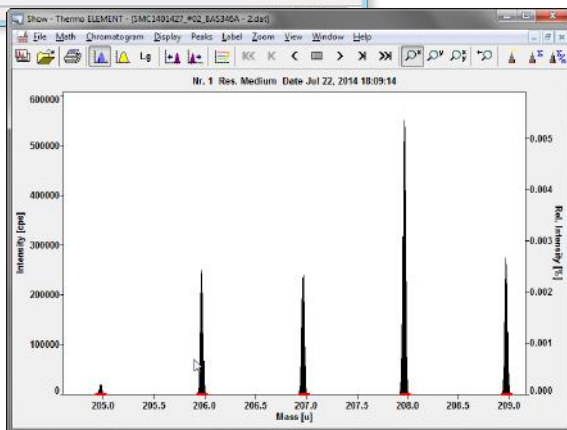
- High scan speed: short scan times, excellent depth resolution
- High mass stability: fast analysis time
- Fast switching between resolutions: no drawback using multiple resolutions for analysis, no manual evaluation of semi-resolved peaks necessary

The mass spectrometer offers:

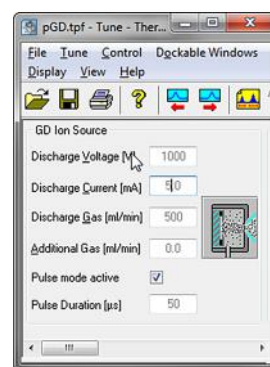
- High mass resolution: easy interference removal even for complex matrices like Ni alloys



Intuitive method creation



Real time display of calibration curves, spectra and results



Glow discharge ion source software control

Software

The software package is optimized for the needs of the routine analyst, providing ease of use for basic operation as well as flexibility for advanced operation. The Thermo Scientific™ Element™ Software Suite controls and monitors all instrument functions for GD-MS analysis and provides all necessary features for data evaluation. Real time display of mass spectra, time resolved data, calibration curves and comprehensive reports guarantee a high level of transparency and therefore easily traceable results. Full and flexible support for LIMS connectivity ensures

convenient, automatic and safe data management. The Element Software package offers full quantitative analysis using Relative Sensitivity Factors (RSF) obtained from standard materials or semi-quantitative analysis using Ion Beam Ratios (IBR). It encompasses automatic detector cross calibration and mass drift correction. The Element GD Plus GD-MS detection system is capable of measuring traces and the matrix within one analysis, allowing the ratio between the analyte and the matrix to be used for quantification.

Instrument specifications

Ion source specifications	
Ion source	Glow Discharge source: Fast flow DC source for continuous mode, and modulated pulsed mode operation. Grimm-type design for high sample throughput, maximized sensitivity, and low levels of interferences.
Starter kits	<ul style="list-style-type: none">• High purity kit (graphite source parts, cleaning with mineral acids)• Medium purity kit (stainless steel source parts, disposables/mechanical cleaning)
Gallium sample preparation kit – <i>optional</i>	This option comes with extended cooling including recirculating chiller, source insulation and control software. Contains workflow accessories for clean sample preparation including hot plate, sample molds and deep freezer.
DC voltage	Adjustable, max. 1400 V, working range typical 400 – 1200 V (pulsed/continuous DC)
Current	Adjustable, max. 200 mA, typical 5-10 mA for pulsed mode or 40-50 mA for continuous DC operation
Pulsed mode standard operation settings	1 kV, 50 μ s, 2 kHz, 500 mL/min Ar discharge gas flow
Peltier-cooling	Standard setup: range -25 to +50 °C Extended cooling: range -40 to +50 °C
Extraction lens	Graphite plug-in extraction lens
Interface	Plug-in Cone
Pump	Oil-free pump, pump down time to operate < 10 s
Resolution modes	
Low resolution mode	≥ 300 mass resolution (10% valley)
Medium resolution mode (16 μ m slit width)	$\geq 4,000$ mass resolution
High resolution mode (5 μ m slit width)	$\geq 10,000$ mass resolution
Resolution switching times	< 1 s
Instrument performance specifications	
Sensitivity	$> 1 \times 10^{10}$ cps, (1.6×10^{-9} A) for copper (peak height, total ion current) in medium resolution ($R \geq 4,000$) for pulsed mode operation at standard conditions, and for continuous DC
Darknoise	≤ 0.5 cps
Dynamic detection range	$> 10^{12}$ linear with automatic cross calibration
Minimum integration times	Counting mode: 0.1 ms Analogue mode: 1 ms Faraday mode: 1 ms
Short-term stability (pulsed mode)	<1 % @ 1000 ppm <5 % @ 1 ppm measured after pre-sputtering with standard operation settings over 10 minutes as Ion Beam Ratios (IBR)

Mass stability	25 ppm/8 hrs
Scan speed (magnetic)	< 150 ms from m/z 7 to 238 to 7
Scan speed (electric)	1 ms/jump, independent of mass range
Abundance sensitivity	< 15 ppb (1 amu on ^{63}Cu , medium resolution mode). Abundance sensitivity is defined as the ratio of mass 62/ ^{63}Cu

Software specifications

Windows 10 Operating System for instrument control PC	
LIMS connectivity	

Installation requirements

Instrument properties

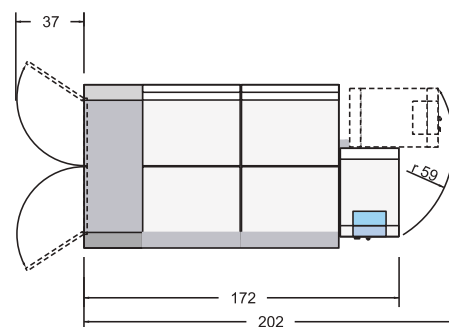
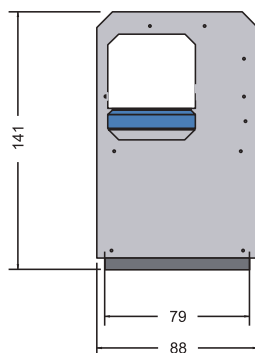
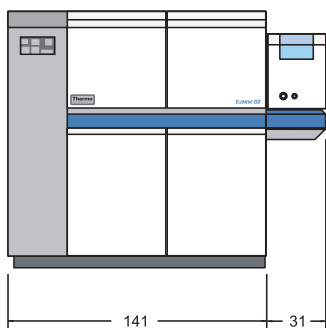
Dimensions/footprint	172 cm wide, 88 cm deep, 141 cm high
Weight	Basic unit 723 kg

Environmental conditions

Temperature range	18 – 28 °C (64 - 82 F)
Max. temperature fluctuation	2 °C/hr
Humidity	50 – 60%
Electromagnetic fields	max. acceptable field amplitude (AC) for any frequency is 5×10^{-6} T (50 mG)

Utilities

Power	3-phase, nominal voltage 230 / 400 Volts, 50 or 60 Hz AC, fused 32 A per phase
Power consumption	Max. 8 kVA
Cooling water	Supply temperature: 10 – 20 °C +/- 1°C Supply rate: ~200 L/h Pressure: 4-6 bar (42-65 psi)
Gas supply	Discharge gas: 1 L/min argon 5.0 (or higher) Gas purifier recommended Purge gas: 5 L/min argon 4.6 (or higher), 6 mm tubing supplied
Gas pressure	8-10 bar (116-145 psi)
Discharge gas installation	Steel capillary for discharge gas; 1/8 inch as outlet of instrument
Exhaust	<ul style="list-style-type: none"> • Electronic (heat) exhaust: 1 x 50 mm, 400 m³/h • Backup pump exhaust: 1 L/min, warm air from roughing pump • Pump exhaust: 1 x 25 mm, on average 1 L/min, during sample pump down 5 liters in 10 s



Element GD Plus footprint and dimensions in cm

Our complete portfolio for surface and bulk metal analysis

For your analytical challenges we offer a complete portfolio of solutions. Whether you need to determine thin layer compositions or ultra-trace metals in bulk material, we can support you with expertise and technology, offered by our sales network and service support all over the world.



Find out more at thermofisher.com/GD-MS

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