

# GDA 550 HR & 750 HR

Glow discharge analyzer for bulk and depth profile analysis

# Company Profile



SPECTRUMA is one of the most important producers of high-tech analysis equipments in the market. Operating since 1982, our highly skilled team of experts is remarkably experienced in development, production and service with a background of 35 years within the field of glow-discharge spectrometry.

Priorities lie with both customer service and engineering and production of instruments. SPECTRUMA steadily improves its cooperation with its customers by understanding itself as equal partners in the field of spectral analysis.

SPECTRUMA sets up new standards in the field of instrumental analysis by continuous cooperation with partners from various industries. SPECTRUMA

provides advanced technology “Made in Germany” and offers an extensive worldwide customer support.

These factors made this company the most important initiator of the market. Furthermore, SPECTRUMA also has an exceptional know-how in the application fields like material engineering, foundry, heat treatment, galvanic inspection and surface engineering. These accomplishments have been certified according to ISO 9001 endorsing the customer-oriented development of SPECTRUMA.

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# GDOES

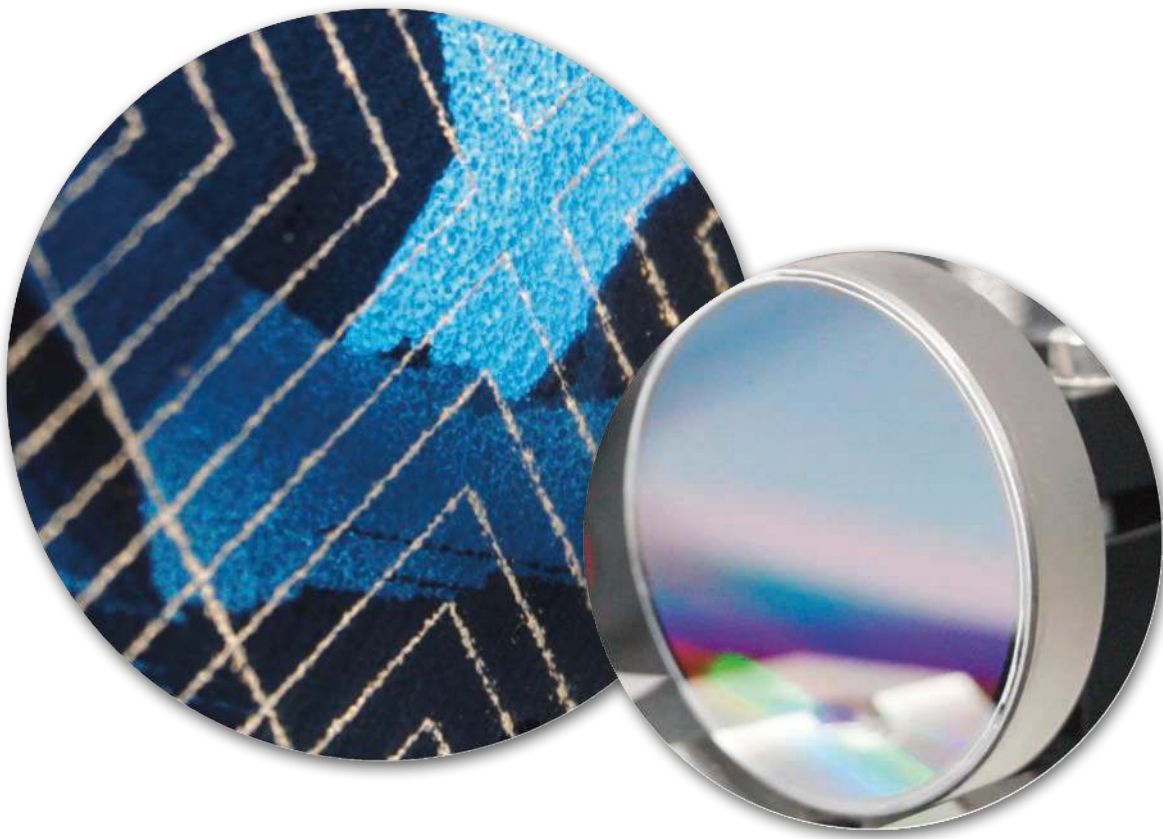
Glow Discharge Optical Emission Spectroscopy (GDOES) was initially developed for bulk spectrochemical analysis of various metals and their alloys. While at first being invented for the fields of surface and coating analysis, GDOES has been steadily developed over the years and surpassed these areas.

The most noteworthy ability of Glow Discharge Technology is discerning defined surface layers in the material being examined and analyzing their chemical composition. GDOES is ideal for concentration profile analysis and surface analysis in the field of metal analysis.

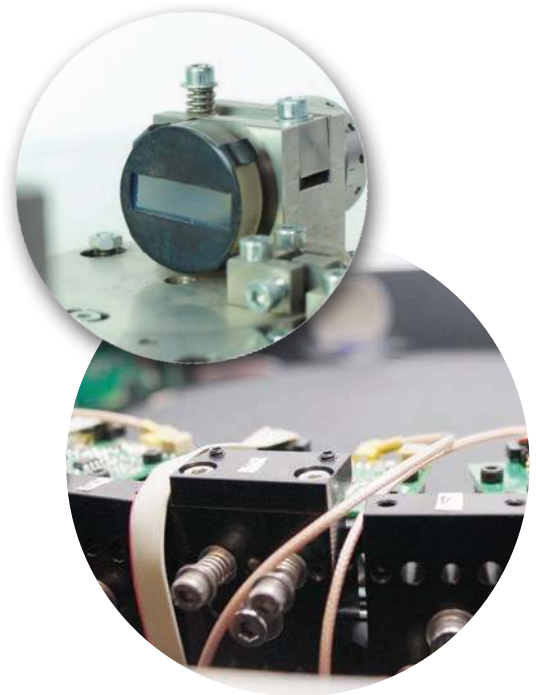
It is possible to monitor surface coating processes and all kinds of surface treatment processes by analyzing the surface and near-surface areas of the treated material.

Using the technique of depth profile analysis, coating thickness and chemical composition can be precisely determined.

While being one of the fastest analysis methods, GDOES is also the highly favored method of analysis for materials that were formerly complex and time consuming to analyze by traditional methods.



# GDA 550 HR



The GDA 550 HR is an exceptionally sensitive high-performance spectrometer to determine the chemical composition of surfaces and coatings. With up to 79 analytical element channels, using photomultiplier tubes, the GDA 550 HR glow discharge spectrometer is the perfect tool for applications requiring flexibility, high resolution, and analytical precision.

Developed by SPECTRUMA, the optional high resolution CCD optics extends the analytical capabilities of the GDA 550 HR into new heights. Because of the unique function of the CCD detector, almost an unlimited amount of analytical CCD channels can be added to any given method. This allows the fast determination of the composition and thickness of technical coatings. All elements including the light ones (H, O, N, and C) may be determined quantitatively.

Though primarily designed to analyze coatings up to a depth of 200  $\mu\text{m}$ , with a depth resolution of one nanometer on the surface and 5 % - 10 % relative in deeper regions, the GDA 550 HR is capable of bulk analysis (chemical composition of materials) providing superior linearity of calibration curves for complex matrices. The detection limit can be as low as 0.1 ppm.

The GDA 550 HR is equipped with a newly developed glow discharge excitation source allowing sputtering diameters of 8 mm to 1 mm. By using the optional universal sample unit (USU), also very small and non-flat samples can be analyzed which could not be sealed with an O-ring normally. The GDA 550 HR is suitable for all electrically conductive matrices.



# GDA 750 HR



The GDA 750 HR includes the same set of features as the GDA 550 HR. Additionally the instrument is equipped with a radio frequency (RF) excitation source to analyze non-conductive materials. Using this RF glow discharge lamp, the GDA 750 HR is unsurpassed in analysing insulating materials such as ceramics, glass and paint layers, using the standard lamp set or a specially designed version of the universal sample unit. The GDA 750 HR is upgraded with a newly developed external plasma ignition that enables extremely low excitation conditions extending the range of applications in the material analysis again.

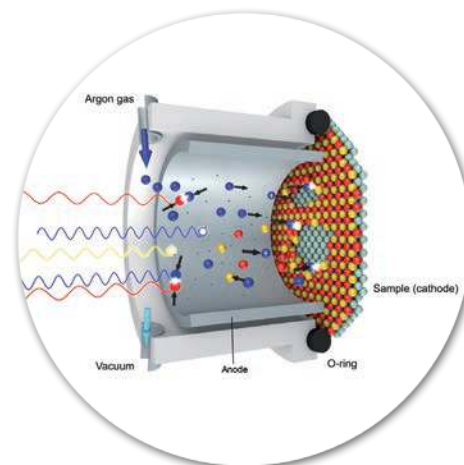
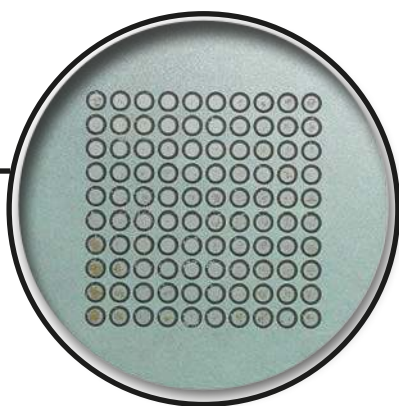


# Technical Data

## Excitation source

The excitation source permits anode diameters ranging between 1 mm and 8 mm with optimum stability and reproducibility.

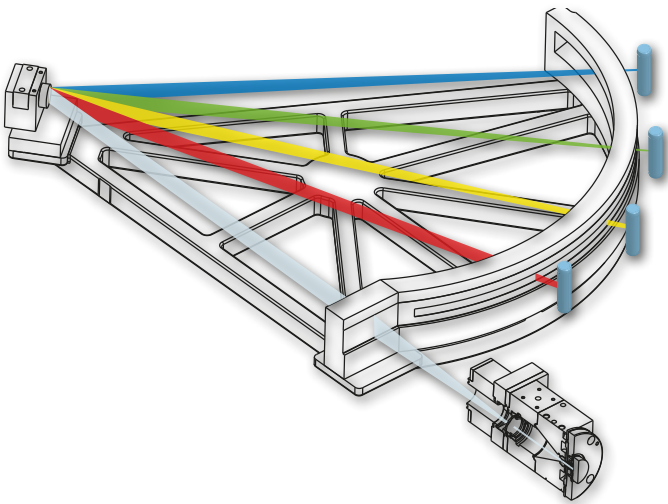
- High-performance direct sample cooling device. Used for thermally sensitive samples and the analysis of very thin foils. Stainless steel foils with a thickness of 50  $\mu\text{m}$  can be analyzed directly
- Optimized argon injection in the sample area for low detection limits and extremely high resolution in depth profiling analysis.
- Special automatic cleaning function for maximum measuring precision
- Maximum sample thickness 45 mm, minimum sample thickness 0.05 mm in standard configuration
- DC source, fully programmable in the range of up to 1500 V, and up to 250 mA
- Only GDA 750 HR: RF fully programmable up to 150 W, U, I monitor, real plasma regulation, pulsed plasma operation
- External plasma ignition enables extremely low excitation conditions and is intended for analysis of sensitive materials  
Optional: Auto-sampling unit for automated analysis of up to 100 samples



## Optics

- High spectral resolution typically less than 20 pm (FWHM)
- Usable wavelength range from 119 nm to 800 nm
- Paschen-Runge mounting with Rowland circle diameter of 750 mm
- Holographic master grating with 2400 lines/mm
- Single exit slit mask with all element channels pre-assigned
- 63 PMT channels simultaneously determinable in the standard configuration. 16 PMTs in an optional 400 mm optics. The maximum number of PMTs is expandable
- Facilitated lens cleaning
- Optimized high-voltage supply for photomultipliers with a dynamic measuring range of  $10^6$
- Optional: High-performance CCD spectrometer with spectral ranges from 200 nm to 800 nm. Optical resolution of minimum 0.02 nm (FWHM) depending on configuration. The CCD spectrometer can be operated simultaneously to the 750 mm polychromator
- Virtually unlimited number of CCD element channels simultaneously determinable
- Optional: Monochromator with a spectral range of up to 1500 nm. Up to three different gratings can be installed which are individually selectable during runtime

# Technical Data



## Vacuum System - GDA 750 HR

- One rotary vane pump for the optics chamber, one dry-running pump for the GDS source to avoid C-H contaminations from the pump
- Stainless-steel tubing in the whole system. Indispensable for trace element analysis, in particular for nitrogen

### Optional:

- Turbo molecular pumping for optic chamber for complete oil free system
- Optional: Turbo molecular pump for quick evacuation and best degassing performance of the GDS source

## Vacuum System - GDA 550 HR

- Two rotary vane pumps: one for the optics chamber and one for the GDS source
- Stainless-steel tubing in the whole system. Indispensable for trace element analysis, in particular for nitrogen
- Safety valve inside the rotary vane pump prevents unintentional ventilation in the case of a power failure

### Optional:

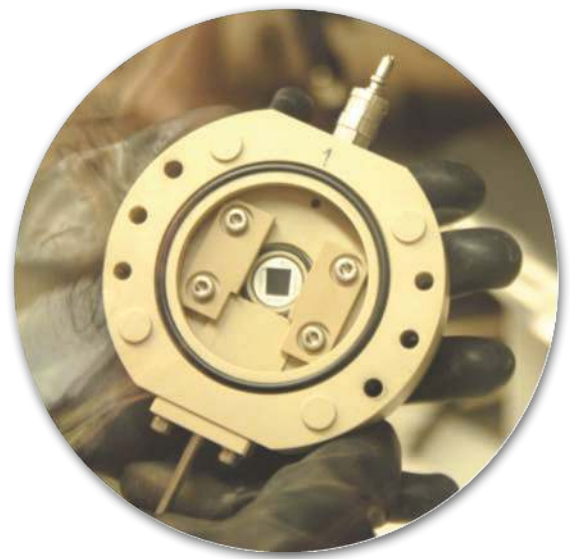
- Turbo molecular pumping for optic chamber for complete oil free system
- Optional: Turbo molecular pump for quick evacuation and best degassing performance of the GDS source
- Optional: The rotary vane pump may be replaced by a dry-running pump to avoid C-H contaminations from the pump



# Options

## Sample transfer vessel

- For analysis of air sensitive samples, sample will be placed in a chamber safe from atmospheric gases
- No contact to air for whole preparation and analysis time
- After the measurement, the sample can still be kept in the vessel, if it should not be exposed to air



## USU - Universal sample unit

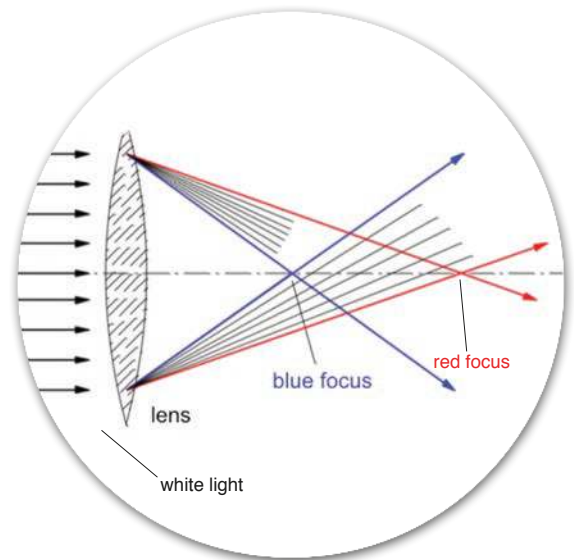
- For analysis of geometrically complicated and small samples
- Analysis of round / curved samples like tubes and balls
- Analysis of porous samples



# Options

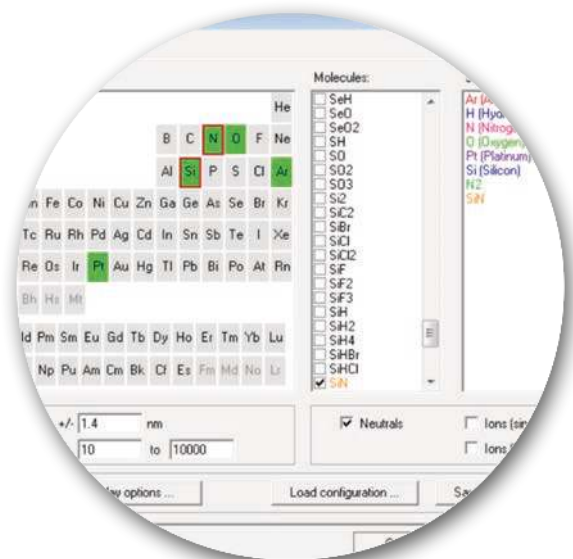
## Depth measuring system (DMS)

- The confocal chromatic measuring principle enables high precision distance measurements on both diffuse and mirrored surfaces
- It is designed for high accuracy, non-contact displacement distance and position measurement against any surface: solid, transparent, polished mirror surfaces, and low reflective surfaces
- The measuring range can be up to 2000  $\mu\text{m}$  with a resolution in the nanometer range
- A lens is used to focus white light in the middle of the sputter spot
- The blue part of the white light has a focus closer to the lens as opposed to the red light which is in a greater distance from the lens
- Only the very focus of every "color" is reflected back to the sensor and hence the depth of the crater can be determined
- The measurement is performed continually during the sputtering of the sample and therefore in situ depth measurement is made possible
- For this technique of Spectruma no different demand of sample geometry is necessary



## Molecular Database

- PLASUS SpecLine is the most powerful software tool for evaluating your spectral data. The worldwide unique database for atoms and molecules makes line identification fast and easy
- Identification of atoms, molecules and their ions using the included database is possible
- Data can be compared and overlaid in several spectra - even with different file formats
- Automatic peak finding is permitted via search algorithms for peak finding in the spectra
- Database versions in atoms and ions (A), atoms, ions and most of two-atomic molecules (AM) and all available atoms, ions and molecules (AMS) available



# Software

## WinGDOES Software

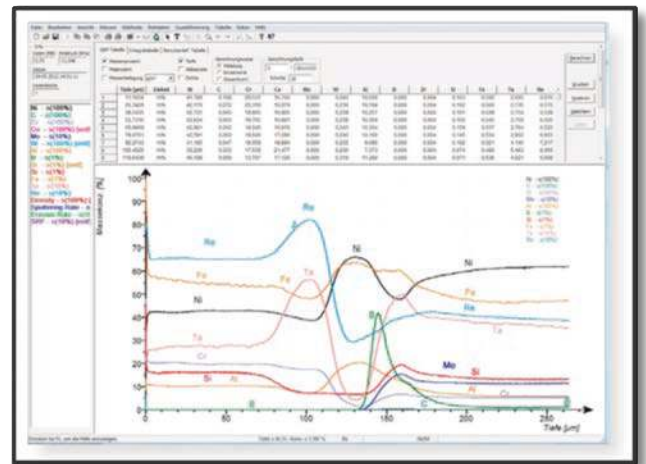
Operating System:

- Software with Windows 10 Professional
- 8 GB RAM
- Hard disk 256 GB SSD
- Full HD-Display

Features:

- Bulk analysis module
- Automatic storage of test results for statistical evaluations
- Results stored in database
- Export filter to transmit the data to other programs
- Software available in German and English

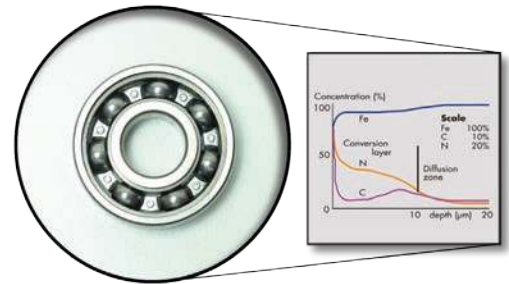
- Depth profile analysis with quick quantification in routine analysis. After quantification, the following results and display options are available:
  - ◆ Concentration (weight or atom percentage) vs. depth
  - ◆ Bulk concentration in definable depth ranges
  - ◆ Coating weight ( $\text{g/m}^2$ ) of individual or all elements in definable depth ranges
  - ◆ Sputtering rate ( $\mu\text{g/Ws}$ ) vs. depth
  - ◆ Density ( $\text{g/cm}^3$ ) vs. depth
  - ◆ Simultaneous presentation of several depth profiles for comparison purposes
  - ◆ and many more...



# Sample Applications

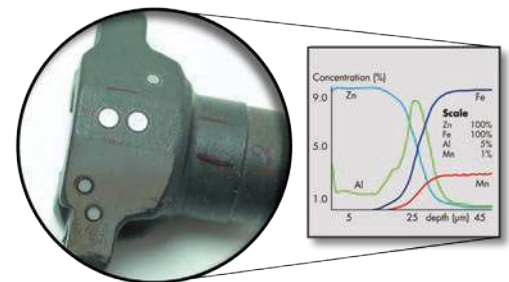
## Thermochemical treatments

Determine the thickness of a layer and concentration profile of all elements with respect to depth. Quantify and/or qualify surface contamination, inclusions and phase ratios



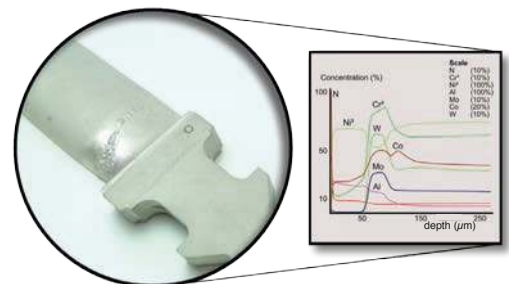
## Coated sheets

Complete characterization of the coating layer with respect to chemical composition, thickness and element distribution. Analyze non-conductive coatings such as varnishes and paints with the RF source



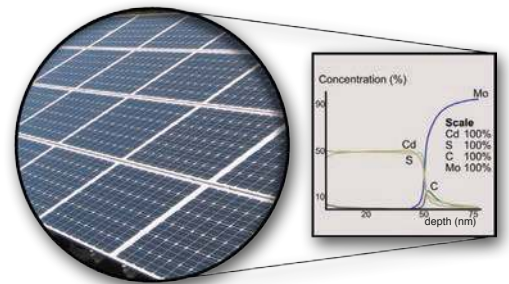
## Hard-phase coatings

Compound layer development can be determined by rapid analysis of the chemical composition. Other important material aspects such as depth penetration of the treatment process are possible



## Thin films

Determination of thin films, e.g. CdS, like those being used for solar cells



## Chemical composition

Precise determination of chemical material composition. High reproducibility of analyses. Quick analysis < 60 s. Determination of all elements from H up to U from 100 % down to the ppm level





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