GDS850A Glow Discharge Spectrometer

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Glow Discharge Spectrometer

LECO Glow Discharge Atomic Emission Spectrometers (GD-AES) are the clear choice of leading companies around the world, providing the most accurate bulk analysis, as well as quantitative depth profiling for a wide variety of sample matrices and applications.

Delivering customers a true turn-key solution, the GDS850 is configured and calibrated at the factory, in order to provide a custom analytical tool optimized to your sample matrices. Due to the robust nature of the system, samples can be analyzed immediately after installation. Only LECO provides this level of customization and customer support.

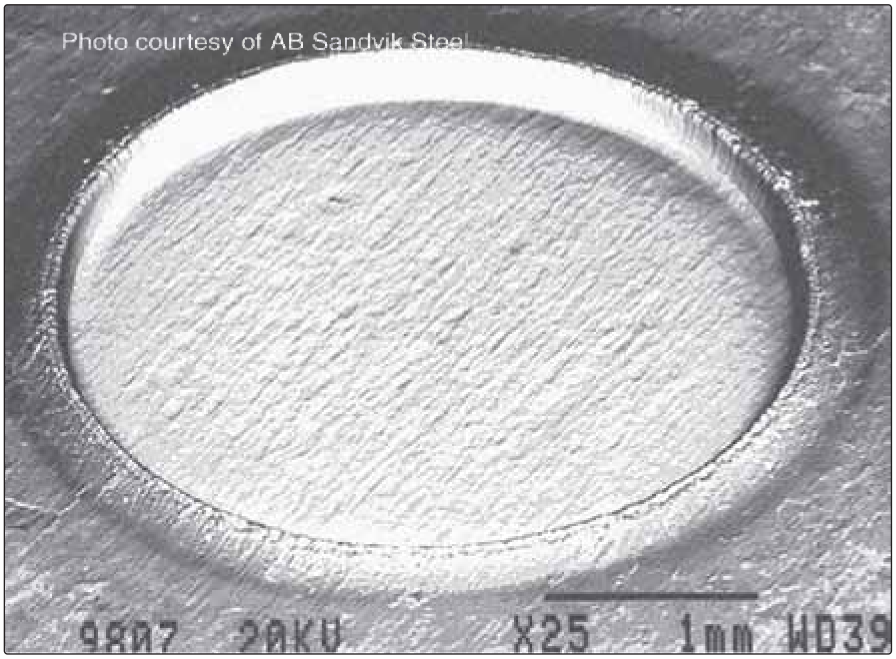
Using the latest technology in hardware and software, the GDS850A is designed to enhance the performance of both process control and R&D applications. This instrument covers a wide spectral range (120 to 800 nm) and allows for custom configurations of up to 58 channels. Compared with spark sources, GD-AES employs a non-thermal glow discharge source for atomic excitation. Excitation of the atoms occurs in the glow discharge plasma discretely apart from the sample surface thereby reducing the metallurgical and chemical history inherent in all samples. Emission of ion wavelength spectra is almost completely eliminated thereby giving rise to less complex spectra typical of thermal excitation sources.

This unique method of excitation results in true bulk analysis providing a distinct advantage in accurately identifying chemical compositions, especially of difficult materials, over other excitation methods.

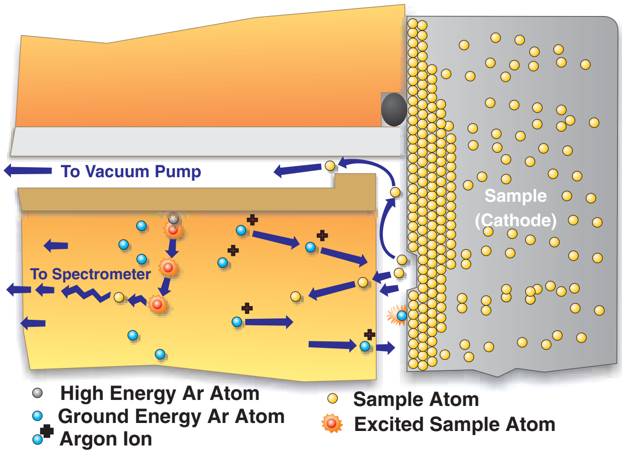
GDS advantages over other analytical techniques

- Separation of sputtering and excitation
- Linear calibration curves with wide dynamic range
- Less self absorption and no material re-deposition
- Atomic emission consists primarily of ground state atom lines, resulting in fewer lines and reduced interferences
- Freedom from metallurgical and chemical history
- Fewer standards required for calibration
- Minimal memory effects for a quick matrix change
- Low Argon gas consumption
- Automatic cleaning between samples

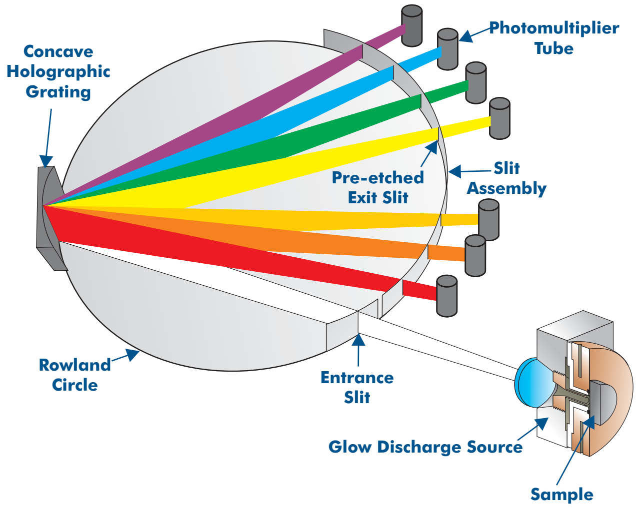
The Power of Glow Discharge Spectrometry



The signature "sputter spot" from glow discharge spectrometry shows uniform sample removal and provides the large representative area needed for accurate sampling of bulk content and depth profile information. Competitive methods cannot provide this quality of data because of their random sampling processes. The cathodic sputtering process of the Grimm-type lamp is created by applying a controlled voltage, current, and argon pressure to the sample surface. The diagram below details the excitation and emission of the sample atoms in the argon plasma. Reduced line interferences by glow discharge result in simple linear calibrations. GDS delivers higher precision with fewer calibration standards for an unbeatable advantage over arc spark.



Other methods may preferentially attack the sample surface and do not always provide a representative sample to analyze. With glow discharge spectrometry, sample material is uniformly sputtered from the surface. The non-thermal nature of the sampling process makes this an excellent technique for difficult applications. The sputtering produces atoms for excitation that takes place away from the sample surface.

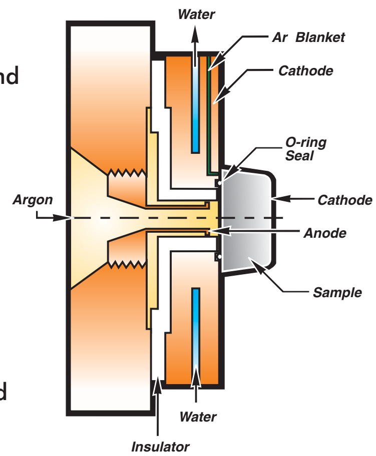


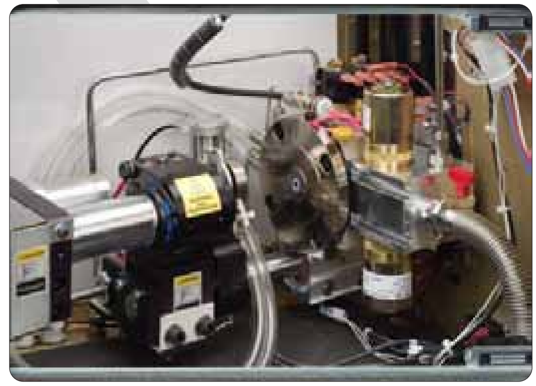
When the excited atoms return to ground state, they emit light. Each wavelength emitted is characteristic of the element from which it came. A holographic diffraction grating separates and focuses the light by wavelength. Exit slits pass the light of your chosen elements on to the detectors for accurate measurement.

BULK

Bulk Performance Plus

Unlike other methods, GDS can handle your bulk applications like sheet, powder, fastener, pressed, and mounted samples. Even small samples like wire (0.25 mm diameter) can be accurately tested. Thin sheets (down to 0.02 mm in thickness and even thinner) may be successfully analyzed using a backplate and cooling puck. Just about any sample form can be characterized by glow discharge technology. The flexibility of LECO instruments allows you to easily add depth profiling capabilities as your needs change.



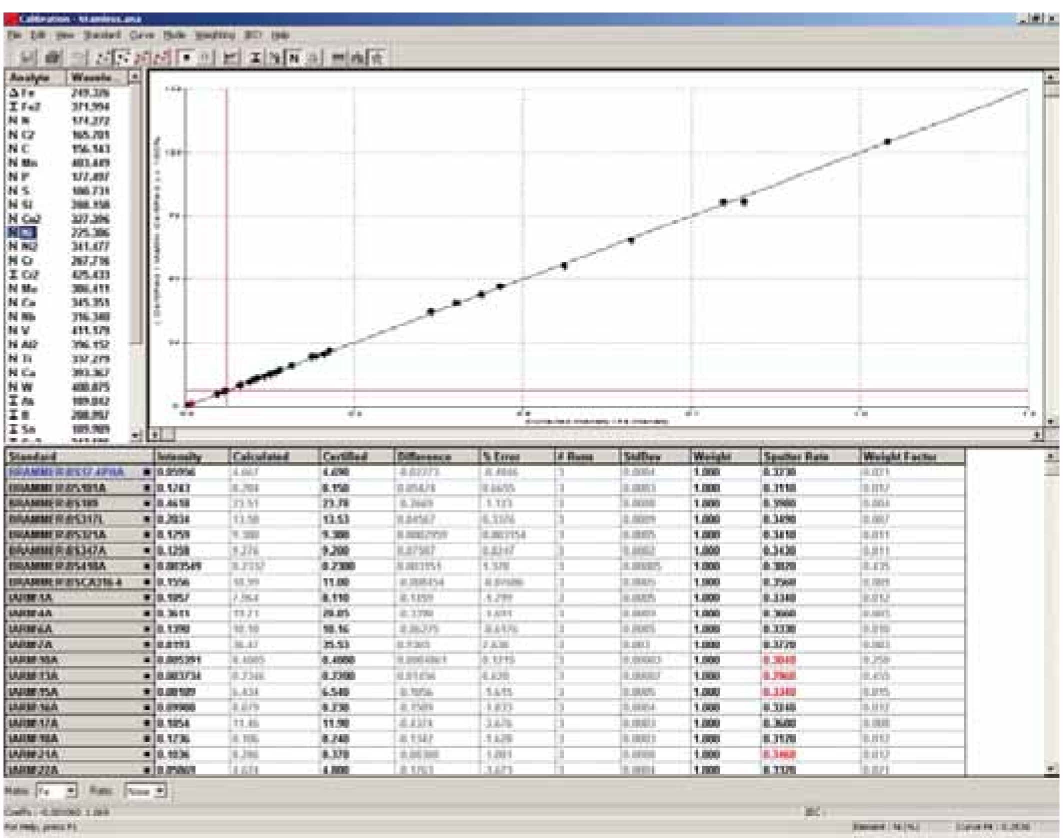


The LECO GDS source offers complete flexibility for control of operating parameters including current, voltage, and pressure.

Bulk Applications

LECO delivers a fully calibrated instrument based on your applications.

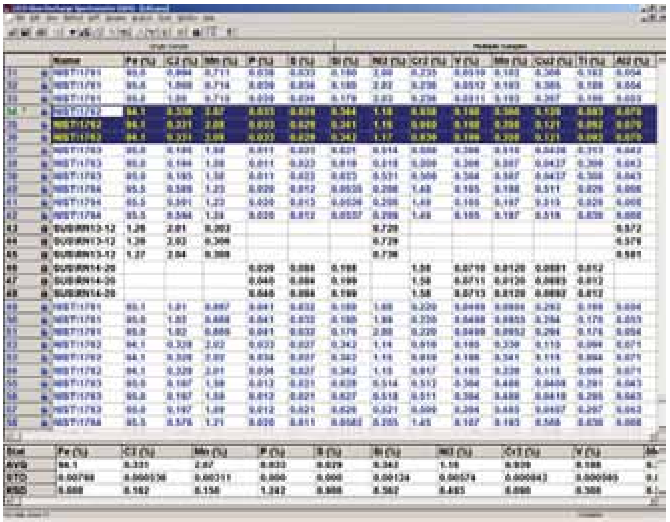
- Steel (low and high alloyed, leaded, resulfurized)
- Iron (as-cast, chilled-cast, gray, ductile)
- Aluminum (high Si, composites)
- Copper
- Brass/Bronze (leaded)
- Nickel
- Cobalt
- Titanium
- Tungsten
- Magnesium
- Solders (Zn, Pb)
- Zinc
- Carbides
- Powdered Metals
- Low Melting Point Alloys
- Elements not in Solid Solution



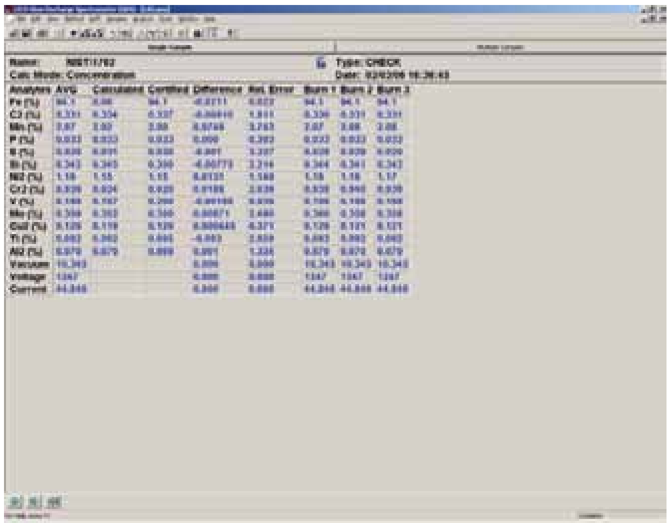
Ni calibration in stainless steel. Calibration curve exhibits linearity and wide dynamic range.

Accurate Bulk Analysis

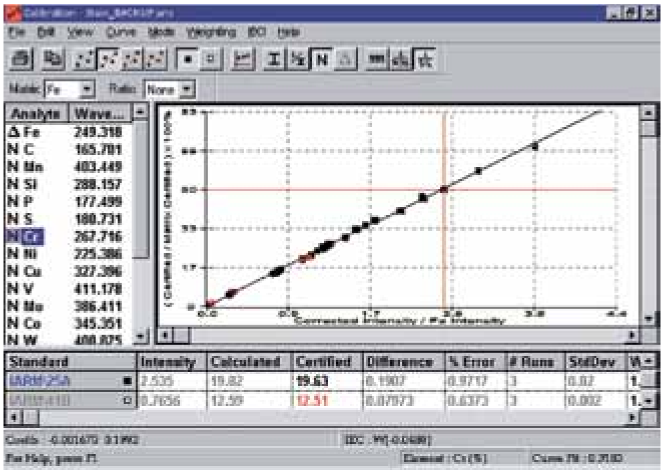
Ideal for foundries, die casters, smelters, and all ferrous/nonferrous applications.



Multiple sample presentation of bulk data using the GDS850A Glow Discharge spectrometer displaying all samples analyzed in a simple organized spreadsheet.



Single sample screen of a certified check standard can be easily monitored for elements of interest and accuracy.



Calibration Screen

Use the Windows®-based toolbars and drop-down menus to select a variety of analytical procedures. Simply select a method, choose the samples and standards to be analyzed, and start.

The software allows sampling rates of up to 2000 data points-per-second regardless of the number of channels selected. Results from ppm levels can be viewed on a large color monitor.

Quantitative Depth Profiling (QDP) Solutions

QDP is an ideal method for early identification of potential problems with your materials (including coatings, layers, and thermochemical treatments). Why use GDS? The GDS technique can perform a depth profile analysis continuously from nanometers to hundreds of micrometers. Combined with a fast sputtering rate (0.5 μm to 30 μm/min.), GDS provides the complete chemical composition (ppm to 100%) from the surface to the substrate in only a few minutes. All elements are acquired simultaneously, increasing sample throughput while minimizing cost-per-analysis.

QDP Applications

Your instrument will be fully calibrated for your specific application upon delivery.

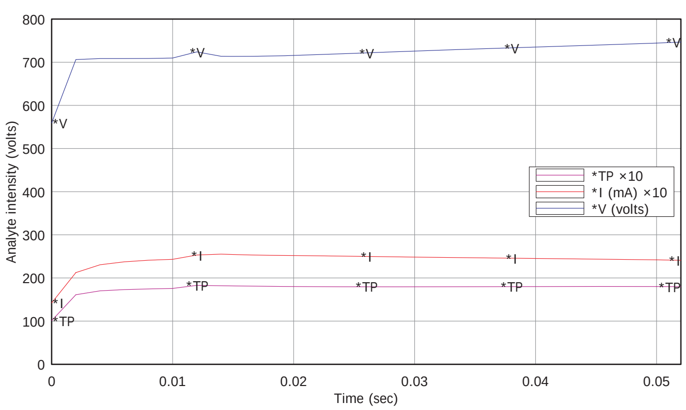
- Galvanizing (EG, Hot Dip, Galvalume, Galvanneal, Galfan, Zinc-Nickel)
- Plating (Sn, Cr, Cd, Ni, Cu)
- Thermochemical treatments (Carburizing, Nitriding, Carbonitriding)
- Hard coatings made by PVD/CVD
- Clad (Aluminum)
- Oxide layers
- Organic coatings
- Semiconductors
- Glass/Ceramics

QDP Quickly Identifies

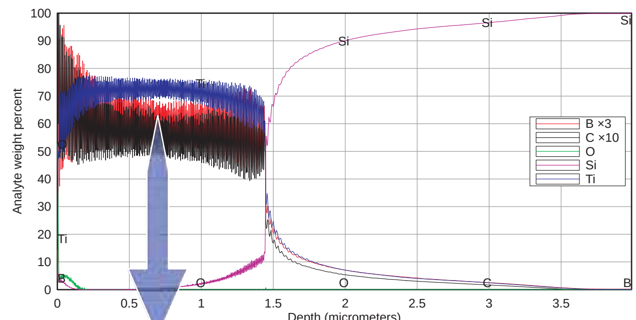
- Contamination and cleanliness at the surface and interfaces
- Migration and diffusion at interfaces
- Heterogeneity of coating/substrate
- Adherence issues
- Oxidation/corrosion
- Inclusion/blister
- Chemical composition
- Layer thickness/coating weight

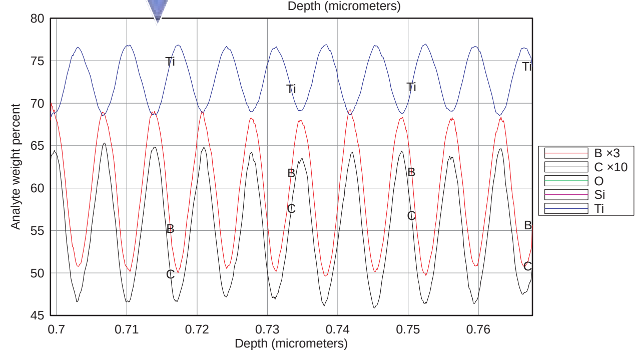
Thin Alternating Multi-Layers

LECO offers you the ultimate Glow Discharge Spectrometer capable of quantifying thin alternating multi-layers.



Example of <u>fast startup plasma</u> stable in less than 5 ms.

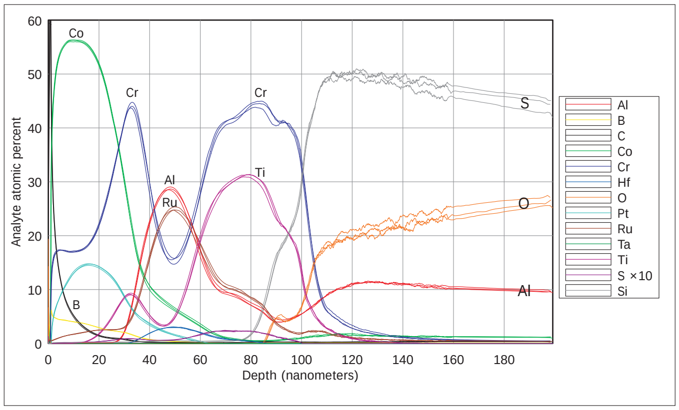




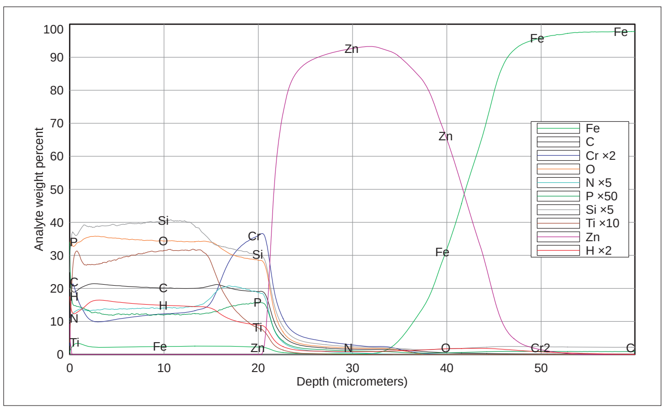
Zoom showing the composition of the PVD coating layers of boron carbide and titanium on silicon, providing resolution in the nanometer range.

Quantitative Depth Profiling (QDP) Solutions

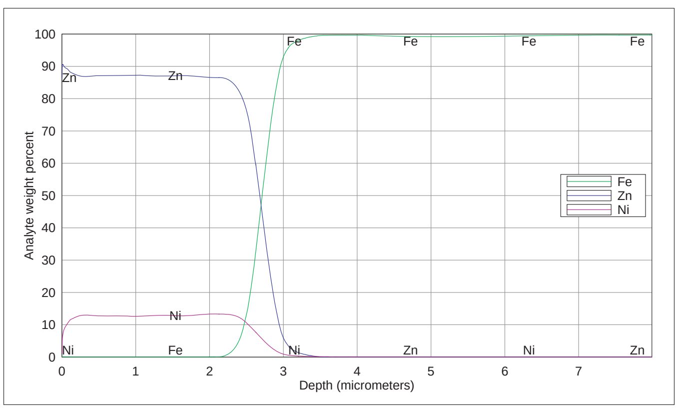
Meeting production, process, and research requirements.



Three replicate QDPs of the surface of a hard disk exhibiting seven resolved layers at a depth of 100 nanometers.

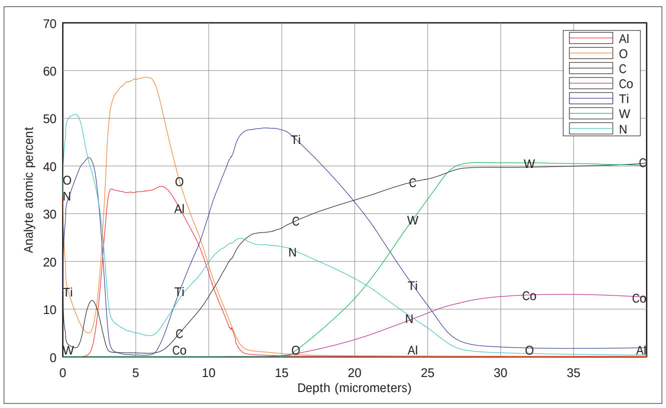


QDP analysis of organic coatings. QDP of painted steel sheet showing three different organic layers—topcoat paint and primer—on the galvanization (Zn).



QDP of the corrosion-resistant electro-galvanized Zn/Ni coating on the surface of sheet steel, showing coating thickness, weight, and alloy composition.

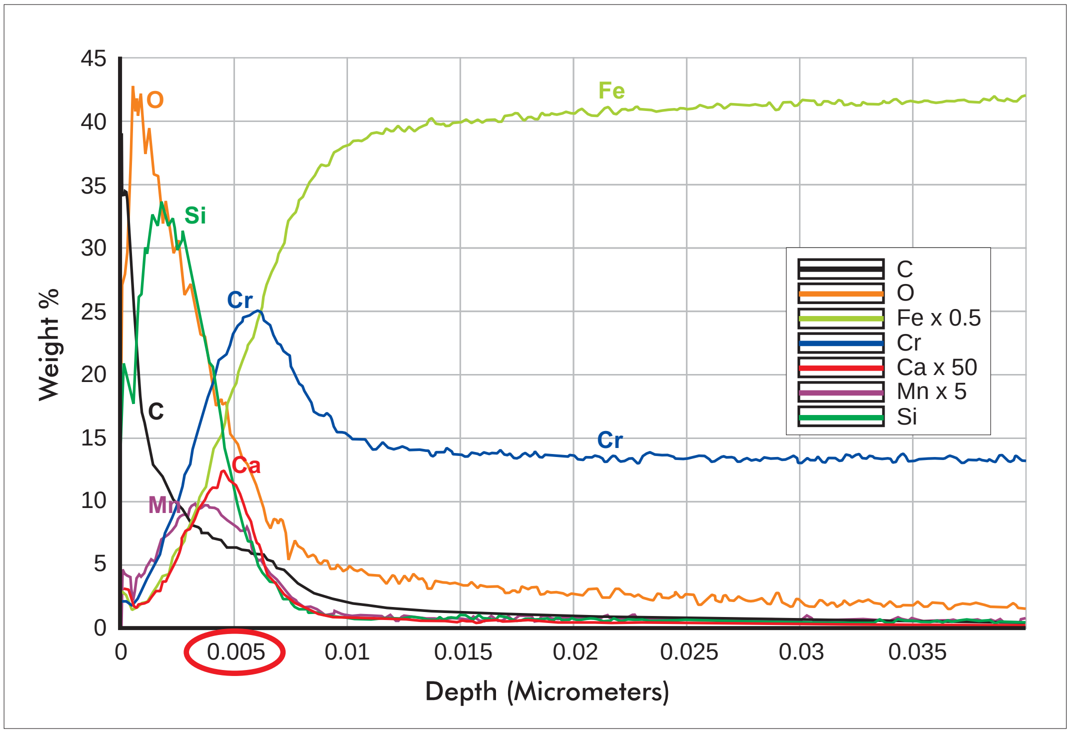
Name	Zn Depth, µm	Coating Wt, g/m²	Zn%	Ni%
Zn-Ni 1	2.72	19.93	87.36	12.61



QDP analysis of multilayer sample, including conductive and non-conductive layers. Example of TiN, TiCN, Al_2O_3, TiN, and TiCN on cemented carbide. Display of Atomic % vs. Depth for stoichiometry check.

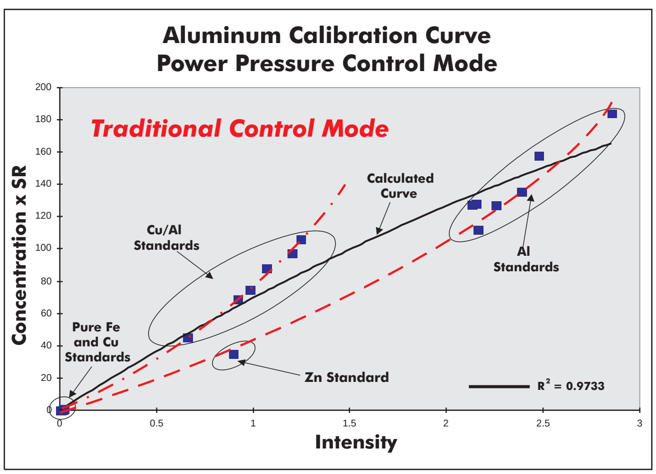
RF Source Option

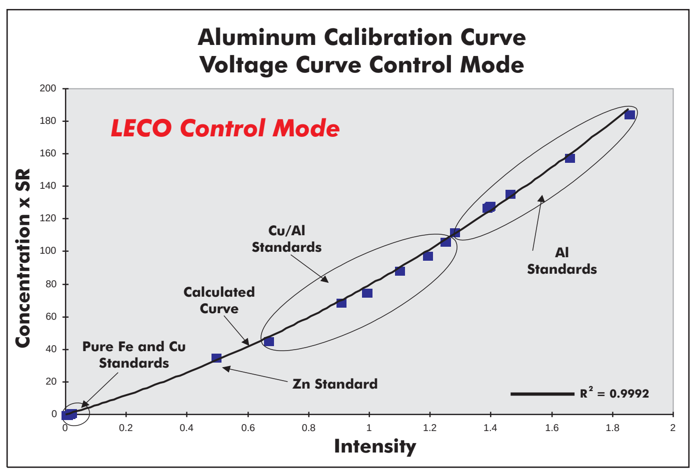
With an additional RF option, the GDS is capable of quantifying non-conductive thin oxide layers, at nanometer resolution, on materials such as stainless steel.



QDP of a stainless steel coupon coated with a 5 nm oxide layer.

True Plasma Power® (TPP)





In conjunction with LECO's patented front coupling is the exclusive treatment of RF power to ensure that lamp parameters are constant regardless of matrix and material thickness. TPP is power control in real-time which compensates for the various RF power losses. Compensated losses include transmission losses, absorption losses, and radiative losses, in addition to real-time compensation of reflected power.

It has been well documented that GD lamp conditions are affected by specimen matrix. It is necessary to apply precise control to the voltage and current for accurate quantification. The voltage-current relationship is important for accurate and consistent results and these parameters can be measured directly in DC. In contrast, for RF, only the voltage and power in Watts can be measured. When the TPP is held constant and the voltage is maintained precisely by varying the lamp pressure, the current is also constant. In this manner the DC control mode is emulated where both voltage and current can be measured and are held constant.

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Delivering the Right Results