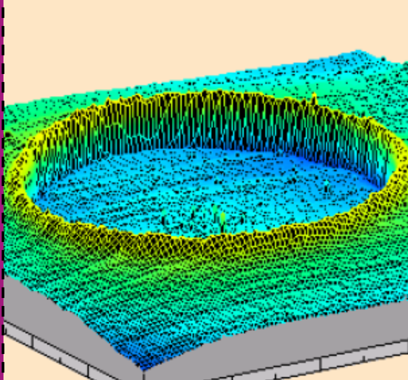
BALAZS™ nanoanalysis

GD-OES for Depth Profiling



Simultaneous Multi-Element Analysis of Films and Materials

Balazs™ NanoAnalysis offers the first commercial Glow Discharge Optical Emission Spectroscopy (GD-OES) service in the world. GD-OES profiling capability at single nm resolution has made it a favorite technique of engineers because it provides more than 40 elements in a variety of films and materials. GD-OES is suitable for contamination process control and depth profiling of films and substrates where the elements of interest are not yet identified. GD-OES complements SIMS by providing valuable impurity information in a single elemental survey. It also complements Auger (AES) and ESCA/XPS with its higher detection sensitivity. In addition, GD-OES has a better depth resolution than laser ablation ICP-MS in profiling both conductive and non-conductive films.

GD-OES Key Features

- Simultaneous elemental depth profiling of more than 40 elements in a single profile with similar depth resolution as SIMS
- H, C, N, O and S can be detected that are difficult or impossible to detect by other techniques
- No charging effect since GD-OES uses radio frequency (RF) plasma for material sputtering and signal generation; fragile, thermally unstable, conductive and insulating films and materials are readily analyzed without sample modification
- Large analysis area of 4 mm improves representative sampling of non-homogeneous materials and films
- Accurate concentration profiles can be obtained for major (>5% w/w), minor (0.05 - 5% w/w) and trace elements (<0.05% w/w), due to its wide linear dynamic range.

GD-OES instrument

www.balazs.com
Tel. +1 510 624 4000

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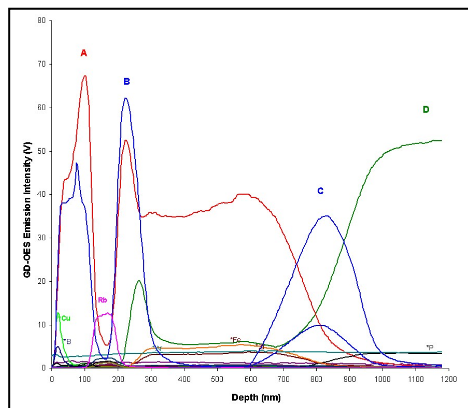
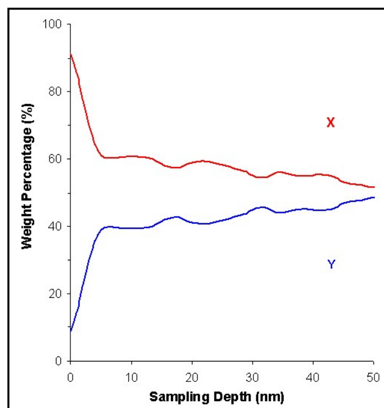
Film Characterization

Single or multi-layer films are used by a variety of industries.

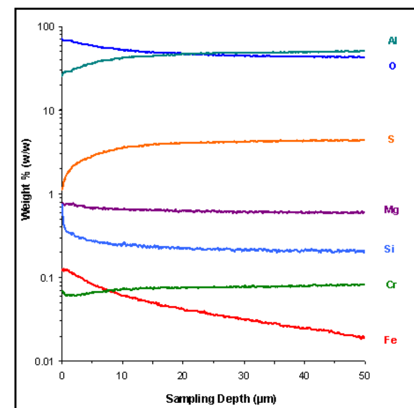
- Corrosion resistance in civic engineering components
- Multi-layer thin film in disk drives
- Anti-reflective coating in optoelectronic optics
- Barrier films in semiconductor devices
- Thin films in photovoltaic cells
- Infrared missile guiding heads in defense



Simultaneous depth profiling of multi-layer thin films



Verification of surface stoichiometry of a solar thin film after a chemical treatment



Deep depth profiling anodized alumina coating (ceramic)

GD-OES provides accurate impurity and compositional analysis with excellent sensitivity, dynamic range and depth resolution making it ideal for

- Lot-to lot variability study of films and materials
- Process reproducibility utilizing its elemental survey capability
- Process development by monitoring more than 40 elements in a single profile
- Process tool cleanliness after preventive maintenance
- Process transfer by surveying simultaneously up to 40 potential cross-contamination elements including H, O, C and N

Materials R&D

Contamination is a key metric for optimizing film and coating performance. GD-OES and LA ICP-MS are both elemental survey depth profiling techniques that provide cost effective characterization of new materials. The two techniques complement each other in detection limit, sampling area and depth of analysis.

Table 1. A comparison of GD-OES and LA-ICP-MS

Technique	Elements Detected	Profiling Mode	Analysis Area	Detection Limit
GD-OES	Periodic table Including H, O, C, N and Cl	Multi-element survey Simultaneous up to 46 elements	4 mm	ppm
LA ICP-MS	Periodic table Except for He, H, F, N, Ar, and O	Multi-element survey Simultaneous up to 85 elements	5 mm	ppm - ppb

Balazs[TM] NanoAnalysis operates ISO 17025 certified laboratories that identify, analyze and resolve contamination issues for high-tech industries around the world. The Microcontamination Experts[TM] at Balazs provide rapid and accurate analyses and expertise for water, air, chemicals, process gases, components, wafers, consumables and any other contamination sources.

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