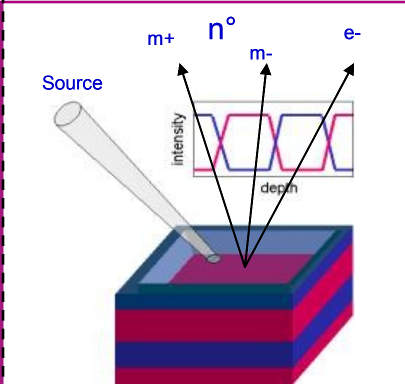
BALAZS™ nanoanalysis

Advanced Elemental Depth Profiling



Comprehensive Depth Profiling for Total Contamination Control

Elemental contamination in front end processing (FEP) can affect oxide thickness, gate oxide integrity (GOI), film property, threshold voltage and form silicides. Surface, interfacial and in-depth elemental monitoring is therefore essential during key front end wafer fabrication processes such as:

- Starting materials
- Surface preparation and cleaning
- Thermal and thin films
- Doping
- Diffusion
- Etch

The advanced elemental depth profiling capability of Balazs™ NanoAnalysis will enable process yield improvement, on-time production ramp up, seamless production technology transfer and ensure contamination control during a product technology node change.

Advanced Materials Characterization

GD-OES and LA ICP-MS are ideal multi-element survey techniques for determining the depth distribution of unknown contaminants. SIMS can provide more detailed information of selective target elements, if required. When used together these complementary techniques provide rapid elemental depth profiling information at the surface, interface, in-depth and bulk of the material for all technologies.

Table 1. Complementary Capabilities of GD-OES, LA ICP-MS and SIMS

Analysis Mode	Surface	Interface	In-Depth	Bulk
Multi-Element Survey	GD-OES (no matrix affect)	GD-OES	GD-OES	GD-OES
			LA ICP-MS (>200nm)	LA ICP-MS
Element Specific	SIMS (requires O_2 flooding)	SIMS	SIMS	SIMS

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AIR LIQUIDE ELECTRONICS

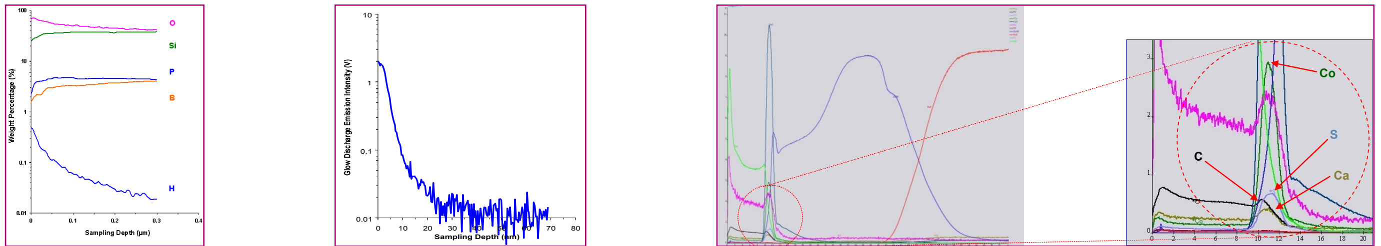
Analytical Technique Summary

Our suite of advanced depth profiling techniques provides a cost effective solution for quality control (QC) of materials and failure analysis (FA).

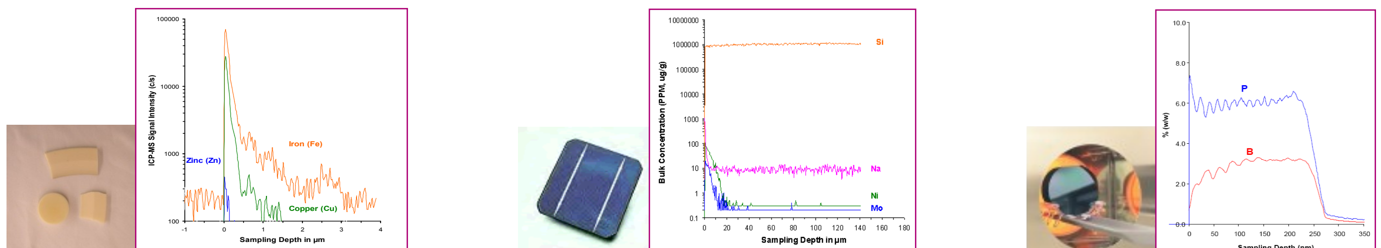
Technique	Elements Detected	Profiling Mode	Analysis Area	Detection Limit
GD-OES	Periodic table including H, O, C, N and Cl	Multi-element survey simultaneous up to 46 elements	4 mm	ppm
LA ICP-MS	Periodic table except for He, H, F, N, Ar, and O	Multi-element survey simultaneous up to 85 elements	5 mm	ppm - ppb
SIMS	Periodic table H to U	Target elements 1-5 elements per film thickness	75 mm	ppm - ppb

Applications

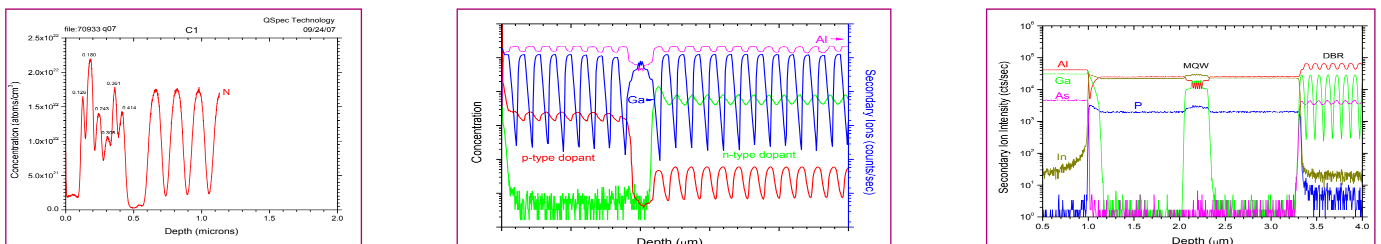
GD-OES: The left profile shows quantitative depth profiles of B, P, H and O in a BPSG film indicating the presence of Si-H bonding and water. The second profile shows a boron implant ($2x10^{15}$ at/cm^2, 0.5 keV). Additional co-implanted elements were detected with B but are not included here. The right figure shows a depth profile with the expanded insert of the interface illustrating the interfacial survey capability of GD-OES.



LA ICP-MS or SARIS™: Its key strengths are its fast profiling and multi-elements survey capabilities making it ideal for quality control (QC) of materials and films either during their R&D phase or as an incoming material. Surface and in-depth contaminants are rapidly revealed in conductive and non-conductive materials. The depth profiles below show elemental in-depth distribution in a ceramic coupon (left), in a Si solar cell (center) and in a BPSG film (left).



SIMS: The strength of SIMS is its good depth resolution and low detection sensitivity making it suitable for ion implantation and film characterization. The three depth profiles below illustrate its capability for film characterization and quality control of optoelectronic materials where specific target elements are known.



Balazs™ NanoAnalysis operates ISO 17025 certified laboratories that identify, analyze and resolve contamination issues for high-tech industries around the world. The Microcontamination Experts™ 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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