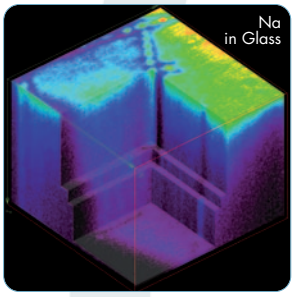
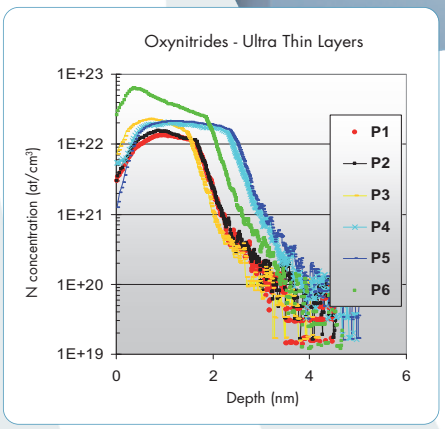
CAMECA
SCIENCE & METROLOGY SOLUTIONS
/ AMETEK®

SIMS 4550

High Depth Resolution
Ultra Low Energy Quadrupole SIMS







Materials Science

Insulator Analysis

Semiconductor Technology

SIMS 4550: a flexible Quadrupole Depth Profiler from the world leader in SIMS, combining benchmark depth resolution and sensitivity with easy operation.

SIMS 4550: Your best choice for semiconductor applications and beyond

Secondary Ion Mass Spectrometry (SIMS) is the only method for depth profiling of composition and trace elements to meet the high requirements of semiconductor applications in terms of **depth resolution** and **sensitivity**.

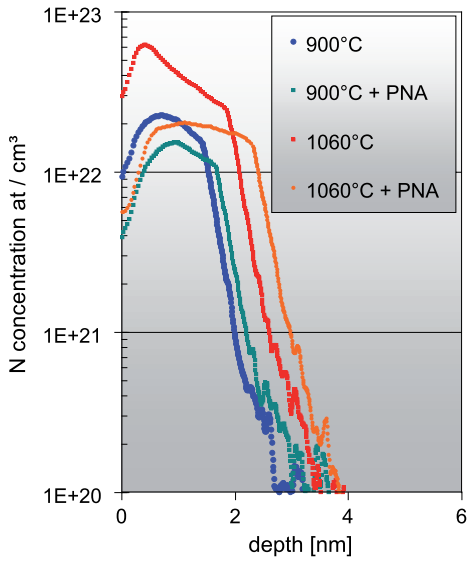
The **SIMS 4550** provides process engineers with timely, accurate depth information essential for designing integrated circuits and maintaining high production yields. It outperforms conventional quadrupole systems by providing automated SIMS with exceptional performance for analyzing ultra-shallow implants, SiGe, Oxynitrides, GaAs and other semiconductor materials.

Repeatability from batch to batch and **uniformity** across wafers are crucial, especially as devices become smaller and shallower. The use of EPI processes in production increases the demand for SIMS process control. The **SIMS 4550** enables process engineers to maintain **high production yields** by generating essential profiling data required to keep the elemental composition within narrow margins.

The **SIMS 4550** uses the most advanced technology to combine **depth resolution, profiling speed, automation, tool stability and operational flexibility including free sputter angle**. Designed for ease of use, it enables users with varied levels of expertise to easily measure depth profiles, elemental composition and segregation within materials.

The **SIMS 4550** is qualified for any application requiring elemental analysis at ultra high depth resolution. Easy to use in-house SIMS provides rapid feedback of essential information for process diagnostics and R&D.

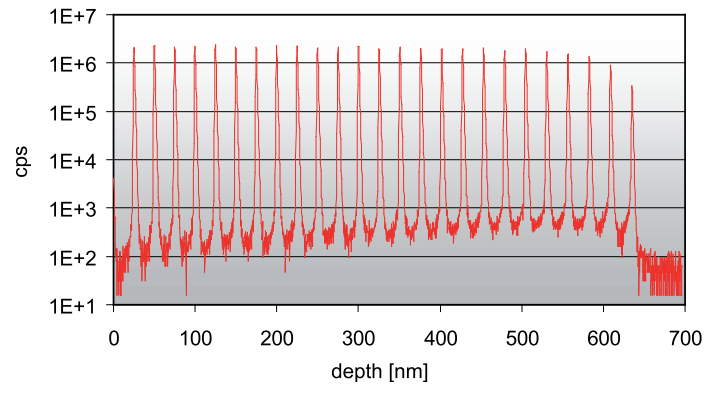
CAMECA's SIMS 4550 achieves excellent depth profiling performance thanks to its unique FLIG™ technology (Oxygen and Cesium Floating Low-energy Ion Gun).



Oxynitrides: Accurate depth profiling of ultra thin material with an advanced protocol: primary ions 250eV O_2 at 70°. Under these conditions, a depth resolution <1nm/dec is achieved.

Samples: various thermal oxynitrides prepared by Mattson Thermal Products.

Al in GaAs: Atomic layers measured with five orders of magnitude, displayed in logarithmic scale. Decay length (1/e) at 600nm depth: 0.7nm, approximately 90min total profiling time.



SIMS 4550 Main Features

SIMS 4550: The State of the Art Quadrupole SIMS

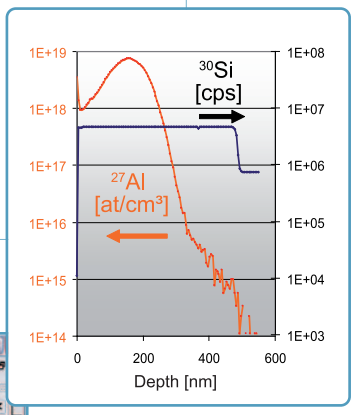
- Unique **FLIG™ ion gun technology**: high current, high quality primary ion beams over the entire energy range for fast and small area depth profiling of conventional and ultra shalllow implants.
- **Free sputter angle** from normal to glancing incidence for cesium and oxygen primary ions at any PI beam energy.
- **Low detection limits** and **high throughput**, even for novel materials like oxynitrides, low- and high-k dielectrics, compound semiconductors, coatings on glass and steel...
- **Automated operation** for repeated measurements such as uniformity control of implant with RTA/LTP and SPE in process monitoring and equipment characterization.
- **Ultra low primary beam energy** (down to 150eV): epitaxial layers, and quantum wells (LEDs, lasers, GaAs, InP) made visible by ultimate depth resolution.
- Strained silicon, SiGe process control supported by **OCE (Optical Conductivity Enhancement)**, a unique technology for easy and reliable quantification in SiGe and other amorphous Si matrix.



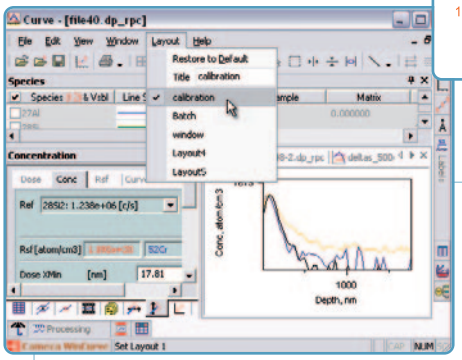
- Depth profiling on small test pads: **checkerboard gating** allows users to select the area of interest off-line, after an automatic measurement.
- Fast mass spectrum and 4D depth profiling: >50 images (mass channels) per second.

Precision & Stability

- Dose measurement within 1% for B and As
- Beam current stability within 1%
- Spectrometer with:
  - high abundance sensitivity and low detection limits, even in insulators (see example of Al in SiO_2)
  - high transmission for heavy and light elements



Low detection limits of Al in SiO_2 thanks to excellent mass separation and charge compensation.

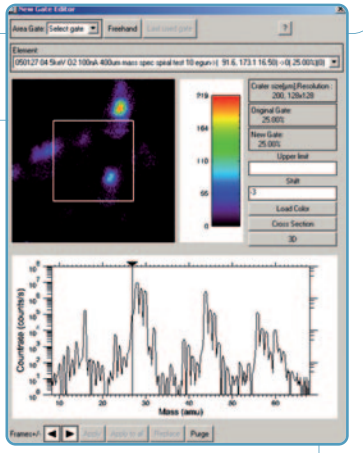


Automation & Ease of Use

- Automated multi-analysis queuing
- Unattended diagnostic routines
- Pre-programmed recipes for quick and easy set up
- Batch processing for unattended overnight measurements
- Remote operation & e-diagnostic
- **WinCurve:** SIMS Data Processing Software with high volume data acquisition and processing capabililites (depth profiling, mass spectra...)

Checkerboard Gating

- Checkerboard gating allows to record ion images on every scan of the ion beam and for each detected element, thus offering full flexibility to modify the electronic gate for the depth profile after measurement.



Checkerboard gating of a mass spectrum

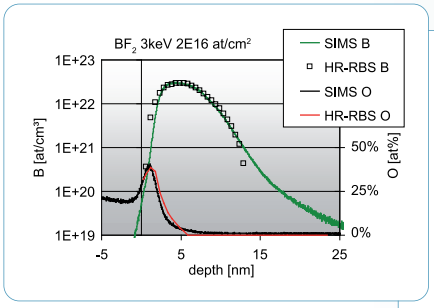
- The operator is able to check the validity of the results and to remove artifacts from sample inhomogeneity or dust particules without having to re-run the analysis.
- Checkerboard gating is a unique solution for the analysis of small features and a useful tool for quality improvement in automatic measurements. It thus greatly improves throughput and reproducibility.

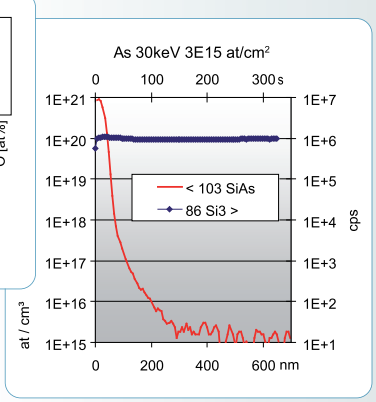
CAMECA's Quadrupole SIMS 4550 covers a wide range of applications in semiconductor technology and beyond.

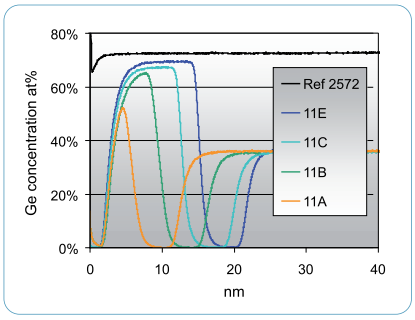
Implant Analysis

Left side graph illustrates the **outstanding ultra shallow depth profiling capabilities** of the SIMS 4550. Surface oxide layer and implant profile analysis fit perfectly with high resolution RBS measurements.

The measurement of a shallow As-implant on the right demonstrates **combined high erosion rate** (>100nm/min) **and high dynamic range** (6 orders of magnitude) within one depth profile.







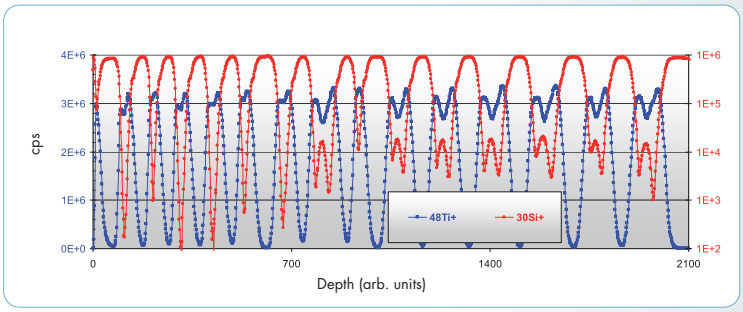
SiGe Technology

Analysis of test pads with varying layer thickness of strained SiGe on relaxed SiGe. Analytical conditions: 250eV O_2 @ 0°.

The SIMS 4550 achieves excellent quantitation and a depth resolution of 1.5nm/dec with normal incidence and low energy.

Multilayer Analysis on Insulator

Reflector of projector bulb. Control of concentration gradient and width of layers. **The SIMS 4550 combines high sensitivity together with high depth resolution.**



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