CAMECA
SCIENCE & METROLOGY SOLUTIONS
AMETEK

World Leader in Elemental & Isotopic Microanalysis

www.cameca.com

High-Performance Analytical Instrumentation & Metrology Tools for Academic Research, Industrial R&D & Production Support

CAMECA's scientific instruments can measure and image the elemental composition (such as copper, oxygen, hydrogen, silicon, etc.) and isotopic composition (such as ^{235}U / ^{238}U in uranium) directly at the surface of solid samples. Very small amounts (micro or nano volumes) of material can be measured in situ using electrons, ions, or X-rays, instead of using visible light (photons), as in classical optical microscopy.

The analyses performed by CAMECA's instruments are extremely sensitive and measured at ppb levels (parts per billion; that is, one detected atom among one billion surrounding atoms) for elemental concentration measurements or ultra-high precision (ppm levels) for isotope ratio determination. The analyses can also be very localized, ranging from bulk material to a few cubic micrometres down to a single atom, depending on the instrument and the analysis technique. The instruments can display measurement results as element or isotope concentrations in a given volume, elemental or isotope lateral distribution and depth profiles (2-dimensional images and graphs), or 3-dimensional (volume) images.

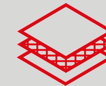
Applications for CAMECA's instruments are very diverse. High technology manufacturers of semiconductors use the instruments for their research on novel materials and devices as well as for automated in-line process control. CAMECA instruments are also used at the most prestigious academic laboratories for basic research, in fields such as earth and planetary sciences, materials and nuclear sciences, environmental sciences, cell biology, and microbiology.

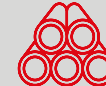
Geochemistry

Planetary Science

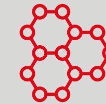
Environmental Science

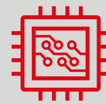
Life Science


Material Science


Metals & Alloys

Nuclear Science


Nanotechnology

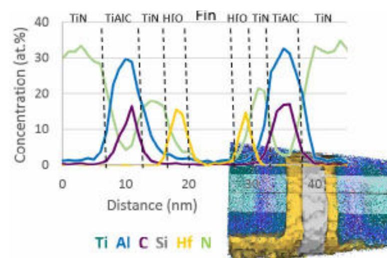

Semiconductor

A Wide Range of Applications

Semiconductors & Electronics

Silicon, III/V, II/VI, Thin Films, FinFET, Nanowires, Optoelectronics, Oxides, Memory, HKMG, Logics...

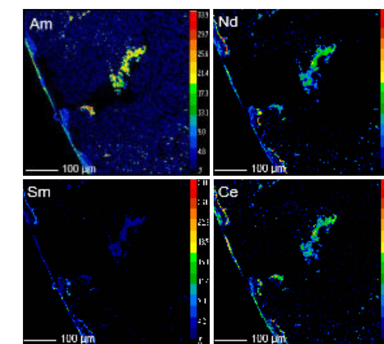
LEAP® analysis of a 14 nm SRAM device capturing the Si fin and gate dielectrics with 3D nanoscale spatial resolution.
From: P. Parikh et al. Three-Dimensional Nanoscale Mapping of State-of-the-Art Field-Effect Transistors (FinFETs). Microsc Microanal. 23(5), 916 925 (2017)



Materials, Metals & Nuclear Science

Metals & Alloys, Thin Films & Coatings, Ceramics, Glass, PV, Display, LED, OLED, Energy Storage, Fuel Cells, Graphene & 2D Materials, Nuclear Structural Materials, Fusion & Fission Research, Radioactive Waste Management, Nuclear Safeguards...

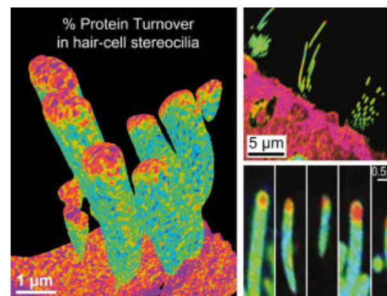
Investigation of diffusion and migration mechanism in at the interface between irradiated nuclear fuel and cladding: precise and accurate quantitative elemental mapping of Am, Nd, Sm and Ce in U-Pu-A metallic fuels.
From: K. Wright et al. Electron probe microanalysis of irradiated FUTURIX-FTA U-Pu-Zr alloy with added minor actinides. J. Nucl. Mater. 526, 151745 (2019)



Life & Environmental Sciences

Cell Biology, Neurosciences, Oncology, Pharmacology, Cosmetics, Environmental Microbiology, Plants & Soils, Microbial Ecology, Microbiome, Aerosols, Nanoparticles, Radiological Protection...

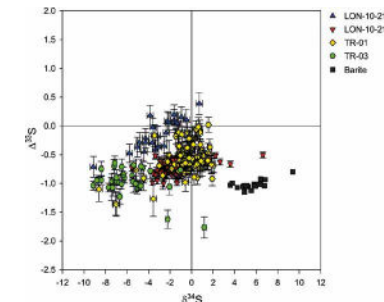
NanoSIMS 50L measurements of molecular fluxes in hair-cell stereocilia from adult mice inner ear using stable isotope labeling. From: D. S. Zhang et al. Multi-isotope imaging mass spectrometry reveals slow protein turnover in hair-cell stereocilia. Nature 481, 520–524 (2012)



Earth & Planetary Sciences

Petrology, Gemology, Mineralogy, Geology, Geochemistry, Cosmochemistry, Geochronology, Thermochronology, Early Life, Paleoclimatology, Mineral Exploration, Oil & Gas Industry...

High-resolution, in situ measurement of the four sulfur isotopes in pyrite associated with a 3.52 Ga hydrothermal barite deposit (Barberton Greenstone Belt, Swaziland).
From: D. L. Roerdink et al. Reworking of atmospheric sulfur in a Paleoarchean hydrothermal system at Londozi, Barberton Greenstone Belt, Swaziland. Precambrian Res. 28, 195–204 (2016)



Broad Solutions to your Analytical Needs

CAMECA makes products tailored to the characterization of materials at all length scales, from millimeters to nanometers and can provide a complete solution to materials characterization challenges. From bulk composition with ppt sensitivy to nanometer scale atom clusters, you can find your characterization solution at CAMECA.

APT
Atom Probe Tomography
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- Invizo® 6000
- LEAP® 6000 XR
- EIKOS-UV™ / EIKOS™

Dynamic SIMS
NanoSIMS
Secondary Ion Mass Spectrometry
pages 12 - 17

- IMS 7f-Auto
- ACTINIS
- IMS 7f-GEO
- IMS 1300-HR³ / KLEORA
- NanoSIMS 50L
- IMS Wf / SC Ultra
- AKONIS
- SIMS 4550

EPMA
Electron Probe Micro Analysis
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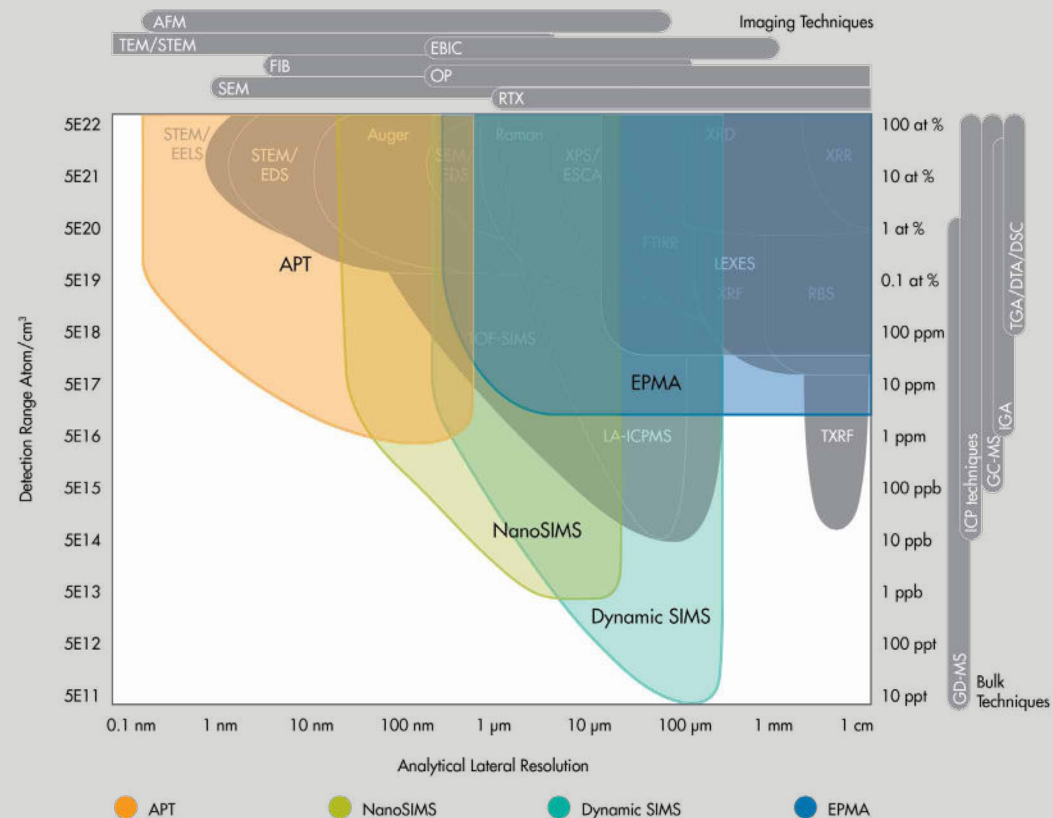


APT

Atom Probe Tomography

3D Imaging & Compositional Analysis with Near Atomic Resolution

Atom Probe Tomography (APT) is the only material analysis technique offering extensive capabilities for both 3D imaging and chemical composition measurements at the atomic scale (0.1-0.3 nm resolution in depth and 0.3-0.5 nm laterally). It takes advantage of ionizing single atoms at a time and identifying up to 80 % of them in a 3D volume.

Since its early development, APT has contributed to major advances in materials science. It can rapidly generate useful information on many different types of samples, including semiconductors, ceramics, and even complex structures such as geological and biomineral materials.

Invizo® 6000

APT with the Largest Field of View

The **Invizo® 6000** 3D Atom Probe microscope introduces major technology breakthroughs to push the boundaries of atom probe analysis. It introduces a completely new counter electrode concept which, in addition to enabling ion optics with unprecedented APT field of view, allows the symmetric laser illumination of the specimen, thus leading to unrivaled analytical capabilities. The **Invizo® 6000** offers a unique combination of the largest field of view of all 3D Atom Probes, while maintaining a high mass resolving power (MRP) thanks to a novel double einzel lens technology. The new advanced 257.5 nm deep UV (DUV) laser module enables dramatic improvements in specimen yield and data reconstruction quality. The **Invizo® 6000** is an ideal choice for advanced research on a diverse set of applications from metals and alloys to ceramics, semiconductors, biomaterials and geological materials.

LEAP® 6000 XR

APT with Highest Data Quality & Productivity

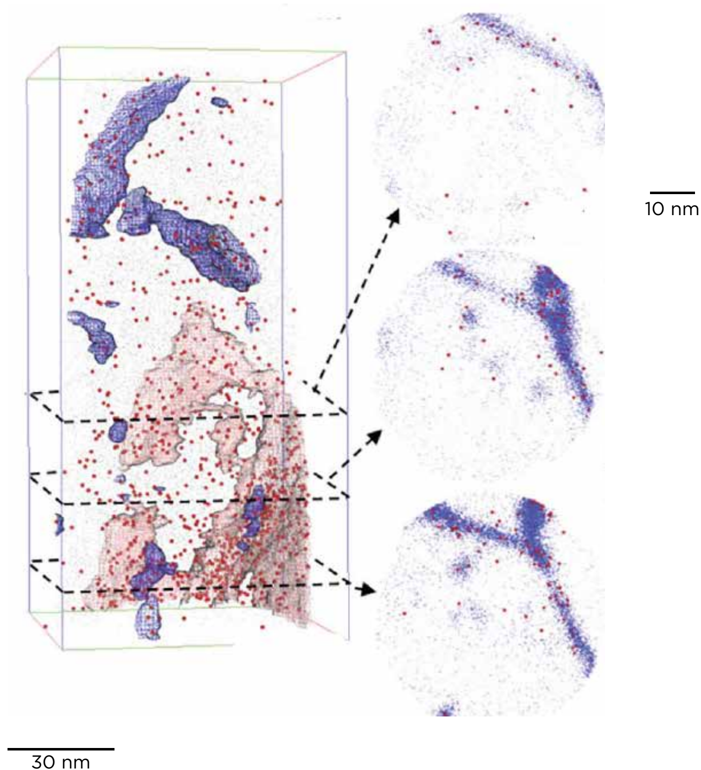
The **LEAP® 6000 XR** inherits key features from previous APT generations adding deep UV laser pulsing to the proven local electrode design to deliver higher yield and data quality. A unique simultaneous voltage and laser pulsed operating mode minimizes background, resulting in a dramatically enhanced detection sensitivity. Through compatibility with the microtip array and a redesigned optical system, the **LEAP® 6000 XR** can run up to 25 specimens unattended, providing enhanced ease of use and the potential for fully automated operation and high productivity. Whether in a research facility with a wide range of users and samples, or in a near-fab lab focused on high-volume process monitoring, the **LEAP® 6000 XR** maintains the microtip compatibility and automation required to support a high sample volume environment.

EIKOS-UV™

Workhorse Atom Probe for Research & Industry

Building on 30 years of success in Atom Probe Tomography instrumentation and application, CAMECA developed **EIKOS-UV™**, an Atom Probe that enables routine, high performance 3D nano-analysis in metals, semiconductors, minerals, nuclear structural materials and more. Easy to site with its small footprint and requiring very few consumables, **EIKOS™** delivers high quality quantitative compositional data that helps accelerate your research.

EIKOS-UV™ is available in two configurations: the base **EIKOS™** system (voltage pulsing) enables a variety of metallurgical applications, while the full configuration **EIKOS-UV™** (automated 355 nm laser pulsing) expands the application range and provides higher signal to noise.



APT analyses of deuterium charged martensitic steel samples containing GBs and dislocations.
A 3D image showing deuterium (red), iron (gray), and 2% carbon isosurfaces in blue and pink.
Five nm thick slice, from three positions in the dataset showing the spatial correlation between carbon and deuterium.

From Y. S. Chen et al. Observation of hydrogen trapping at dislocations, grain boundaries, and precipitates. Science 367, 171 (2020).

SIMS

Secondary
Ion Mass
Spectrometry

The Most Sensitive Elemental & Isotopic Surface Microanalysis Technique

The SIMS technique provides a unique combination of extremely high sensitivity for all elements from Hydrogen to Uranium and above (detection limit down to ppb level for many elements), high lateral resolution imaging (down to 40 nm), and a very low background that allows high dynamic range (more than 5 decades).

While static SIMS concentrates on the first top monolayer, providing mostly molecular characterization, in dynamic SIMS mode, bulk composition and in-depth distribution of trace elements are investigated with a depth resolution ranging from sub-nm to tens of nm.

All CAMECA SIMS instruments are optimized for dynamic SIMS analysis.

IMS 7f-Auto

Versatile Magnetic Sector SIMS

Designed to deliver high precision elemental and isotopic analyses with high ease-of-use and productivity, the **IMS 7f-Auto** is optimized for challenging applications such as Si-based, III-V and II-VI devices, bulk materials, thin films, glass, metals, ceramics and more.
It offers unparalleled depth profiling capabilities with high depth resolution and high dynamic range, as well as high-sensitivity secondary ion imaging (2D & 3D) with sub-µm lateral resolution.
Excellent detection limits including for light elements. Analysis of multiple samples in chained, unattended mode thanks to its automated sample loading system.

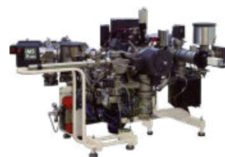
ACTINIS

Shielded SIMS for the Analysis of Radioactive Samples

Derived from the field-proven IMS 7f system, **ACTINIS** is designed to perform high precision elemental and isotopic analyses of radioactive samples in a safe environment: it is integrated in a set of biological protections in order to protect operators from contamination and irradiation effects during sample transfer and analysis, and includes specific adaptations to minimize manual operations such as a full-security sample introduction system. Including a glove box with manipulator for Alpha protection and lead-walled cell for Gamma protection, the shielding package enables **ACTINIS** to analyze samples with an activity (dose rate) of up to 2 Gy/h measured at 5 cm from the sample. The equivalent dose outside the biological protections is less than 25 µSv/h.
ACTINIS is the tool of choice for nuclear fuel cycle optimization, pre and post irradiation examination, nuclear waste management, and more.

IMS 7f-GEO

Compact, Monocollection SIMS for Geosciences



The **IMS 7f-GEO** is a mono-collection SIMS model specifically designed to perform high precision, high throughput measurements in geological samples, i.e. stable isotopes, REE (Rare Earth Elements), trace elements and more. It is also used for material sciences analyses and environmental studies. Derived from our proven IMS 7f instrument, the **IMS 7f-GEO** is equipped with a specific detection system combining two low-noise Faraday cups and one electron multiplier. Thanks to this configuration and a fast mass peak switching system, acquisition time is shortened, and analyses are run in a pseudo bi-collection mode ensuring sub-permil precision for stable isotope ratio measurements. The **IMS 7f-GEO** also performs benchmark depth profiling and superior ion imaging. Detection limits are excellent, including for the challenging light elements.

IMS 1300-HR^3

Ultra-High Sensitivity Large Geometry SIMS

The **IMS 1300-HR^3** is a multicollection, large geometry ion microprobe with unmatched analytical performance for in-situ trace element and isotope ratio analysis of minerals. In multicollection mode, five moveable detectors allow the instrument to perform fast, high precision isotope ratio analyses from lithium to uranium, with a precision reaching the tenth-permil level. A high brightness RF-plasma oxygen ion source enables dramatic improvements in spatial resolution, data reproducibility and throughput.
The **IMS 1300-HR^3** is used worldwide to track geological processes using stable isotopes and trace elements analyses, to perform mineral dating as well as to map and measure uranium particles for nuclear safeguards.

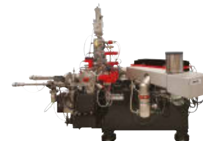
KLEORA

The Advanced Solution for U-Pb Geochronology

Derived from the IMS 1300-HR^3, **KLEORA** provides benchmark performance for in-situ mineral dating (U-Th-Pb isotopic analyses) in a high throughput, easy-to-use platform, perfectly tailored to the needs of geochronologists.
KLEORA benefits from the breakthrough instrumental advances of the IMS 1300-HR^3, uniquely combining High Reproducibility with High spatial Resolution and High mass Resolution. Covering the entire range of U-Pb geochronological applications, from precise age determination of zircon to dating of other U-rich minerals such as rutile or baddeleyite, **KLEORA** is perfectly taylored to the needs of geochronologists.

NanoSIMS 50L

High Resolution Ion Microprobe



The **NanoSIMS 50L** is a unique SIMS instrument optimized for lateral resolution while keeping high sensitivity at high mass resolution.
The simultaneous detection of up to seven species is possible with electron multipliers detectors for imaging, or Faraday Cups for high-precision isotopic measurements. Thanks to recent improvements, isotope ratio reproducibility of a few tenths of a permil can be achieved.
The **NanoSIMS 50L** is used in material sciences, geology, cosmochemistry, environmental microbiology and cell biology. It allows ultra-fine elemental and isotopic feature analysis in sub- micron grains or inclusions from interplanetary dust particles, meteorites and mineral sections; provides trace element (dopant) imaging and quantification in semiconductors and ceramics; performs intra-cellular measurement of accumulations and fluxes of molecules for biomedical research, and more.

IMS Wf / SC Ultra

Full Wafer & EXLIE Magnetic Sector SIMS

Used in semiconductor development and manufacturing support, optimized for ultra shallow depth profiling. These tools specialize in sample sputtering at **EX**treme **L**ow **I**mpact **E**nergy providing best depth resolution without compromising detection sensitivity.

The **IMS Wf** can analyze full 300 mm wafers and can be equipped with Oxygen and Cesium high density ion columns. Thanks to its high level of automation and its high density ion column, it performs fast deep depth profiling with sub-nanometer depth resolution. Excellent measurement stability ensures unequaled SIMS tool productivity, enabling support of high volume manufacturing.

The semi-automatic, small sample version, the **SC Ultra**, has manual sample loading. Computer automation allows full control of all analytical parameters (analysis recipe, instrument set-up and more).

AKONIS

The Only In-Line, Fully Automated SIMS

The **AKONIS** platform fills a critical gap in the semiconductor fabrication process by providing a fast tracking of compositional changes and conformity directly in the fab line. Complementing the IMS Wf / SC Ultra and the SIMS 4550 currently used to support the semiconductor industry via off-line characterization labs, **AKONIS** is the only fully automated Secondary Ion Mass Spectrometer that will make SiGe and SiP process monitoring possible in high volume manufacturing environments.

The **AKONIS** offers:

- Fast & precise high resolution depth profiling of epitaxial processes
- Blanket & patterned wafer measurement in pad down to 35 µm
- Intuitive recipe creation making SIMS data accessible to non-experts
- A fully automated SEMI compliant platform with >95% uptime.

SIMS 4550

Ultra Low Energy Quadrupole SIMS

Benchmark quadrupole SIMS with optimized performance in semiconductor depth profiling, thin layer and insulator analysis. Its unique FLIG™ technology (oxygen and cesium Floating Low energy Ion Gun) ensures high depth resolution analyses. The **SIMS 4550** offers:

- Total flexibility in sputter conditions (primary ion angle of incidence, energy, species), low extraction field
- Low energy electron flood gun, unique Optical Conductivity Enhancement for SiGe analysis
- Sample holders accommodating a variety of samples: small pieces of a few mm, up to 100mm diameter sample size
- Easy operation, benchmark automation and reproducibility for metrology.

EPMA

Electron Probe Microanalysis

Qualitative & Quantitative Elemental Microanalysis

EPMA is a non-destructive technique that involves bombarding a specimen with a focused electron beam and analyzing the emitted X-rays using WDS (Wavelength Dispersive Spectroscopy) and/or EDS (Energy Dispersive Spectroscopy). EPMA is able to produce x-ray maps showing the distribution of elements over the surface while also accurately measuring their concentrations. It is fully compatible with routine analysis sessions, and offers easy and direct interpretation of the results.

Particularly adept at analyzing geological samples, metals, and alloys, EPMA has found a wide range of other applications, studying everything from the latest advanced solar cells to archeological materials.

SKAPHIA

Shielded EPMA for Radioactive Samples

SKAPHIA provides a safe environment for manipulating and analyzing nuclear samples together with benchmark analytical performance, allowing scientists to gain a deeper understanding of fuel performance; to explore irradiated material behavior and radiation damage processes; to develop innovative alloys and structural materials; and to optimize the nuclear fuel cycle and achieve better nuclear waste management.
Derived from CAMECA state-of-the-art EPMA instruments, **SKAPHIA** reveals compositional information for both major and trace elements of radioactive samples. The information is obtained from sub-micron areas with excellent precision and accuracy.
Column, spectrometers and sample stage are installed in a hot cell. WDS analyzers and detectors are shielded to prevent the background caused by radiations.

Worldwide Service & Customer Support

To serve customers at the level required by demanding environments, CAMECA has developed a worldwide customer support organization. Our service offer is part of an innovative and comprehensive program - AMECARE Performance Services - designed to ensure peak performance and extend the life of your analytical instrumentation.

A comprehensive range of service contracts are available, allowing our customers to focus on their core activity and leave their maintenance needs to us. All CAMECA's Field Service Engineers are specialists offering the highest level of support. They are certified through advanced training at our factories.

Our high-quality products along with an expansive support network result in many years of dependable, high-performance operation. Spare parts inventories are maintained at our factories and subsidiaries, ensuring speedy delivery. Upgrades & Accessories offer our users the benefits of the latest improvements, maintaining high levels of instrument performance.

To help customers make the most efficient use of their instruments, CAMECA offers various types of training, ranging from general operation to solving specific scientific problems. Training can be given on site or at our facilities.

Innovation & Quality

At the core of our operation lies a dedicated research & development team of scientists and engineers who strive to design and develop innovative ways of meeting the needs of our users. Our instruments are well known for their unbeatable analytical capability, ease of use, reliability, and low cost of ownership.

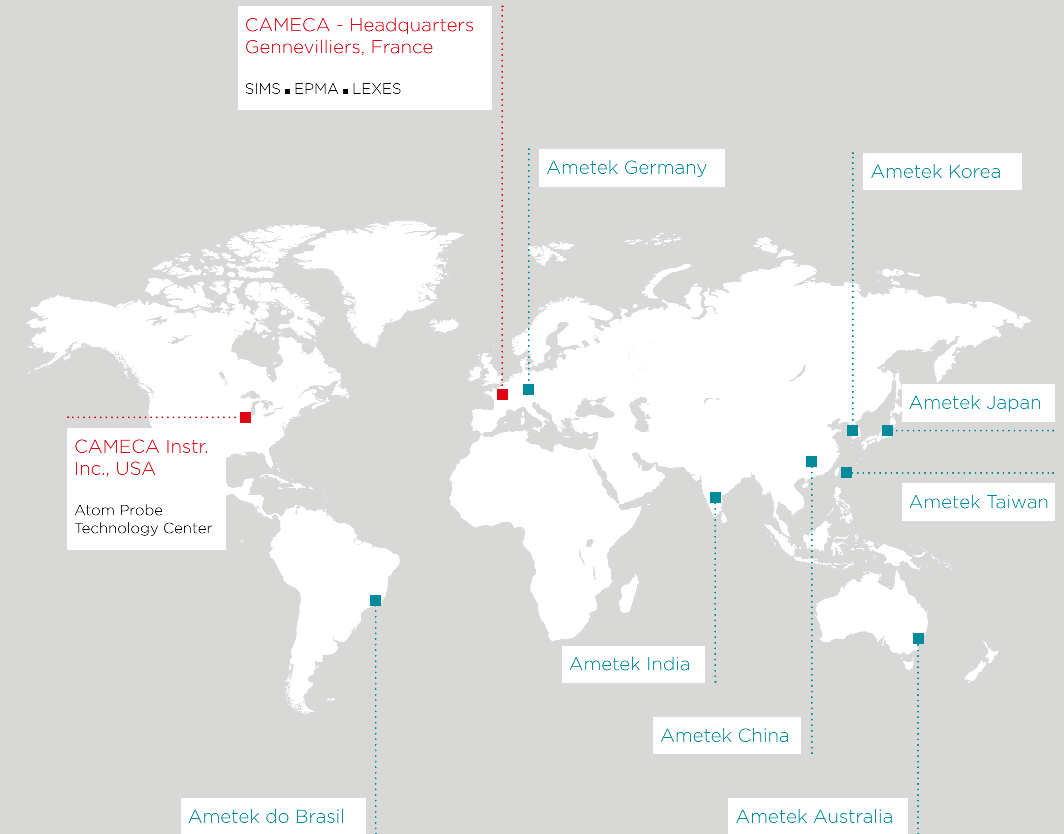
About CAMECA

CAMECA started in France in 1929 as a manufacturer of movie theater projectors, before rapidly evolving into a provider of scientific instrumentation for the international research community and in-fab / near-fab metrology solutions for the semiconductor manufacturing industry. From its inception, CAMECA has been renowned for its precision mechanics, optics and electronics.

Since pioneering Electron Probe MicroAnalysis (EPMA) in the 1950's and Secondary Ion Mass Spectrometry (SIMS) in the 1960's, CAMECA has remained the undisputed world leader in these techniques while achieving numerous breakthrough innovations in complementary techniques such as Atom Probe Tomography (APT).

Operating under ISO 9001 certification, CAMECA controls not only the technology, but all aspects in the designing, manufacturing, installation and servicing of products. Located near Paris, France (CAMECA headquarters) as well as in Madison, Wisconsin, USA, our plants are state of the art facilities, using the best practices for clean room production, computer networking, electron and ion optics simulation and advanced CAD.

CAMECA is a business unit of AMETEK, Inc., a leading global provider of electronic instruments and electromechanical devices, as part of the AMETEK Materials Analysis Division.



R&D and production center, Sales and service

Sales and service

World leader in Elemental & Isotopic Microanalysis

Geochemistry

Planetary Science

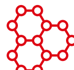
Environmental Science

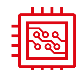
Life Science

Material Science

Metals & Alloys

Nuclear Science


Nanotechnology


Semiconductor

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WORLD PREMIER PROVIDER OF SCIENCE & METROLOGY SOLUTIONS FOR ELEMENTAL & ISOTOPIC MICROANALYSIS.

WE DELIVER CUTTING-EDGE SCIENCE AND METROLOGY SOLUTIONS, AND OFFER OUR CUSTOMERS UNPARALLELED SUPPORT AND MAINTENANCE SERVICE THROUGH THE COMPREHENSIVE AMECARE PROGRAM.

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