

AMETEK Materials Analysis Division



**A leading global supplier
of instrumentation for
materials analysis needs**



AMETEK[®]
MATERIALS ANALYSIS DIVISION

AMETEK's common stock is New York Stock Exchange listed since 1930 and today a component of the S&P MidCap 400 and the Russell 1000 indexes.



Over the past five years, AMETEK has invested over US\$ 500 million in new product development and introduced a steady stream of successful new products.



AMETEK Materials Analysis Division

AMETEK, Inc. is a leading global manufacturer of electronic instruments and electromechanical devices. The Corporate Office is located in suburban Philadelphia, USA. AMETEK has over 11,000 colleagues working at more than 80 manufacturing facilities and more than 100 sales and service centers around the world.

AMETEK's corporate vision is to double the size and profitability over the next five years: The solid execution of the Four Growth Strategies - Operational Excellence, Global & Market Expansion, New Products, and Strategic Acquisitions - is key to achieving this vision for the Company.

Operational Excellence is the cornerstone strategy and focused on operating efficiency, asset management, and the ability to consistently deliver quality and value to the customers. AMETEK is using Global & Market Expansion to increase the low-cost manufacturing base in key global regions, and to strengthen the marketing and distribution capabilities worldwide. Since the beginning of 2000, AMETEK has completed more than 40 acquisitions, achieving critical mass and a competitive position in a number of emerging markets and technologies. This coupled with a comprehensive new product program has spurred AMETEK's growth.

AMETEK consists of the two operating groups Electronic Instruments Group and Electro-mechanical Group. The Electronic Instruments Group again is divided into four market groups: Process & Analytical, Aerospace, Power and Industrial. The AMETEK Materials Division belongs to the Process & Analytical Market Group and comprises the four business units CAMECA, EDAX, SPECTRO Analytical Instruments and VISION Research, each of which are technology and quality leaders in their markets.



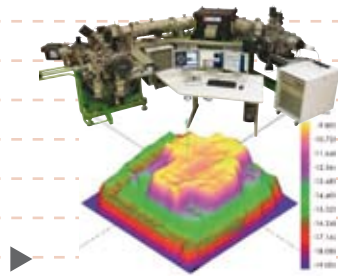
Engineering and manufacturing facilities are located in Paris (France), Kleve (Germany), Bucharest (Romania), Mahwah NJ and Wayne NJ and Madison WI (USA). Major sales and service centers in Beijing, Hong Kong and Shanghai (China), Paris (France), Wiesbaden (Germany), Milan (Italy), Osaka and Tokyo (Japan), Suwon-City (Korea), Groningen and Tilburg (Netherlands), Singapore, Kempton Park (South Africa), Birmingham (UK), Boston MA, Draper UT, Madison WI and Stuart FL (USA).



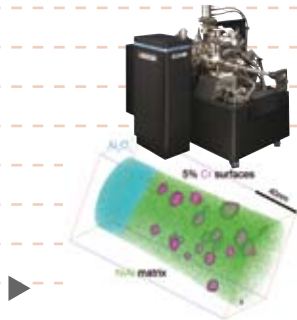
CAMECA provides the most precise and accurate elemental and isotopic micro- and nanoanalysis systems. EDAX offers instrumentation and complementary techniques for the elemental and structural microanalysis of materials. SPECTRO is a leading supplier of analytical instruments to detect the elemental composition with optical emission and x-ray fluorescence spectrometry. VISION RESEARCH designs and manufactures high-speed digital imaging systems used in measurement and entertainment applications.

Examples

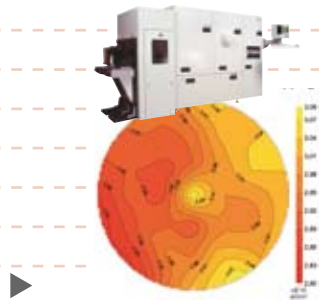
Carbon isotope analysis of a natural diamond with the CAMECA IMS 1280 ultra high sensitive magnetic sector SIMS for geosciences.



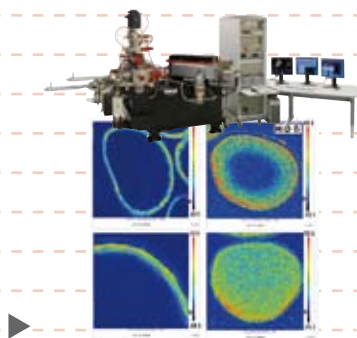
Rapid quantitative 3D imaging of structural alloys with buried interfaces on the CAMECA LEAP 4000 local electrode 3D atom probe. Courtesy of K. Stiller, Chalmers University.



N dose mapping on a 300mm SiON wafer with the Shallow Probe LEX-FAB-300, CAMECA's leading metrology tool for ultra low energy implants and thin films.



Cosmetics industry: quantitative visualisation of the incorporation of a deuterium-labeled shampoo molecule inside the core of a human hair with the CAMECA high sensitivity ion probe NanoSIMS 50

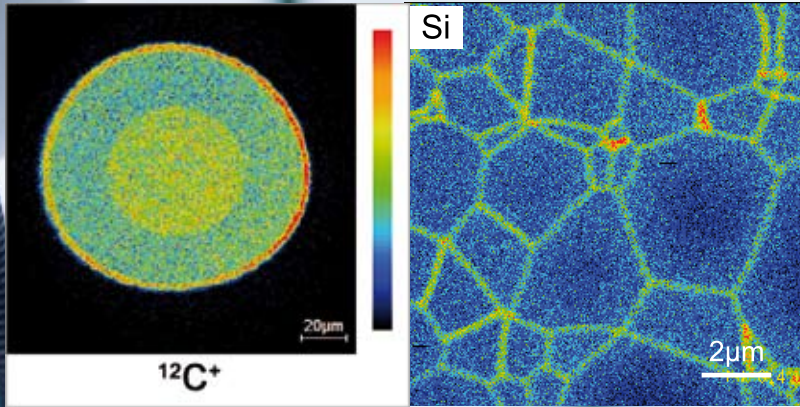


CAMECA has over 50 years of experience in designing, manufacturing and servicing scientific instruments for material micro- and nano-analysis. Since pioneering Electron Probe Micro-Analysis (EPMA) in the 1950's and Secondary Ion Mass Spectrometry (SIMS) in the 1960's, CAMECA has remained the undisputed world leader in these techniques, while achieving numerous breakthrough innovations in complementary techniques such as Low Energy Electron induced X-ray Emission Spectrometry (LEXES) and 3D Atom Probe (TAP). CAMECA evolved from a provider of scientific instrumentation for the international research community to a provider of metrology solutions for the semiconductor manufacturing industry, successfully expanding both product range and market reach.

The CAMECA instruments provide elemental and isotopic composition data from micron down to sub-nanometer scale and have numerous applications in mineralogy, geochemistry and cosmochemistry, cell and microbiology, materials science, nanomaterials and semiconductors. CAMECA also develops innovative metrology tools to solve semiconductor manufacturing challenges, from infab process control to R&D for thin film and new materials. These tools address all issues of ultra-thin film elemental composition, ULE implants, dopant dosimetry and layer thickness.

Users of CAMECA instruments are scientists involved in fundamental or applied research at all major government and university labs around the world, researchers in R&D departments of leading high tech industrial companies, and metrology engineers in semiconductor fabs. The working environment ranges from pure research to automated in-line process control.

The CAMECA instruments perform extremely sensitive analyses: atomic concentration is measured down to the ppb level (one detected atom among one billion surrounding atoms). The analysis is also very localized: from a few cubic micrometers down to the volume of single atoms, depending on the selected technique. The analysis outputs are 1D - elemental depth profiles, 2D - isotope or elemental lateral distribution images, or 3D - volumic images and composition of volumes.

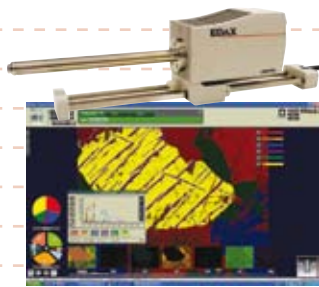


CAMECA-Techniques

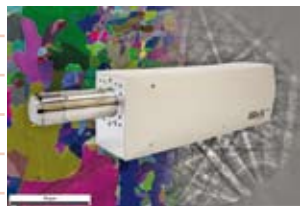
- **SIMS: Secondary Ion Mass Spectrometry**
- **EPMA: Electron Probe Micro-Analysis**
- **LEXES: Low energy Electron induced X-ray Emission Spectrometry**
- **TAP: Tomographic Atom Probe (or 3D Atom Probe)**

Examples

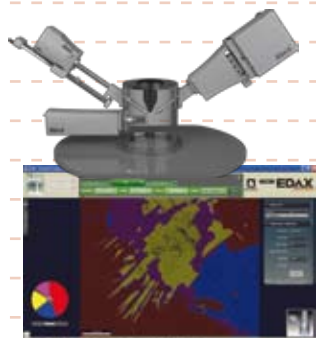
EDAX's TEAM™ EDS System provides materials characterization solutions for many X-ray microanalysis applications. Shown is a phase map of a complex, multi-phase solder produced in the new TEAM™ software. ▶



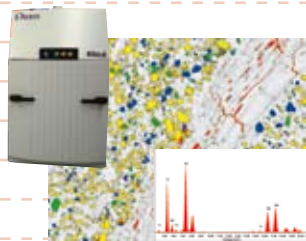
EBSD in the scanning electron microscope is a mature analytical tool to determine crystallographic microstructures. Examples shown include a meteorite map and a silicon diffraction pattern. ▶



To fully understand a material, the scientist often needs to determine the relationships between its physical, chemical, crystallographic and morphological properties. The seamless integration of EDS, EBSD, and WDS provides complete materials characterization. ▶



The Orbis micro-XRF spectrometer yields a system with excellent micro-XRF capability while setting a new standard in analytical flexibility. ▶



Founded in 1962,

EDAX raises the standard as the technical innovator with high performance and functionality. EDAX is the world's largest supplier of energy dispersive spectroscopy (EDS), electron backscatter diffraction (EBSD), and wavelength dispersive spectroscopy (WDS) systems for electron microscopy applications and Micro X-ray fluorescence systems, all providing technical and performance leading solutions for materials characterization. EDAX's seamlessly integrated systems provide a powerful combination of elemental information from EDS and structural information from EBSD or advanced X-ray microanalysis by combining EDS and WDS. EDAX also offers a unique combination of EDS, EBSD and WDS in one analytical tool, combining the latest technological advancements for all three techniques. The μ XRF system provides a powerful platform for reduced spot X-ray analysis and X-ray mapping on a large variety of materials. EDAX sets the standard with advanced features in an easy to use format, providing exceptional results.

EDAX instrumentation for elemental and structural analysis is found in a broad spectrum of industrial, academic, and government applications from the quality control department to the most advanced research and development laboratory. Typical markets served include semiconductor and microelectronics, academic and industrial R&D laboratories, ROHS/WEEE, pharmaceuticals, mining, security, forensics, catalysts, petrochemicals, metallurgy, energy, photovoltaic and manufacturing operations.

EDAX's X-ray microanalysis systems provide the materials scientist with data to help in the understanding of the most complex materials characterization analysis. EDS provides chemical analysis from a simple qualitative study to a complex quantitative analysis including mapping and particle morphology. EBSD supplies crystallographic orientation data necessary to understand the microstructure-property relationships for alloy design, materials characterization, and failure analysis. WDS is a complimentary technique for EDS X-ray analysis providing superior energy resolution for more accurate qualitative analysis and improved quantitative measurements. Micro-XRF provides X-ray analysis capabilities with a spot size varying from 2 mm to $50 \mu\text{m}$.

EDAX has a worldwide organization with manufacturing and development facilities and sales organizations supporting demonstrations, training customers, and providing technical support to optimize the system performance.

EDAX-Techniques

- EDS: Energy Dispersive Spectroscopy
- EBSD: Electron Back Scatter Diffraction
- WDS: Wavelength Dispersive Spectroscopy
- Integrated Solutions Combing EDS, EBSD and WDS
- Micro-XRF: Micro X-ray Fluorescence



Examples

On-site quality control and material analysis in the metal processing industries with the SPECTROTEST



Analyzing melt in a steel plant with the SPECTROLAB for process control of the smelting process



Analysis of traces and main components in complex matrices from the mining, metal and chemical industries with SPECTRO-ARCOS



Ultra trace determination and isotope ratios with SPECTRO-MS; ICP-MS spectrometer.



Process analysis in lubricant manufacturing with the SPECTRO XEPOS X-ray fluorescence spectrometer



Starting point and cornerstone for

SPECTRO's successful development was the first mobile spectrometer for on-site metal analysis introduced in 1979. Many spearheading ideas and innovative products later, SPECTRO is now one of the most well recognized companies for element analysis in the world. Subsidiaries and representatives in more than 50 countries in the world ensure that the high expectations in respect to quality and analytical performance, long associated with the name SPECTRO, are fulfilled and surpassed. SPECTRO's customers include some of the smallest of businesses as well as many international concerns. A worldwide network of local service sites guarantees comprehensive support for every installed system, fast reaction times in case of required service and the continuous availability of consumable and replacement parts.

Mobile metal analyzers, for the rapid and reliable sorting control as well as for the sorting and analysis of metals, continue to be among the most important SPECTRO products. These instruments are used, for example, for the incoming and outgoing inspection of metals, to control welded seams, to sort scrap metal or to verify components that have already been mounted in chemical or petrochemical plants.

In contrast, stationary metal analyzers are used mainly in metal producing companies and foundries for monitoring and controlling of the smelting process. Other application areas include the use for incoming inspection by metal processing factories and companies in the recycling industry, for quality control of semi-finished and finished products and in many other cases in which the chemical contents of a metal material must be exactly determined.

The ICP-OES and ICP-MS spectrometers from SPECTRO are characterized by excellent measurement accuracy, maximum sensitivity and a high degree of flexibility. They are predestined for trace and ultra-trace analysis of solutions in environmental applications, for comprehensive analysis of foodstuffs, petrochemical products, geological materials, and for the monitoring of innumerable manufacturing processes in the chemical and pharmaceutical industry.

Energy-dispersive X-ray fluorescence analysis technology is one of the simplest yet most efficient and economical analysis methods. With SPECTRO's polarization technology it is also one of the most versatile and precise methods. Whether dealing with waste at an incinerator, raw materials in incoming goods inspection, petrochemical, chemical and pharmaceutical intermediate and finished products in manufacturing processes, soils in nature conservation or rocks in geology – SPECTRO X-ray fluorescence spectrometers are suitable for many thousands of applications.

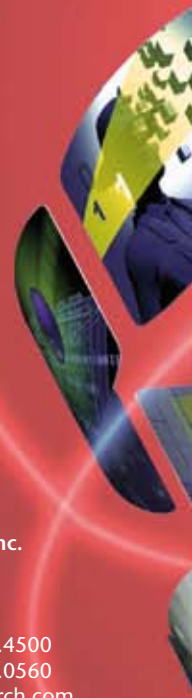
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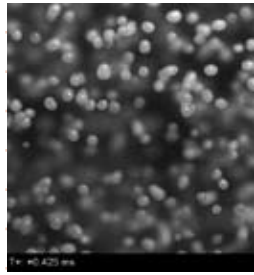


SPECTRO-Techniques

- **MMA: Mobile Metal Analysis**
- **SMA: Stationary Metal Analysis**
- **ICP-OES: Inductively Coupled Plasma Optical Emission Spectrometry**
- **ICP-MS: Inductively Coupled Plasma Mass Spectrometry**
- **EDXRF: Energy-dispersive X-ray Fluorescence Spectrometry**

Examples

Characterization of the high-speed dynamics of coal particles during the gasification process with the Phantom V7.1 high-speed digital camera.



High-speed testing of the impact of an explosion on windows, glazing systems and building components with the Phantom V4.2 high-speed digital camera.



Visual evaluation of human vocal folds with the Phantom V7.3 high-speed digital camera.



High speed imaging is an engineering tool, much as is an oscilloscope or a computer. It is a photographic technique that enables us to visualize and analyze physical phenomena, especially motion that is too fast for the human eye or conventional cameras to perceive - "When it's too fast to see, and too important not to". In entertainment and art applications it is applied where the emotional impact of slow-motion is desired.

The history of **VISION RESEARCH** started in 1950 when a young, idealistic, engineer quit his job to form a brand new company named Photographic Analysis Company whose sales mark was "Research Through Photography". During the first forty two years of the company's existence high speed photographic images were generally "captured" on photographic film. In 1992 the company decided to form a separate entity that was to design and fabricate high speed electronic imagers that did not rely on photographic film for imaging. That "spin off" was later to be known as Vision Research Inc. and today designs and manufactures high-speed digital imaging systems. Their broad line of cameras, marketed under the Phantom® brand, span a variety of application domains in measurement and entertainment including defense, automotive, engineering, scientific and medical research, industrial, sports, and digital cinema.

The Phantom product family consists of three camera product lines, and a line of camera accessories. Miro cameras - small, lightweight and untethered from a computer - are great for mobile applications or situations where size and weight might be an issue. V-Series cameras are a broad line of performance cameras with industry-leading resolution, speed and light-sensitivity, whereas Phantom HD, 65 and Flex cameras are targeted at digital cinema and HD television productions.

Being known for their innovations in high-speed digital camera technology and sensor design, Vision Research has received numerous research and development awards. With unsurpassed light-sensitivity, image resolution, acquisition speed, and image quality it sets the benchmark for other high-speed imaging manufacturers.



VISION RESEARCH Techniques

- **Proprietary CMOS sensor designs**
- **High-throughput camera architecture**
- **Embedded technology for image acquisition, analysis, storage and transport**
- **High-throughput, high-capacity, removable memory magazines and docking station**

