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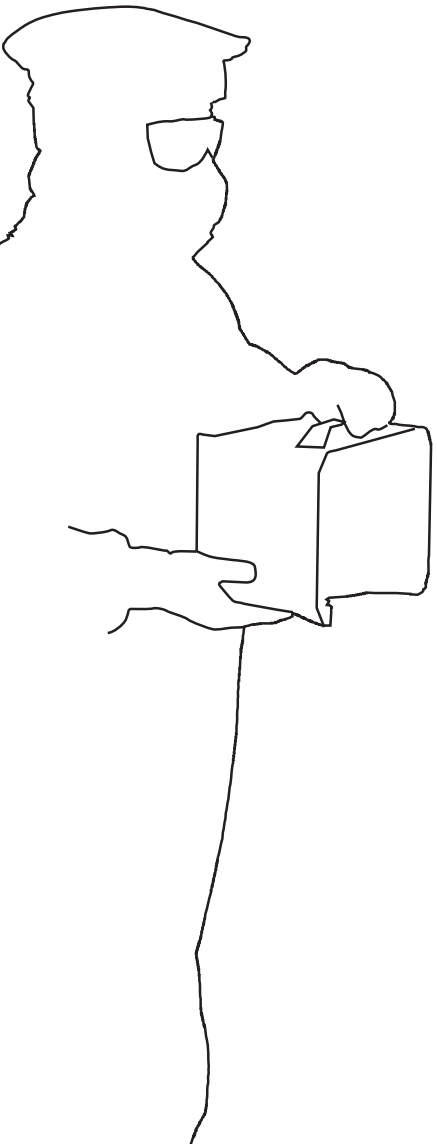
2830 ZT WAFER ANALYZER

Advanced wavelength dispersive XRF analysis

Non-contact determination of layer thickness and composition



The Analytical X-ray Company

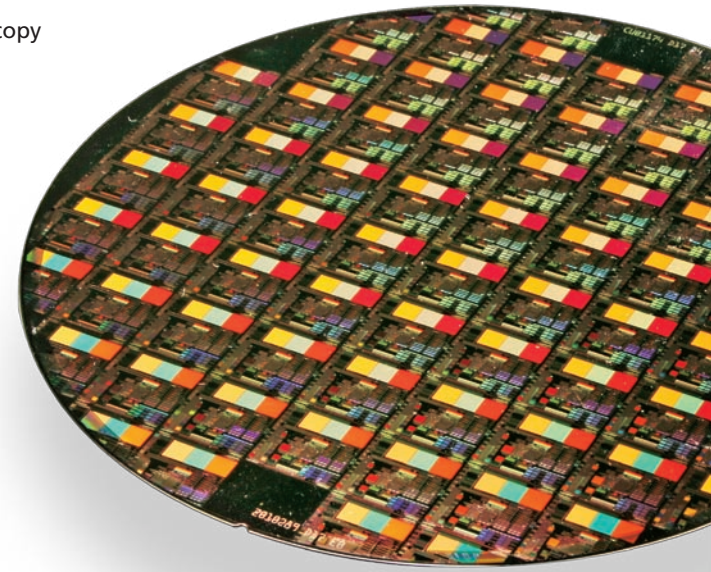
2830 ZT

Supporting the semiconductor and data storage industry – now and in the future

Semiconductor and data storage technology has advanced rapidly over recent years, and the rate of change continues to gather momentum. This places considerable pressure on the metrology techniques used to control production processes - instrumentation must keep pace with developments and meet ever more rigorous demands.

Deposited thin films and multi-layers continue to decrease in thickness while increasing in complexity. As new technologies emerge at an escalating rate, yield improvement (during process ramp up) must evolve accordingly. Flexible and cost-effective process monitoring has become increasingly critical to obtain optimal process conditions and maximum yield.

X-ray fluorescence (XRF) spectroscopy meets the key requirements of semiconductor and hard disk manufacturers. The technique is inherently suited to thin film analysis, offering exceptional precision and sensitivity for the simultaneous determination of layer thickness and composition. Moreover, XRF is compatible with a broad range of applications, facilitates straightforward stack analysis and is synonymous with high uptime and low running costs.



The 2830 ZT is designed for maximum uptime and capability. It features the latest X-ray technology, including:

- Zeta technology, eliminating X-ray tube aging, greatly enhancing operational efficiency
- 4 kW SST-mAX tube for operation at 160 mA current to give the highest sensitivities and lowest detection limits
- FP Multi software allowing simultaneous analysis of film thickness and composition of stacks up to 16 layers

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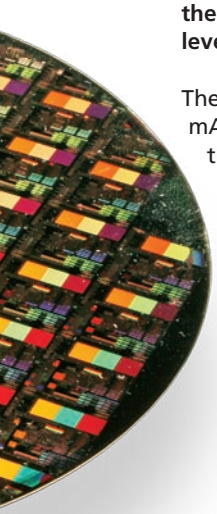
2830 ZT

Ultimate capability for measuring film thickness and composition

The 2830 ZT wavelength dispersive X-ray fluorescence (WDXRF) Wafer Analyzer is the successor to PANalytical's highly acclaimed PW2830. Designed specifically for the industry, it enables the determination of layer composition, thickness, dopant levels and surface uniformity for a wide range of wafers up to 300 mm.



The 2830 ZT Wafer Analyzer is equipped with PANalytical's advanced 4 kW SST-mAX X-ray tube, featuring groundbreaking ZETA technology which eliminates the effects of X-ray tube aging – by far the largest contributor to instrument drift. As a result, the 2830 ZT attains the highest levels of productivity and sensitivity, with excellent light element performance. What's more, thanks to ZETA technology, the 2830 ZT maintains these qualities throughout its entire lifetime.

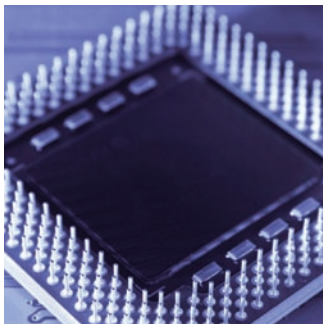
Benefits

Unrivalled productivity
- Continuous capability and speed
- Maximized uptime
- Superior light element capability

Fast and cost-effective multi-layer analysis
- Powerful Fundamental Parameter software
- Analysis of stacks up to 16 layers
- Simultaneous measurement of up to 24 elements
- Intuitive operation

Seamless fab integration
- Efficient, compact system design
- From manual to fully automated wafer loading
- Compliance to all relevant standards

A complete solution
- Excellent tool matching
- Complete support



2830 ZT application examples:

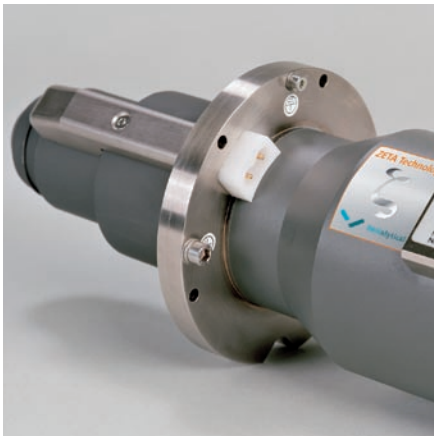
- Dielectrics: *BPSG, PSG, BSG, ASG*
- Doped polysilicon
- Barrier films and stacks: *Ta, TaN, WC_xN_y, TiN, Si_3N_4*
- Silicides/salicides: *$TiSi_x$, $CoSi_x$, WSi_x, $NiSi_x$*
- Metallization films and stacks: *Cu, AlCu, Ti, W, Au, Pt, AuGe, Ag, Sn, etc.*
- Low-k dielectrics: *FSG, SiOF*
- High-k dielectrics: *HfO_2, $HfAlO_x$, Ta_2O_5, etc.*
- TMR and GMR related films and stacks: *CoFe(B), AlO_x, Ru, NiFe, IrMn, CrPtMn, etc.*
- PRAM and FeRAM films: *PZT, SBT, BLT, GeSbTe*
- SAW and BAW films and stacks: *Al, Cu, AlCu, Ti, Ta, Pt*
- SiGe

2830 ZT

Unrivalled productivity

Continuous capability and speed

SST-mAX features groundbreaking ZETA technology which eliminates the effects of X-ray tube aging. 'New tube' performance is maintained throughout the tube's lifetime. Together with high sensitivity, ZETA technology ensures that rapid analysis and short measurement times are maintained across the lifetime of the tube. ZETA technology strongly reduces the need for drift correction and recalibration which increases productivity and uptime of the instrument.



ZETA Technology

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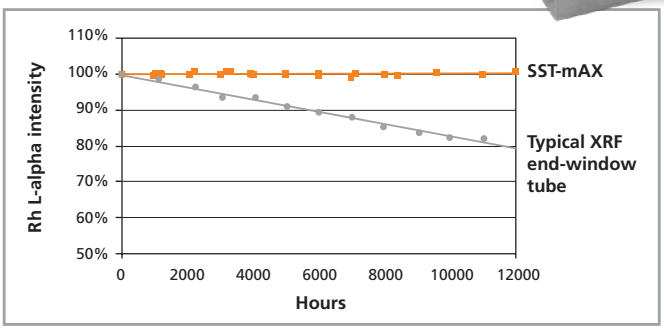
Maximized uptime

Conventional X-ray tubes suffer tungsten evaporation, which causes deposits on the inside of the tube's beryllium window. Instrumentation using such tubes requires regular drift correction to compensate for decreasing intensity, especially for light elements. Implementation of the SST-mAX in the 2830 ZT solves this drift problem, thereby maximizing uptime and maintaining instrument precision over time.



Stability of SST-mAX compared to a typical end-window tube

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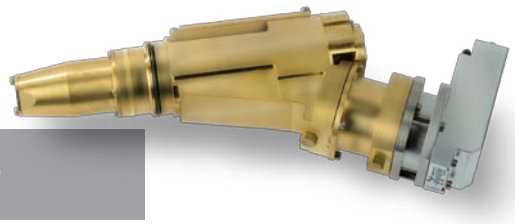
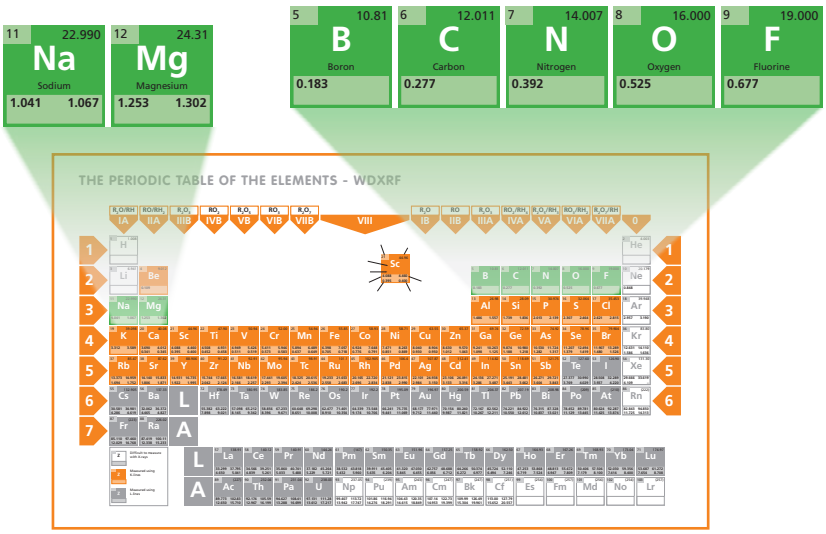


Superior light element performance

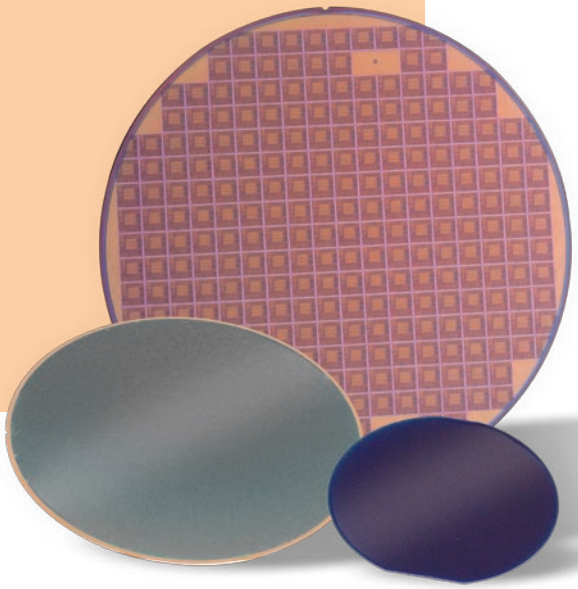
The key features to maximizing sensitvity and stability of 2830 ZT for light elements include:

- 4 kW output SST-mAX, operating at a high current of 160 mA
- Dedicated high performance channels for light elements in the range from boron to magnesium
- Dry (oil-free) pumps maintaining a clean, sub-Pascal vacuum within the measurement chamber



Consistent and stable measurement results

A range of critical features maximize reproducibility and minimize measurement times. For example, the laser-assisted wafer height positioning system guarantees consistent and stable measurement results. This feature also makes it possible for 2830 ZT to analyze films on a large range of substrate materials in addition to Si wafers, including piezo- and pyroelectric, glass and quartz substrates.



Fast and cost-effective multi-layer analysis

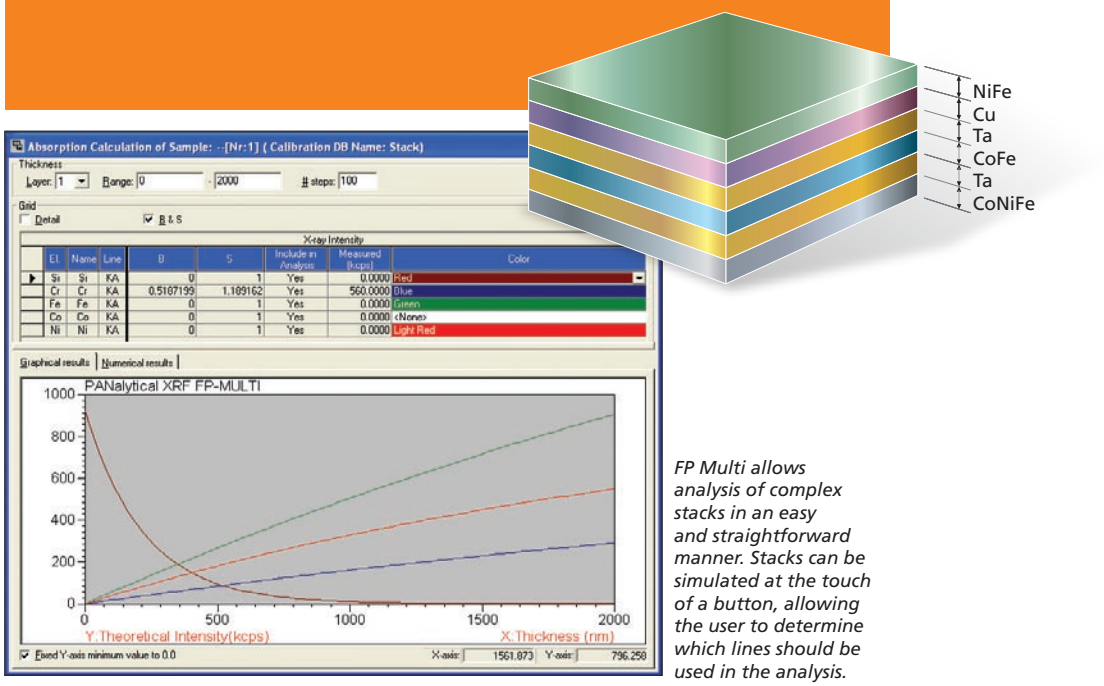
Powerful Fundamental Parameter analysis

PANalytical's Fundamental Parameter (FP) software package, FP Multi, is fully integrated into the SuperQ thin film platform of the 2830 ZT. It enables the direct calculation of chemical composition and thickness of layered materials and is ideal for analyzing both single layer thin films and complex multi-layer film stacks.

Analysis of stacks up to 16 layers
FP modeling allows reliable thin film analysis. PANalytical's best-in-class algorithms model X-ray fluorescent behavior of the elements to calculate precise layer composition and thickness. This reduces the time and cost involved in setting up thin film and multi-layer analyses. System calibration requires only a minimum number of reference samples to analyze complex stacks of up to 16 layers.

Simultaneous measurement of up to 24 elements
The 2830 ZT can be fitted with up to 24 fixed measurement channels, from boron onwards. These high performance channels allow for multi-layer analysis according to specific user requirements. Furthermore, as new channels can be added at any time, the 2830 ZT offers powerful flexibility, allowing the user to keep up with the latest technologies.

Keep track of your stack

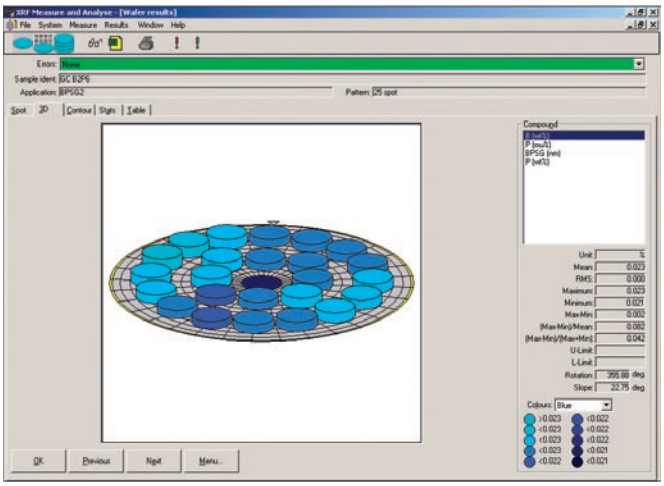


FP Multi allows analysis of complex stacks in an easy and straightforward manner. Stacks can be simulated at the touch of a button, allowing the user to determine which lines should be used in the analysis.

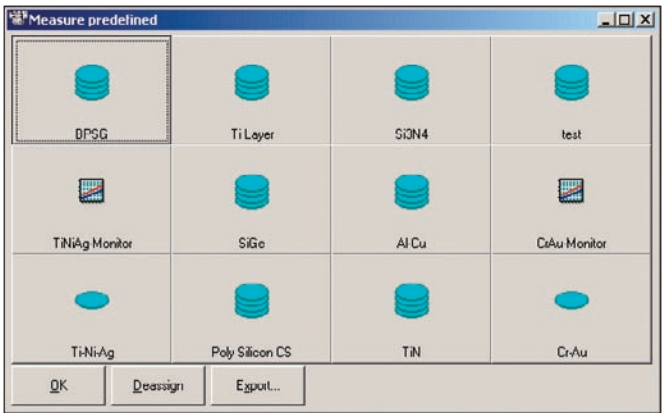
Intuitive operation

The 2830 ZT utilizes PANalytical's proven SuperQ Thin Film software platform. This powerful, easy-to-use thin film data collection and analysis package is renowned for its highly intuitive interface and menu. It enables simple setup of standard measurement protocols and individually customized programs. User-assigned function keys or large on-screen 'speed buttons' permit rapid initiation of measurement for single wafers or complete batches.

Uniformity patterns and wafer maps are easily defined with user-friendly spot location selection. Click-and-drag commands allow straightforward comparison with international wafer configuration standards.



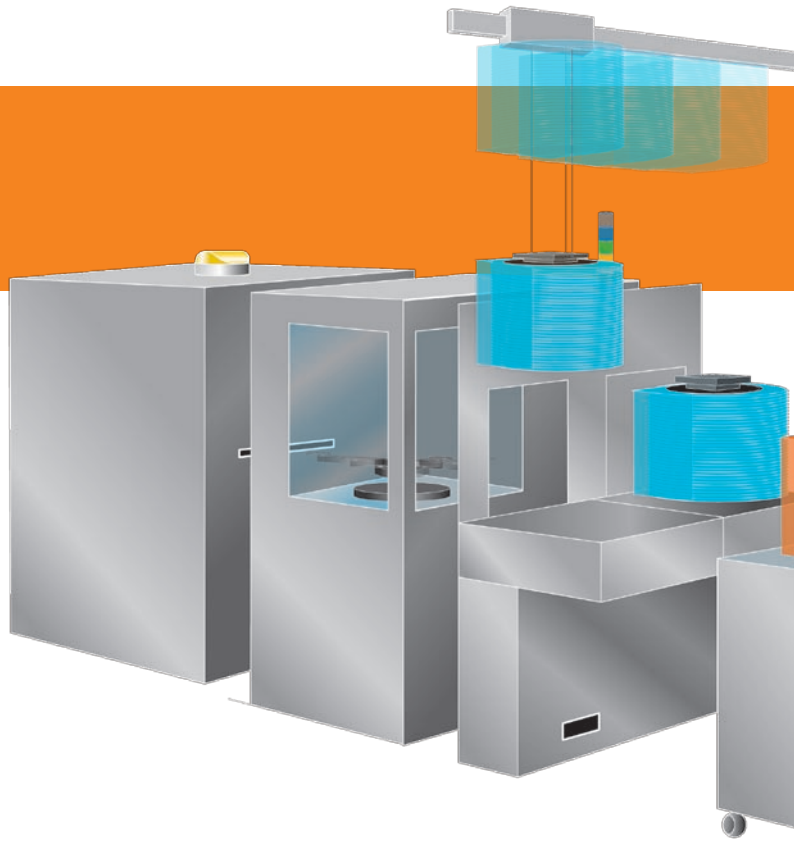
PANalytical's SuperQ software makes it simple to set up spot patterns for uniformity measurement over the full surface area of wafers up to 300 mm.



Measurement programs are quickly selected via clearly labeled "speed buttons" on the built-in touch screen monitor.

2830 ZT

Seamless fab integration



Efficient, compact system design
With a footprint comparable to that of 200 mm XRF wafer analyzers, the 2830 ZT occupies a minimum amount of valuable cleanroom space. A very narrow face print contributes further to space savings. The 2830 ZT can even be flush-mounted into a cleanroom wall, leaving only the loading port panel apparent within the workspace.

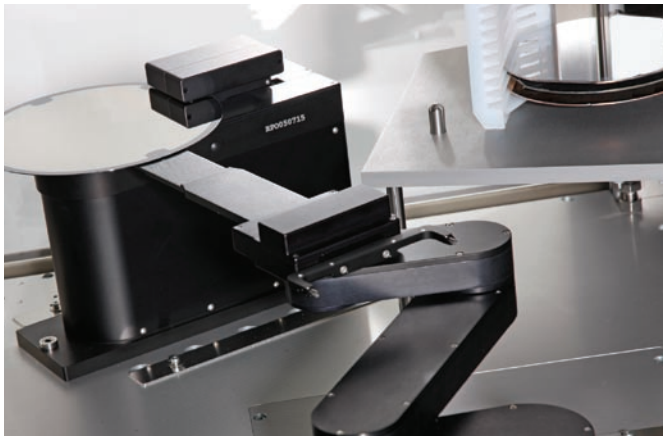
In accordance with normal fab procedures, the 2830 ZT measures wafers in a surface-up orientation. A transfer robot and notch/flat alignment unit position samples on the x-y wafer stage. Vacuum pumps can be installed remotely for convenient maintenance.

The system integrates readily into plant-wide process control and quality assurance networks, using SECS/GEM protocols to communicate with the host computer.

From manual wafer loading to full automation
2830 ZT accepts 100 mm to 300 mm wafers, and smaller wafers or fragments can be measured using adaptors. To ensure integration into any fabrication environment, various wafer-handling options are available:

- Manual loading
- Open cassette loading with the robot in the cleanroom atmosphere
- Single or dual FOUP loading with robot and alignment unit in an ISO class 1 mini-environment
- Single or dual SMIF loading with robot and alignment unit in an ISO class 1 mini-environment
- Any combination of SMIF, FOUP and open cassette loading

Single load port FOUP and SMIF systems can be equipped with an internal reference position which can harbor a cassette with frequently used reference wafers. The reference position accommodates three wafer sizes in a range of 100 to 300 mm.



Compliance to all relevant standards
PANalytical's PW2830 was the first X-ray metrology system to comply with all 300 mm standards. This led to its rapid establishment as the system of choice for automated wafer analysis. Now, the 2830 ZT builds on this reputation, and is designed to accommodate all relevant industry norms and standards.

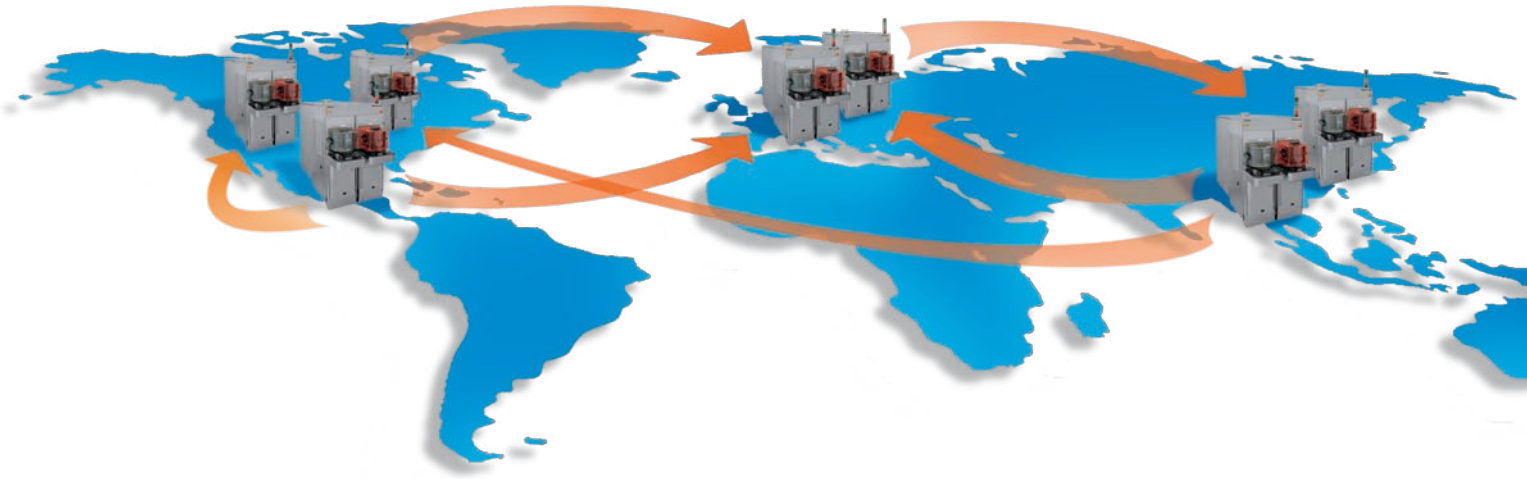
Importantly, the 2830 ZT is fully compliant with SECS/GEM (Semiconductor Equipment Communication Standards/Generic Equipment Model), GEM300, and AMHS (Automatic Material Handling System).

Completing the solution

Excellent tool matching

Metrology accuracy, reproducibility and repeatability are essential for accurate results within a fab. However, many organizations operate fabs at multiple locations. With different fabs making the same product, consistency of results is essential. 2830 ZT can be placed at different fab locations and matched to a 'gold standard' reference tool using a universal set of reference wafers.

This provides easy multi-production line quality control of thin film deposition and other processes. Excellent tool matching is the result of the high quality optical components, in combination with robust software algorithms.



Complete support

PANalytical understands the importance of continuity in production control. The 2830 ZT is based on proven concepts, established throughout the company's XRF thin film metrology product line.

However, technology is only part of a successful process control solution. To make sure that users maximize the benefit of the 2830 ZT, PANalytical provides excellent technical, software and application support.

2830 ZT users can take advantage of a large knowledge base when creating new applications, training new users, or solving technical issues.

PANalytical takes great pride in offering outstanding customer service, and values the trust users repeatedly place in the organization. A range of service contracts, including 24/7 coverage in most areas, is available, delivered by the largest X-ray support and service force in the market.

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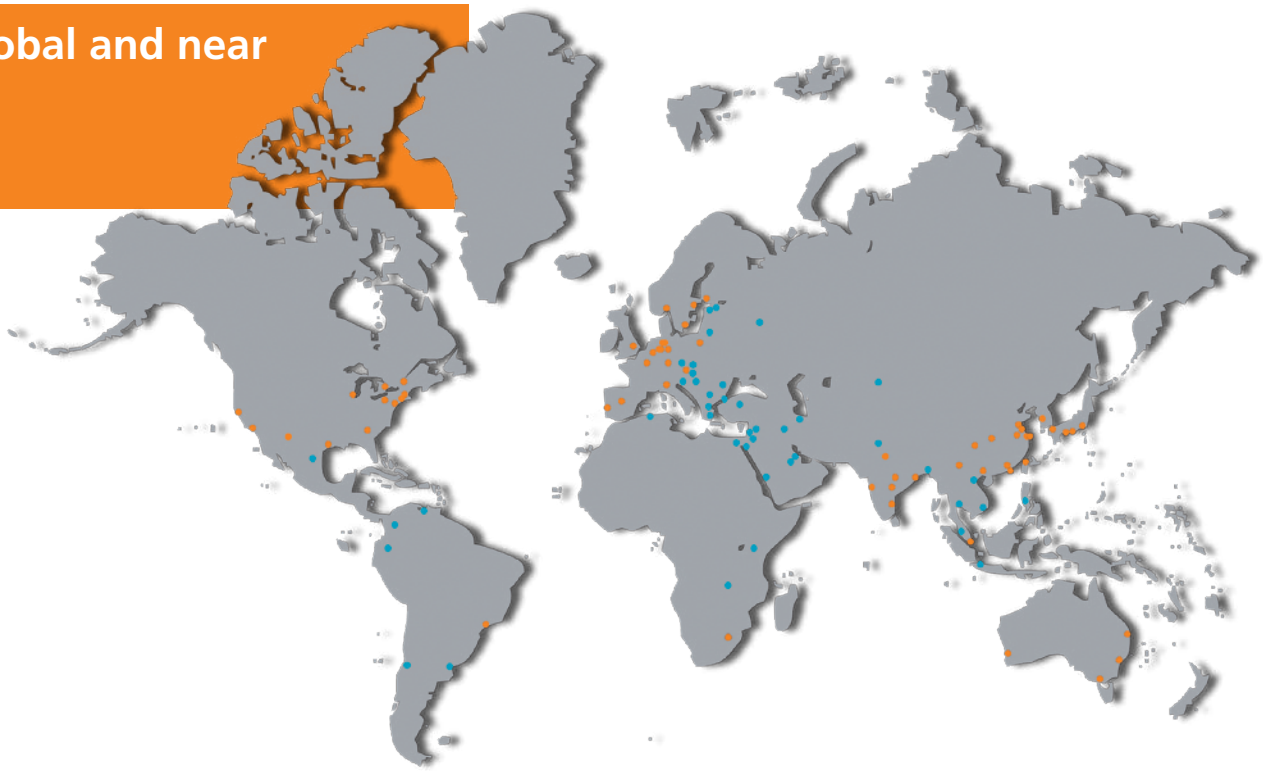
Global and near



PANalytical
PANalytical is the world's leading supplier of analytical instrumentation and software for X-ray diffraction (XRD) and X-ray fluorescence spectrometry (XRF), with more than half a century of experience. The materials characterization equipment is used for scientific research and development, for industrial process control applications and for semiconductor metrology.
PANalytical, founded in 1948 as part of Philips, employs around 1000 people worldwide. Its headquarters are in Almelo, the Netherlands. Fully equipped application laboratories are established in Japan, China, the USA, and the Netherlands. PANalytical's research activities are based in Almelo (NL) and on the campus of the University of Sussex in Brighton (UK). Supply and competence centers are located on two sites in the Netherlands: Almelo (development and production of X-ray instruments) and Eindhoven (development and production of X-ray tubes). A sales and service network in more than 60 countries ensures unrivalled levels of customer support.
The company is certified in accordance with ISO 9001:2000 and ISO 14001.

The product portfolio includes a broad range of XRD and XRF systems and software widely used for the analysis and materials characterization of products such as cement, metals and steel, nanomaterials, plastics, polymers and petrochemicals, industrial minerals, glass, catalysts, semiconductors, thin films and advanced materials, pharmaceutical solids, recycled materials and environmental samples.

Visit our website at www.panalytical.com for more information about our activities.

PANalytical is part of Spectris plc, the precision instrumentation and controls company

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