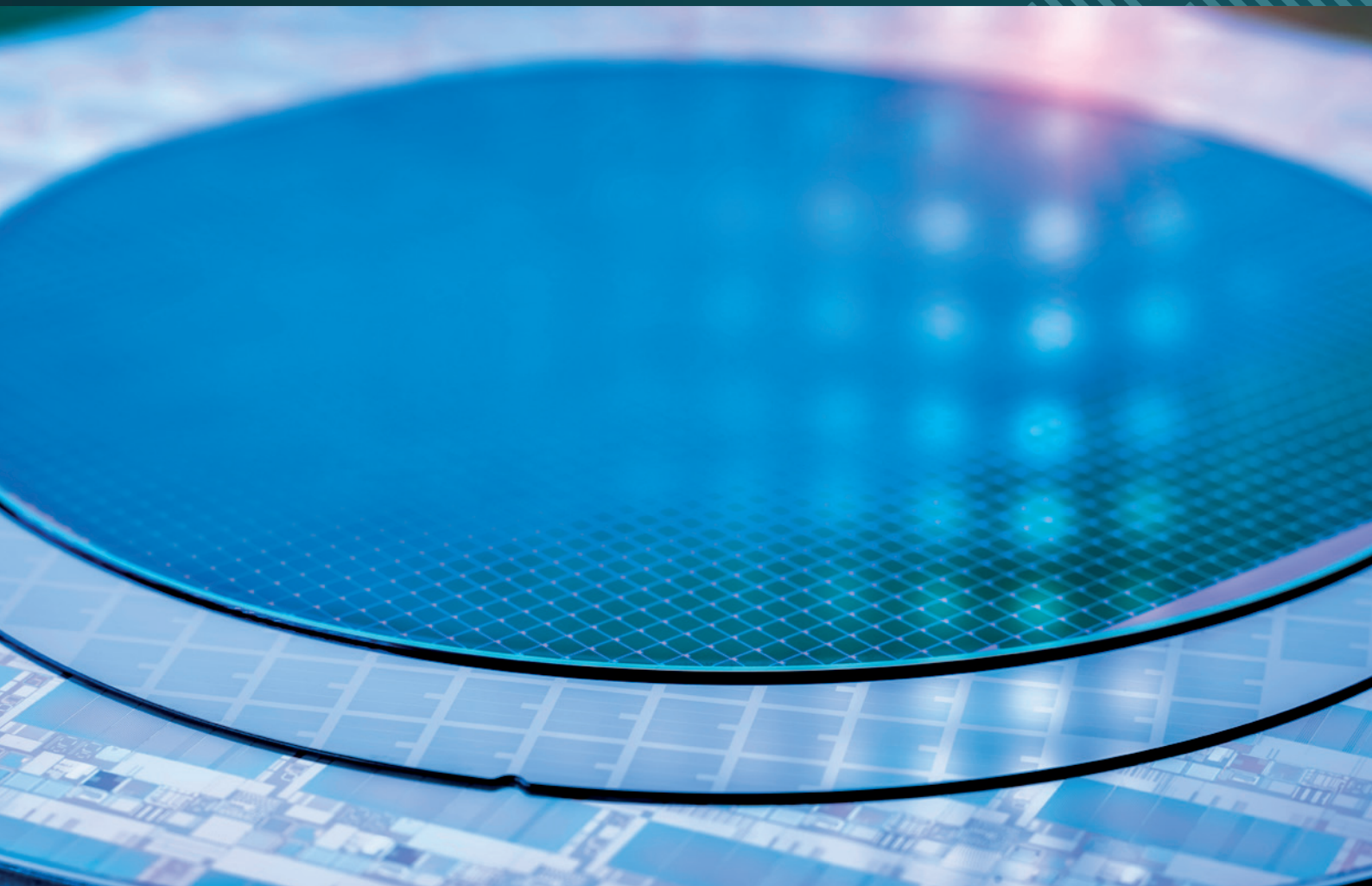




DifferAction

Optimizing XRF analysis by avoiding diffraction effects



Making sure your XRF analysis is free of diffraction effects

Wafers often comprise thin film coatings grown on Si(100) substrates. When measuring these film coatings, the substrate and stacked layers can cause diffraction signals when measured with XRF spectrometers equipped with tens of measurement channels positioned at different angles. Diffraction is a specific, undesired, way of scattering. When a diffraction signal is measured together with the signal of interest, this will lead to disturbing influences, such as higher background signals and a larger spread in the measurement results. Furthermore, as technology advances, average layer thicknesses of coatings are getting smaller and smaller. As a result, these disturbing influences are getting more significant compared to the precision and accuracy of modern processes. With the newly developed DifferAction software solution, the desirable wafer offset angle for all elements involved in the measurement can be identified, which prevents these influences. Furthermore, DifferAction allows you to simulate channel positions to find the ideal configuration to suppress the effect of diffraction peaks.

Growing pressure for more precise XRF analysis

Pinpointing the offset angle with the lowest diffraction influence in wafer analysis is cumbersome. But when an alignment improvement of even one degree leads to a significant increase in measurement intensity, a careful and robust analytical technique is crucial. As semiconductor and data storage technology continues to advance rapidly, there is considerable pressure on metrology techniques to meet increasingly rigorous demands. Plus, as industries introduce further substrates for analysis, new measurements are continually required to determine each materials' optimum angle.

Introducing DifferAction: Software for optimized wafer analysis

DifferAction is an optional extension for our Wafer Analyzer 2830 ZT spectrometer platform with SuperQ software. It shows the ideal offset angle at which the selected channels for measurement encounter the lowest interference. As such, DifferAction makes the wafer analysis process quicker, easier, and more precise. DifferAction also comes with pre-recorded patterns, allowing you to see immediately what the analysis results would look like for different channels and positions within the spectrometer. Inspection for optimal measurement position is as simple as selecting the application from the SuperQ database, followed by the applicable reference set for your substrate. Immediately, the diffraction patterns are shown. If your required channel is not available in this set, the software enables you to import new patterns into the software tool, which can overlay the pre-recorded options. With the SuperQ software you have the option to record these patterns yourself and store them for future use.

Example application

With DifferAction, the user can make diffraction patterns visible and determine offset angles to suppress any diffraction effects during measurements. Consider a case of an arbitrary GMR stack with a.o. elements Mn, Co, Ni, and Cu. The diffraction patterns for these elements are very distinct from each other but can be plotted simultaneously with DifferAction, to determine the best offset angle for measurements. This is illustrated in Figure 1. This demonstrates diffraction patterns as measured on a spectrometer with channels at arbitrary positions. In such a case, DifferAction can easily find alternative optima, other than what is found on a regularly used offset angle of 0 degrees. Here, the optimal offset angle is indicated by the vertical red line, for a quartz substrate and arbitrary channel positions.

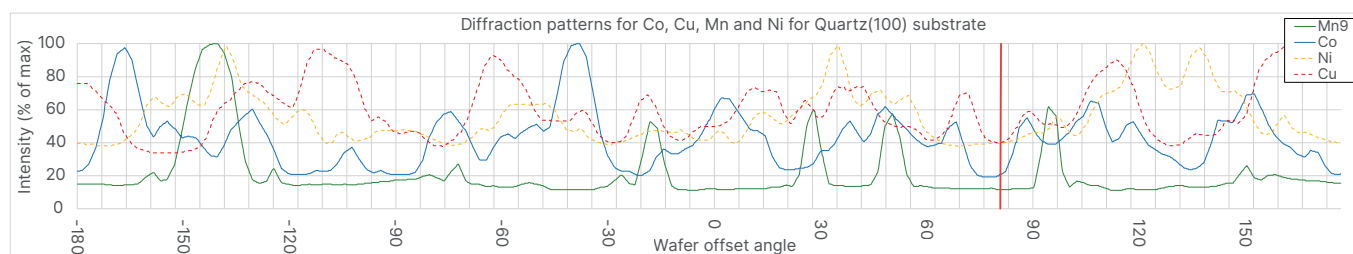
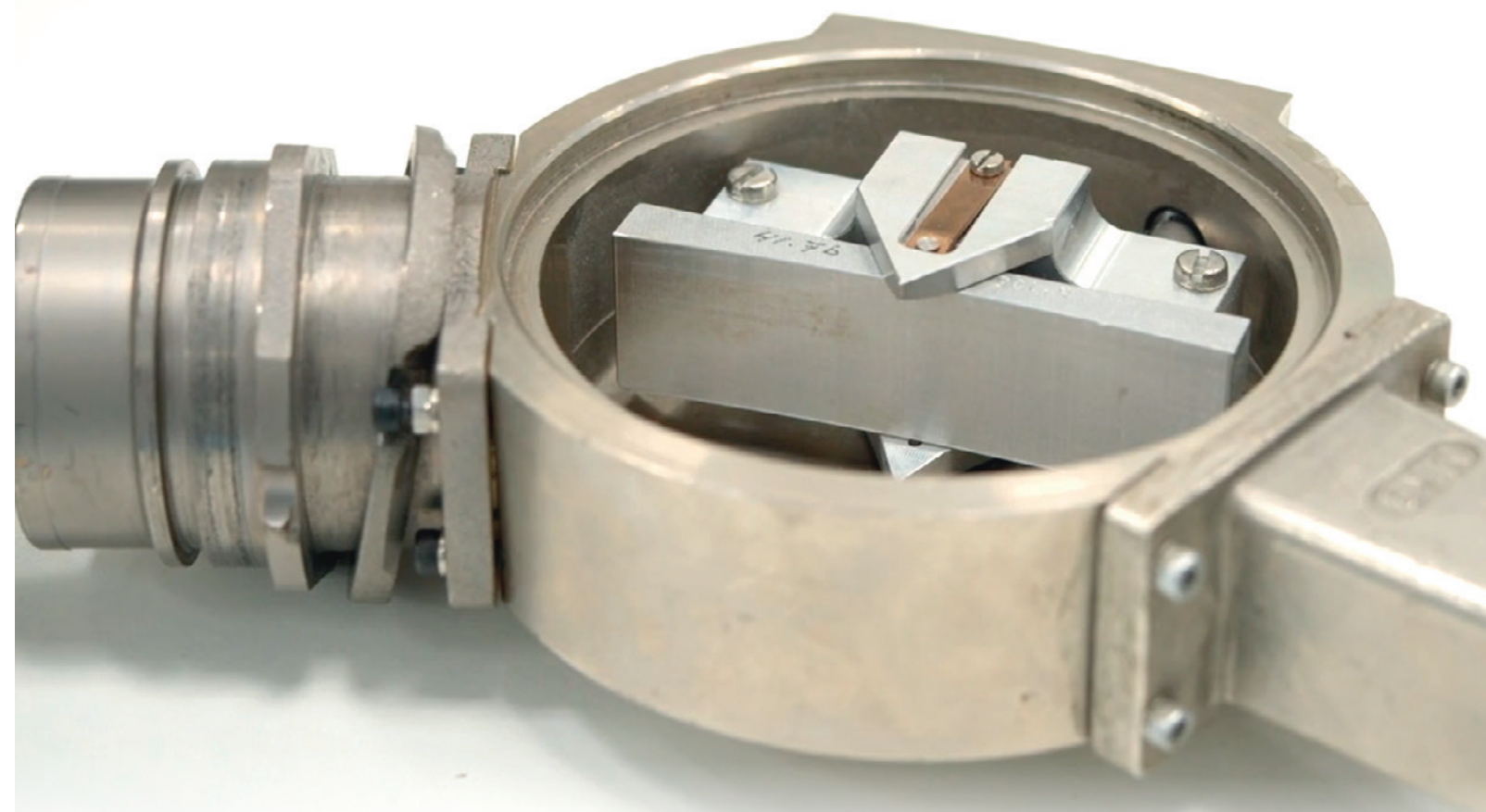


Figure 1. Diffraction patterns for Co, Cu, Mn and Ni for a Si(100) substrate.



Watch this space...

Going forward, we'll continue adding more features to our DifferAction software. Following on from the reference measurements included in the first version of this tool, we plan to make future patterns available to our customers. If you would like pre-recorded patterns for your own wafers, do not hesitate to contact your local sales engineer. Also, keep an eye out for ongoing customer-driven developments for DifferAction.

DifferAction: Minutes of work to prevent weeks of trouble.

Need support? Get in touch!

We pride ourselves on delivering the highest level of customer service. As well as our service engineers, our global customer support network is always on hand with support and advice. So, if there's ever anything you need, don't hesitate to get in touch.

Key benefits

- High-quality analysis for more **precise and stable results**
- **Faster and more reliable** setup for new applications
- **Faster and more reliable** transfer of existing applications to new substrates
- **Find off-set angles that may be used to combine different substrates**
- **Simulation** of the effect of moving channels to another position in your spectrometer to prevent diffraction effects
- **Increased uptime** and lower running costs
- Less sensitive for wafer specifications (notch alignment) and wafer handling robot alignment



About Malvern Panalytical

We draw on the power of our analytical instruments and services to make the invisible visible and the impossible possible.

Through the chemical, physical and structural analysis of materials, our high precision analytical systems and top-notch services support our customers in creating a better world. We help them improve everything from the energies that power us and the materials we build with, to the medicines that cure us and the foods we enjoy.

We partner with many of the world's biggest companies, universities and research organizations. They value us not only for the power of our solutions, but also for the depth of our expertise, collaboration and integrity.

We are committed to Net Zero in our own operations by 2030 and in our total value chain by 2040. This is woven into the fabric of our business, and we help our employees and customers think about their part in creating a healthier, cleaner, and more productive world.

With over 2300 employees, we serve the world, and we are part of Spectris plc, the world-leading precision measurement group.

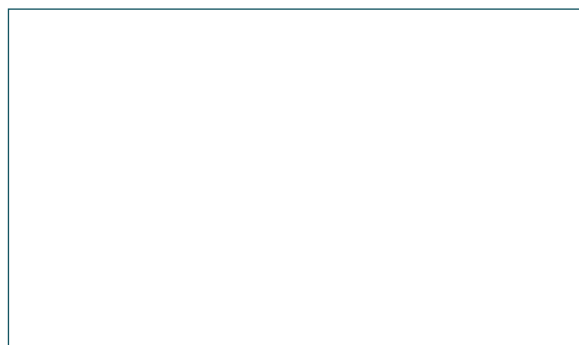
Malvern Panalytical. We're BIG on small™

Service & Support

Malvern Panalytical provides the global training, service and support you need to continuously drive your analytical processes at the highest level. We help you increase the return on your investment with us, and ensure that as your laboratory and analytical needs grow, we are there to support you.

Our worldwide team of specialists adds value to your business processes by ensuring applications expertise, rapid response and maximum instrument uptime.

- Local and remote support
- Full and flexible range of support agreements
- Compliance and validation support
- Onsite or classroom-based training courses
- e-Learning training courses and web seminars
- Sample and application consultancy



Malvern Panalytical

Groveswood Road, Malvern,
Worcestershire, WR14 1XZ,
United Kingdom

Tel. +44 1684 892456
Fax. +44 1684 892789

Lelyweg 1,
7602 EA Almelo,
The Netherlands

Tel. +31 546 534 444
Fax. +31 546 534 598

www.malvernpanalytical.com