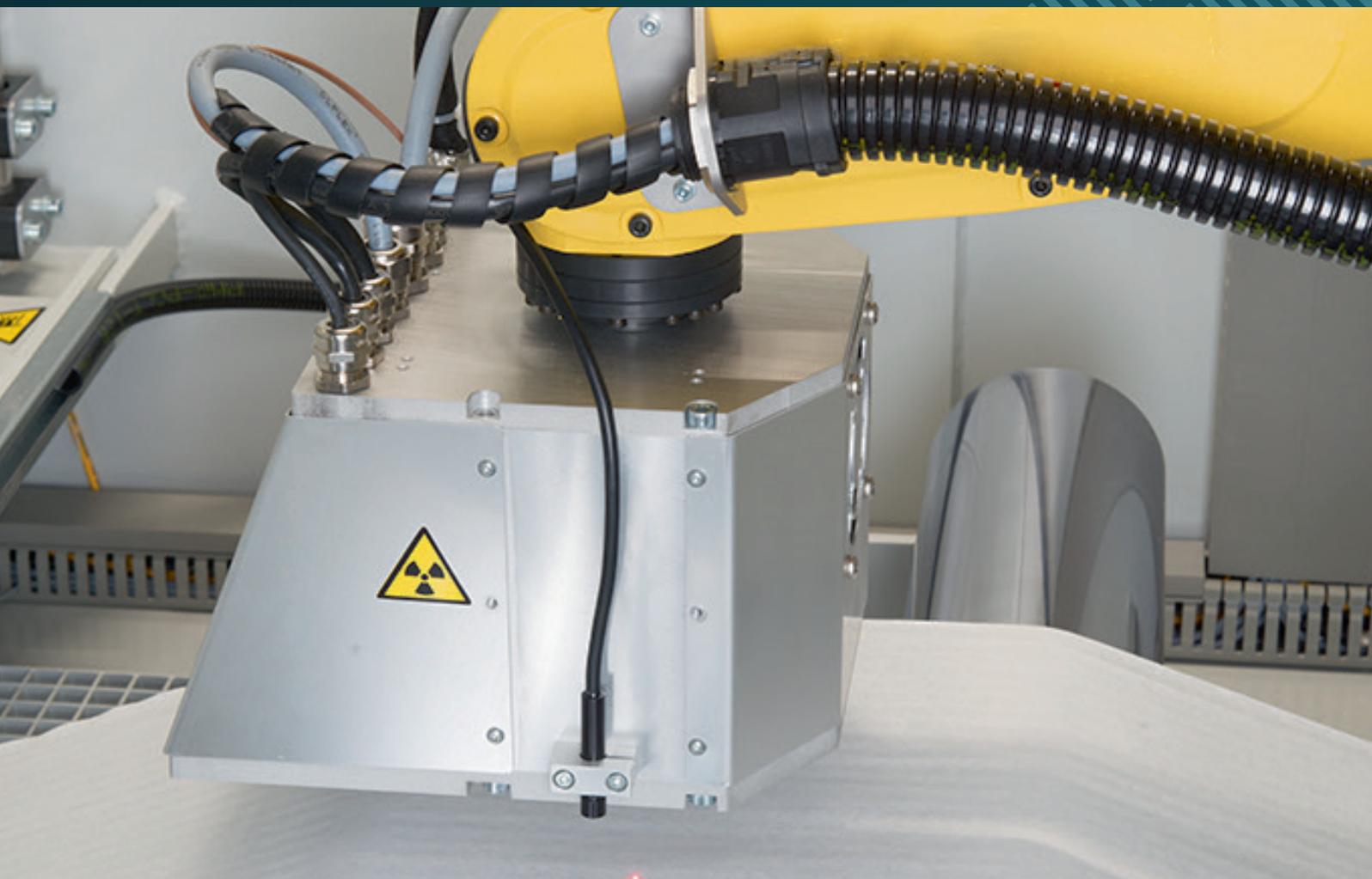




Epsilon Xline

In-line control for continuous catalyst-coating processes



Facing the challenges of fuel cell production

The race toward a sustainable economy is on, which has led to an increasing focus on cleaner, greener hydrogen energy. More specifically, the focus is on the devices that enable the production and usage of green hydrogen: electrolyzers and fuel cells. But as anyone working in electrolyzer or fuel cell production knows, there is still some work to do before this green technology can step in as a viable cost-competitor to fossil fuels.

This is because one of the main challenges to the manufacture of fuel cells is cost control during the production of the catalyst-coated polymer electrolyte

membranes. Not only are the electrocatalysts used in this production capital-intensive, but the variability of the coating process often increases the cost of electrode manufacture even further. While too much coating wastes valuable material, too little renders the catalyst ineffective.

To add to this, the industry-wide problem of rising material costs has also caused one of the most essential production materials, platinum, to rise steeply in price. In this environment, careful material monitoring is essential to better cost control and higher-quality end-products.

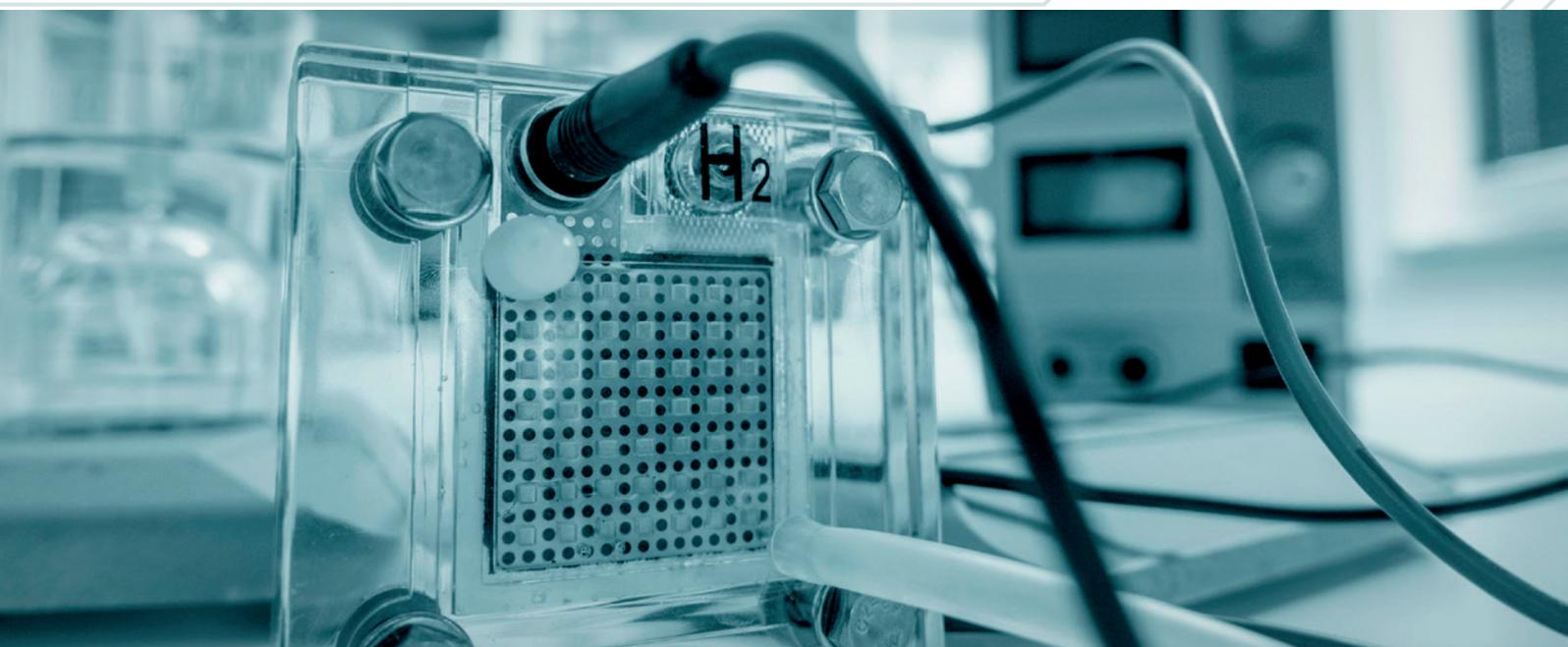
Introducing Epsilon Xline

And that's exactly where our Epsilon Xline can help! By combining our advanced Epsilon 4 technology with in-line functionality, this tool offers real-time material monitoring and up-to-the-minute process control for both the ultrasonic spray coating and roll-to-roll coating processes.

This regular analysis means material thickness and loading are continually optimized, helping to minimize off-specification production and maximize the cost efficiency.

In addition to precise and accurate process control, the Epsilon Xline is adaptable to a wide range of surfaces and catalytic materials.

Beyond catalytic coatings for fuel cell production, it is also an ideal tool for monitoring electrode coatings on current collectors in the manufacture of lithium-ion batteries.



Key benefits



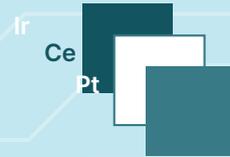
**Non-destructive
and suitable for
in-line process control**



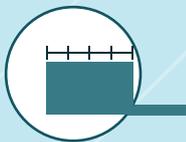
**A range of scanning modes,
to accommodate patch,
continuous, and multi-lane
coating processes**



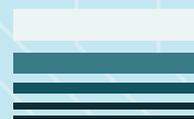
**Easy to integrate into the
production process with standard
communication protocols**



**Able to measure all valuable
elements of interest, including
platinum and cerium**



**Capable of measuring thin layers with
relative standard deviations up to 5%,
with a precision rate of over 95%**



**Accommodates
a range of
roll widths**

An efficient, easy-to-use, and integrated analysis tool

The Epsilon Xline is the first tool to provide in-line analysis for applied coatings in continuous production processes, breaking new ground in analytical process control. With this instrument, manufacturers no longer need to take samples and measure them off-line, minimizing costly process delays in electrode production. Plus, depending on the application, the analyzer can deliver a complete elemental analysis of a measured spot every few seconds!

Comprehensive cost-savings

With platinum catalysts amounting to more than 20% of the overall fuel cell cost, there is a pressing need to optimize the catalyst coating through uniform dispersion and consistent layering. And close and careful process monitoring is the ideal solution! The Epsilon Xline enables fast and efficient operational control, helping

to limit off-specification production, ensure valuable platinum is not wasted, and produce cost-competitive end-products. In a process with ever-tighter margins, these cost-saving benefits are more valuable than ever. And, of course, these cost savings apply to any material application, future-proofing this instrument against any further fuel cell innovation.

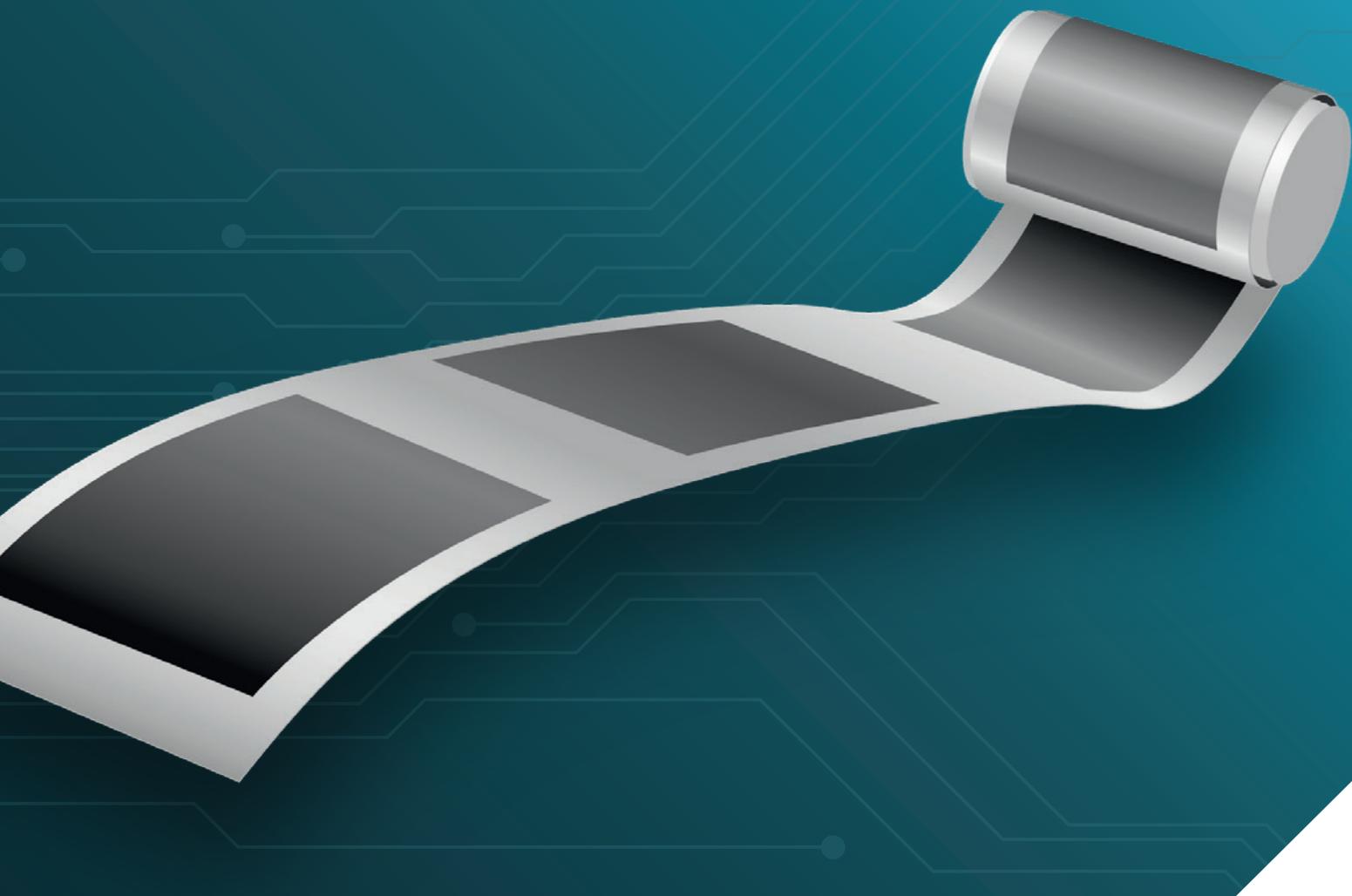
Smart software for easy integration

The Epsilon Xline includes a dedicated software package, making the setup for different materials and measurement modes simple. By entering commands directly into the instrument – or via a remote console – the easy-to-use interface can display an overview with complete tracking data. This built-in OPC connectivity means that this tool can be configured for seamless integration into existing production lines.

A new instrument in a top-quality portfolio

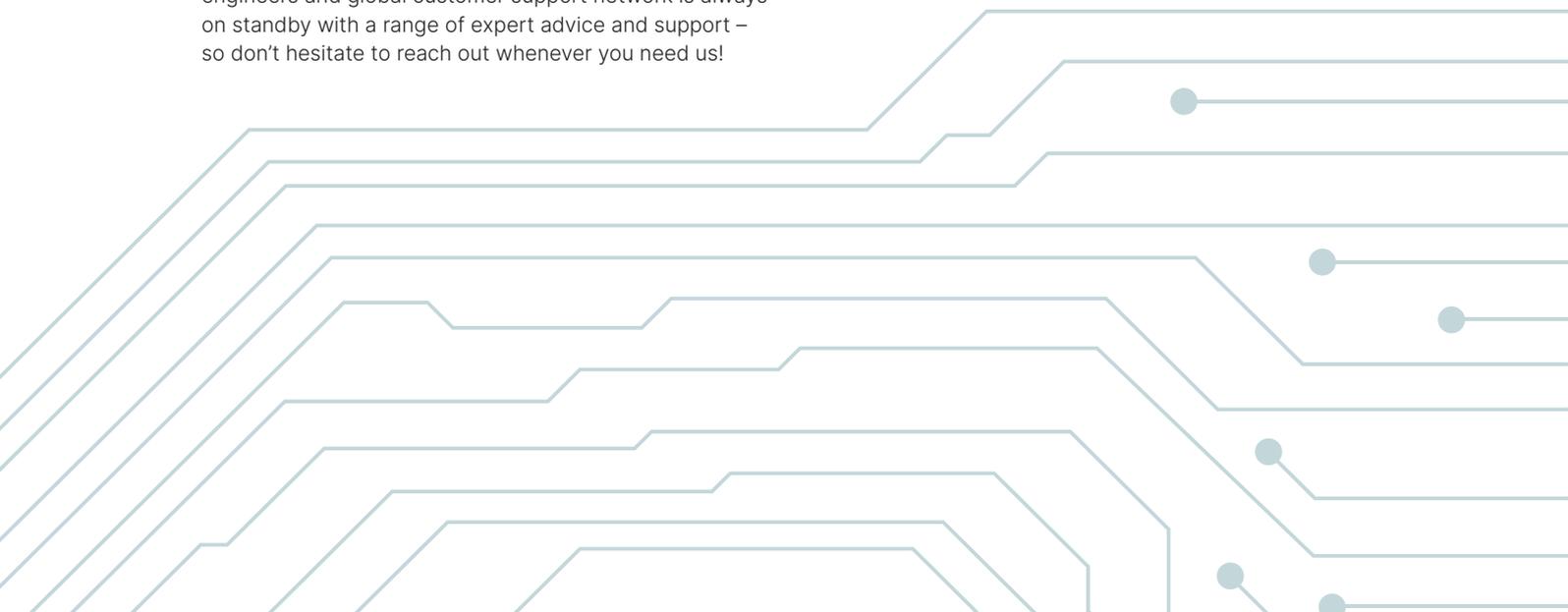
This state-of-the-art tool is part of a growing range of in-line XRF instruments, including our Epsilon XFlow, which measures liquid production processes. Powered by the latest advances in excitation and detection technology, and with carefully designed optical paths, our in-line analytical instruments enable a wide detection range and fast analysis times. With tailored solutions for specific industries and applications, our product range offers everything you need to respond to the latest market developments.





We're here to help

At Malvern Panalytical, you don't just invest in an instrument, you invest in years of high-quality customer service and a lifetime of equipment support. Our service engineers and global customer support network is always on standby with a range of expert advice and support – so don't hesitate to reach out whenever you need us!





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.

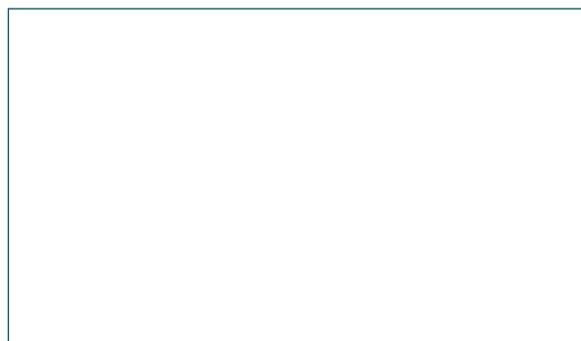
Malvern Panalytical. We're BIG on small™

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.

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



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