

# Inline coating thickness measurement and material analysis

## Precision for your Process



## About FISCHER

### Knowledge, expertise, experience

Since 1953, FISCHER has been creating innovative technologies for measuring coating thickness and microhardness, as well as for materials analysis and testing. Today, FISCHER instruments are used all around the globe – wherever trueness, precision and reliability are essential.

### Research and development

Building leading-edge products requires a strong focus on research and development. All FISCHER products are developed and manufactured in Germany. FISCHER also cooperates closely with universities and research institutes.

At the location in Germany, more than one in five employees works in R&D. Highly qualified specialists in physics, chemistry, electronics, engineering and computer science continually develop new products and processes to meet the ever-changing demands of the market.

### Quality Made in Germany

Keeping its manufacturing lines largely in-house allows FISCHER to fulfill its customers' expectations with truly superior products. In FISCHER's modern, high-tech production facilities, close attention is paid to even the tiniest details in order to ensure consistently high quality. Here, "Made in Germany" is more than just a merchandise mark: it is a point of employee pride and an integral part of the FISCHER philosophy.



*Focus on quality: around the world, approximately 450 people work for FISCHER, 200 of them in the Sindelfingen headquarters*

### Product Assortment

FISCHER instruments cover a comprehensive range of measuring and analysis tasks that are relevant in diverse industries. For each application, the appropriate method is employed for maximum precision and accuracy: whether magnetic induction or eddy current, beta-backscatter, coulometric, microhardness or X-ray fluorescence – FISCHER always has the right technology for the purpose.

Worldwide, FISCHER customers in industry, research and science depend on the reliability and accuracy of these fine instruments. FISCHER rises to this challenge with its rigorous quality standards and relentless development strategy to produce modern measuring systems and innovative software.



*FISCHER – robust and precise metrology, ranging from compact, hand-held gauges to powerful, inline X-ray fluorescence measuring systems*



## Contact measuring systems for integration into production lines

Nowadays, automation is found throughout most areas of industrial manufacture; automated processes are simply more efficient, faster and better networked. As experienced producers of measurement technology, FISCHER has spent decades developing contact measuring systems with which, for example, the thickness of coatings can be determined directly in a running manufacturing line. Various interfaces ensure seamless communication of the measurement values, and integrated I/O boards control interactions with other automation components. These systems, in combination with FISCHER's vast array of probes, ensure that a fitting solution can be found for virtually any measurement task.

## Efficient testing in automotive manufacturing

Quality management in the automotive industry is already highly automated: in this area, efficiencies can be drastically increased by testing coating thicknesses directly in the production line. For this purpose, FISCHER offers measurement solutions that guarantee that the tests conducted on auto bodies are not only fast but also performed under identical conditions: a measurement head guided by a robot will always take the measurements in exactly the same way, which – compared with manual coating thickness testing – greatly minimizes the scatter. A further advantage is the direct connection between the measuring and production systems. In terms of quality management, it means that, for each piece of car body panels built, there is a detailed account of the quality values relating to the coating process.

## FISCHERSCOPE® MMS® PC2 – the solution for inline contact measuring systems

The MMS PC2 is at the heart of many automated coating thickness applications. It is designed for maximal flexibility:

- Between its modular design and its capacity for up to eight different plug-in boards, it can be set up for a variety of diverse measuring tasks
- It is equipped with a USB and an Ethernet port as well as an RS232 interface for connection to the production network
- An optional I/O board can establish communication with e.g. a PLC
- Because all of FISCHER's contact-based probes can be connected to the system, even out-of-the-ordinary thickness measurement tasks can be performed
- The intuitive user interface and touch color display make it easy to set up new applications



Measuring foil layer thicknesses in a running production line

## Measuring systems for strip electroplating and hot-dip tinning

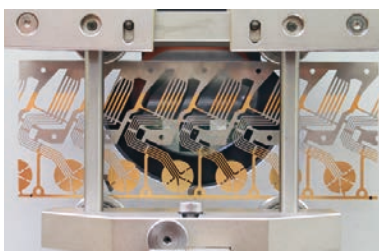


### FISCHERSCOPE® X-RAY 4000 for strip electroplating

Connector contacts, as used in both the electronics and the automotive industries, are often made from electroplated bands. These bands, sometimes only a few centimeters wide, are generally finished with different, customer-specific coating systems.

And these coating systems can vary from batch to batch, which makes a flexible measuring instrument absolutely mandatory. Furthermore, some layers are applied selectively; for example, economics demand that gold is only plated onto those areas of the band where it is functionally necessary. This is where the X-RAY 4000 shows its true strength: it is not only powerful but also very adaptable.

- Contactless measurement on bands of various widths: from just a few millimeters up to 1000 mm
- Measurements taken on tiny structures with measurement spots of ~0.1 mm and up
- Measures both single- and multi-layer coating systems, e.g. Sn/CuSn6 or Au/Ni/CuZn30



Measurement of stamped sensor contacts:  
Au/Ni/Cu



### FISCHERSCOPE® X-RAY 4000 for hot-dip tinning

When entire coils must be plated in a continuous process, the thickness of the coating is important from both a financial aspect as well as for its ability to perform the intended function. Therefore, it is essential to determine as precisely as possible the thickness of coatings such as electroplated zinc, hot-dipped tin, and electroplated nickel – and all while the steel or copper bands are being rolled from coil to coil. For just such purposes, FISCHER developed the X-RAY 4000 series of inline systems to rise to the challenge of performing exacting measuring tasks under tough manufacturing conditions.

- Suited for both precise coating thickness measurement and the analysis of material composition
- The ability of the measuring heads to cover long traverse distances accommodates a wide range of band widths
- Includes automatic measurement system monitoring



Inline coating thickness measurements  
on steel bands, e.g. Cu/Fe



### **FISCHERSCOPE® X-RAY 5000 for the photovoltaics industry**

The internal structure of a solar panel is decisive for achieving the highest possible yields. For example, thin-film solar cells consist of a complex multi-layer system, in which each layer fulfills a specific function. Continuous testing of the current coating thickness and composition is crucial for ensuring the function of the solar cell – and thus the final output of the entire system.

For such highly-automated production facilities as found in the photovoltaics industry, FISCHER offers with its X-RAY 5000 an inline solution for determining the thickness and composition of the various layers of CIGS or CdTe solar cells. It measures coating systems like CuInGaSe/Mo/glass or CdTe directly in the production line, so that even small deviations in the composition can be detected quickly and corrective measures undertaken.

Conceived as a compact measuring head, the system is robust and tailored to the unique demands of the photovoltaics industry.

- Optimizable for the purpose at hand: X-ray source, primary filter and silicon drift detector can be configured to suit the customer's intended application.
- Measurements can be carried out in air or in vacuum.

- As it employs the fundamental parameter principle, the WinFTM software allows fine-tuning using a single calibration standard, which greatly simplifies matters in the context of a manufacturing environment.
- Fluctuations in distance between the sample and the instrument are corrected automatically while measuring on glass panels.
- As an option, the flange can also be supplied in a water-cooled version. This makes taking measurements possible even on very hot substrates (surface temperatures up to 500°C).



*Ensuring the highest-possible solar yields through precise inline quality control*

## Measuring systems for wafer manufacture



### **FISCHERSCOPE® X-RAY XDV- $\mu$ SEMI for semiconductor applications**

Today's integrated circuit packaging poses huge challenges for process technology, and with it, for the technologies used to monitor those processes. This includes the measurement of coating thicknesses and elemental analysis of base metallization layers often only a nanometer thick, C4 and smaller solder balls, lead-free solder caps on copper pillars, tiny contacts and other complex 2.5D/3D packaging applications. In the XDV- $\mu$  SEMI, FISCHER offers an ideal measuring solution for the fully automated testing of such microstructures on wafers.

FOUPs, SMIFs and other cassettes are automatically accessed and opened. In the robot station, the wafers are removed, carefully positioned and placed exactly into the testing station. Advanced instrument technology ensures error-free handling and measurement of the valuable wafers, completely automatically and under exactly the same conditions, every time.

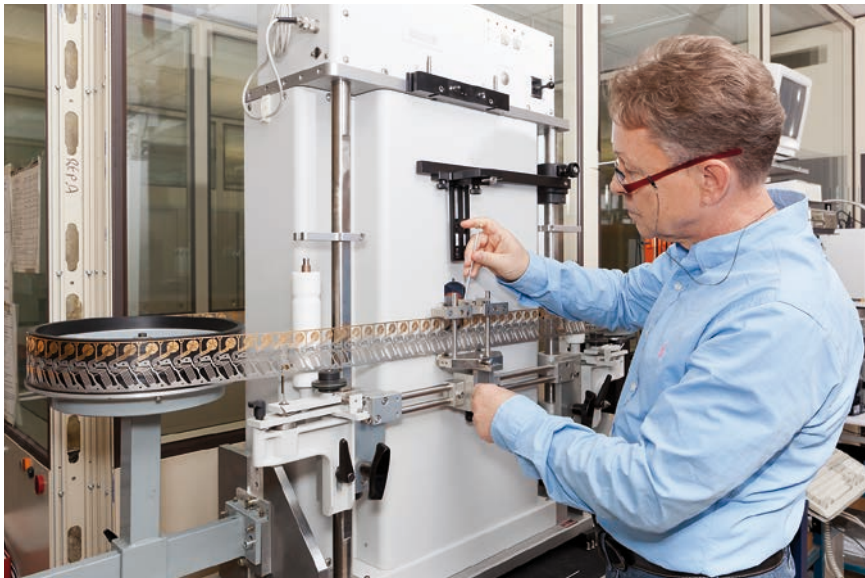
Within the testing station, the XDV- $\mu$  SEMI recognizes the wafer's microstructures optically and selects the pre-programmed measurement points. The integrated, energy-dispersive X-ray fluorescence instrument combines high performance with high measurement resolution. The advanced polycapillary optics bundles the X-ray beam down to just 10 to 20  $\mu\text{m}$ . Thus, even the smallest structures can be tested reliably without undue influence from surrounding elements. The ultra-responsive silicon drift detector guarantees highly

accurate analysis as well as good detection sensitivity – ideal for use in manufacturing process control. Designed specifically for use in cleanrooms, the XDV- $\mu$  SEMI provides an immaculate, enclosed testing environment.

- Fully automated material feed and measuring processes prevent undue human influences
- Defined and consistent measuring conditions
- Highly advanced polycapillary optics for very small measurement spots
- High measurement resolution
- Automatic recognition and approach of the measurement spots
- Absolutely no contamination of the wafers



*Automated precision: the handling robot feeds the XDV- $\mu$  measuring system with wafers*

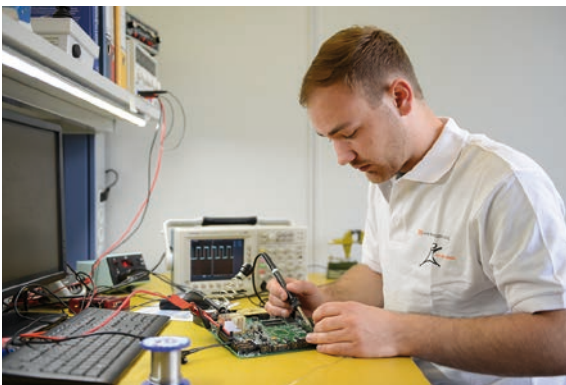


### Competent service – worldwide

In manufacturing processes, every second counts. This is why FISCHER places the same emphasis on the quality of its prompt and professional services as it does on the quality of its products.

FISCHER has established a dense and tightly-linked global network of service partners with highly qualified staff. Extensive services such as setup, maintenance, training and calibration, among others, ensure that your FISCHER instruments always work properly and that the users are well-trained.

During the implementation of your inline measuring system, you can decide on the type and extent of services to suit your company's individual needs. Should measuring tasks change or new parameters arise, FISCHER metrology specialists from the Application Laboratories can lend a hand, either immediately via telephone or, if necessary, on the premises.



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