OPTICAL CONTACT-FREE AND HIGH-PRECISION

3D surface measurement technology for fuel cells

MEASUREMENTS

Bipolar plates

Membrane electrode assembly (MEA)

Solid-matter fuel cell (SOFC)

Direct methanol fuel-cell (DMFC)

Polymer-electrolyte fuel cell

NON-DESTRUCTIVE SURFACE ANALYSIS IN PRODUCTION ENVIRONMENT

Economic production is possible only when processes within a production chain are regulated securely and parameters are monitored reliably. Prerequisite for high production quality is precise and informative measuring equipment, from incoming goods through to product output control.

This is exactly where our measuring tools are applied: In cooperation with leading institutes and manufacturers, NanoFocus AG specialises in the conception and development of essential measuring equipment.

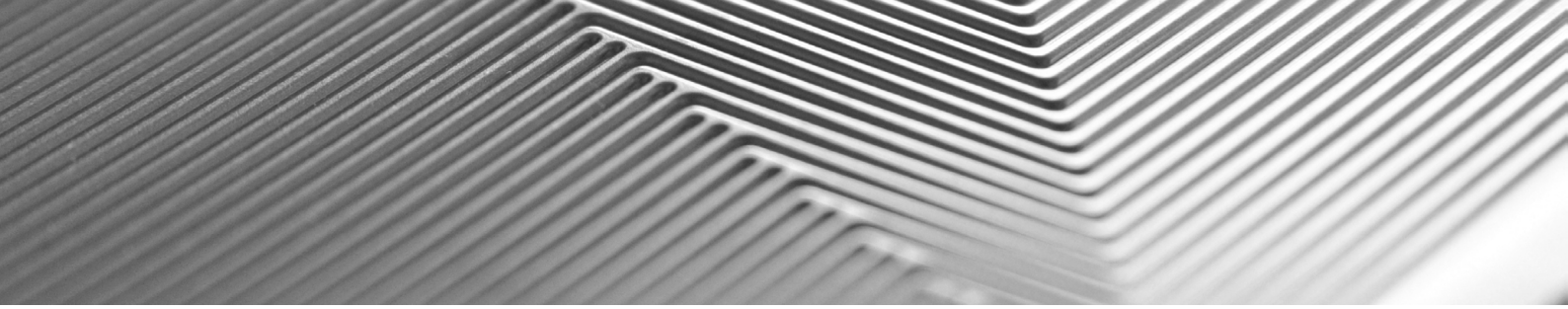
By means of rapid, full-surface 3D-scans the surface quality of tools and bipolar plates (graphite or metal) can be checked with high-precision in production environment and with high-precision.

Our products are also used to detect the smallest cracks and faults in sealing materials and coatings, and to check the gas diffusion layer (GDL) for porosity and defects.

Important test characteristics with regard to quality are:

- Compliance with geometric tolerances of the flow-field (channel structure)
- Identification of tool wear and faults
- Determination of roughness, surface texture and topology

Further information:
Fuel cell technology



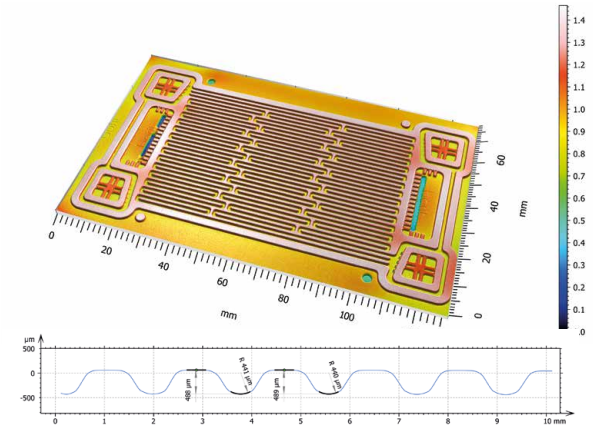
Also large bipolar plates and tools can be measured

HIGH-DETAIL PRECISION WITH MAXIMUM MEASURING AREA

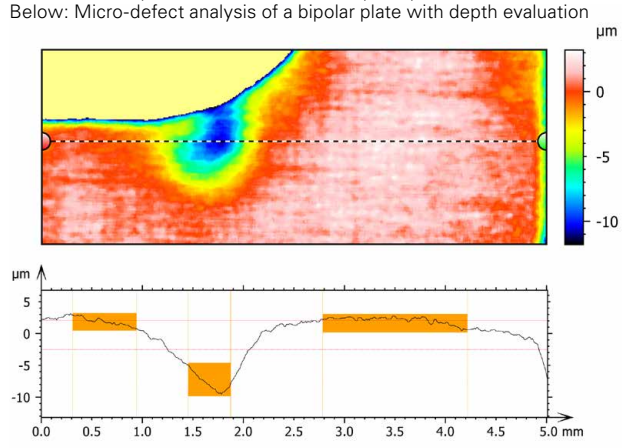
In order to cover large measuring areas, NanoFocus AG has developed an innovative process. It is based on the 3D multi-channel Profilometer measurement principle and was promoted in development by the EU Project Supersurf.

The innovative process of the confocal multi-channel sensor technology enables a dynamic scan length. The advantage in comparison with traditional measuring processes (e.g. laser scanning microscopy): Far larger measuring areas. The travel range of the scanning axis dynamically determines the measured pro file length. Combined with flexibly configurable axis systems with up to 0.5 m setting range, thanks to this process, the measuring of larger bipolar plates and heavy tools is also possible.

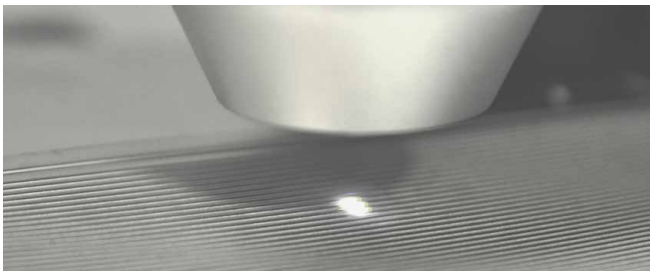
- Automated shape and location analysis through comparison with CAD data
- Result presentation within a few seconds
- Reliable measurement of the weakly-reflective, dark graphite surfaces
- Non-destructive measurement
- Control-check of the bending radii in the channel zones
- Identification of tool wear and faults
- Determination of the position precision of the channels and connection points
- Various different hold-down clamps for warped bipolar plates (mechanical or vacuum)



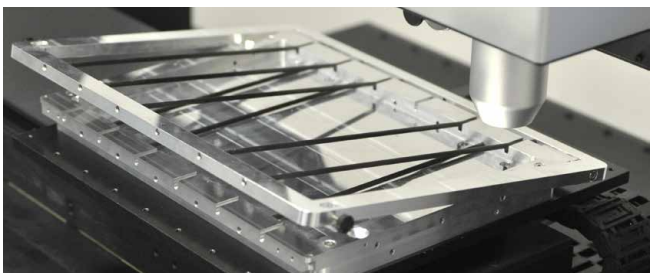
Above: 3D complete measurement of a bipolar plate
Below: Micro-defect analysis of a bipolar plate with depth evaluation



Fast optical measurement with multi-channel sensor



Mechanical hold-down clamp



Conforming to ISO standards and precise

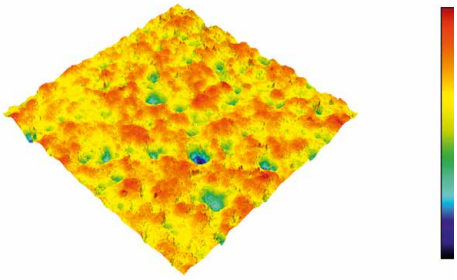
HIGH-RESOLUTION MEASUREMENTS TO INCREASE AND SECURE QUALITY

With a control-check at incoming goods, defective and unsuitable component parts can be sorted reliably and thus possible further errors and scrap avoided.

- Smoothness and ripple measurement
- Roughness measurement
- Centre punch distribution
- Porosity
- Layer thickness
- Defects
- Grain structure
- Fibre texture and fibre diameter

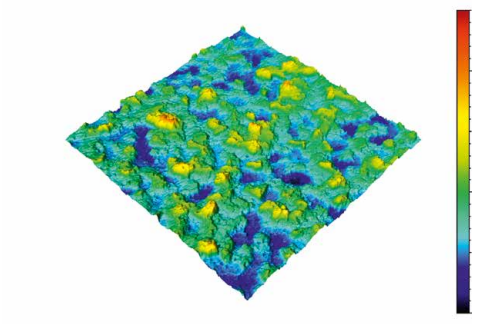
If required, the full-area scanning Profilometer can be combined with a high-resolution 3D microscope. This confocal-optical measuring system allows detailed assessment of the 3D roughness according to international standards.

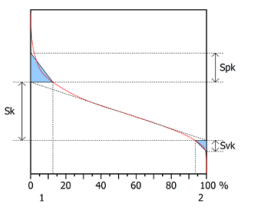
ISO 2D/3D roughness



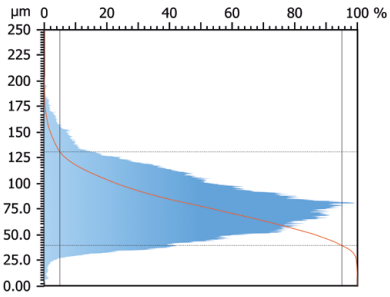
ISO 25178			
Height-parameter			
Sa	1.17	µm	*Arithmetic average height*
Sq	1.56	µm	*Quadratic average height*
Sp	4.53	µm	*Maximum centre height of the surface*
Sv	10.11	µm	*Maximum trough height*
Sz	14.64	µm	*Maximum height*
Topography parameter - Parameter			
S10z	8.62	µm	*Ten-points height*

Tribology, support surface parts, functional volume





Parameter	Value	Unit
Sk	72.3	µm
Spk	36.1	µm
Svk	13.6	µm
Sr1	12.6	%
Sr2	93.6	%



µsoft metrology

The intuitive measurement and control software µsoft metrology guarantees the efficient implementation of measurements.

With the µsoft metrology, all sensors and an overview camera can be controlled from the operator interface. With the switchover between the sensors and the overview camera, the measuring head moves automatically to a defined measuring position. Expressive 3D illustrations of the results of measurement with intensity overlay are available after a few seconds.

µsoft analysis

The µsoft surface analysis software offers a comprehensive functional package for the representation and analysis of structure, roughness, ripple, step heights, contours and other surface features.

In the intuitive multilingual User Interface, complex analy- sis reports can be generated by the push of a button. Diverse representation capabilities, such as 2D profile view, 3D reconstruction or photorealistic image rendering generate detailed and expressive measuring reports. Individual evaluation recipes are simple to adjust and implement.

The software includes filter functions and always the latest standard parameters according to ISO 25178, ISO 4287, ISO 13565 or EN 15178. If required, NanoFocus also generates individual plug-ins for the further processing of the measuring data.

www.nanofocus.de

THE NANOFOCUS FACTOR

NanoFocus AG orients their products, services and innovations closely to customer processes. From the phase of consultation, through to operational commissioning and further support, we offer everything from a single source. Our customer can rely at all times on our well-founded engineering experience and on our high demand on quality. NanoFocus is certified to ISO 9001, OHSAS 18001 and ISO 14001.

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