Surface Inspection of Bipolar Plates for Fuel Cells

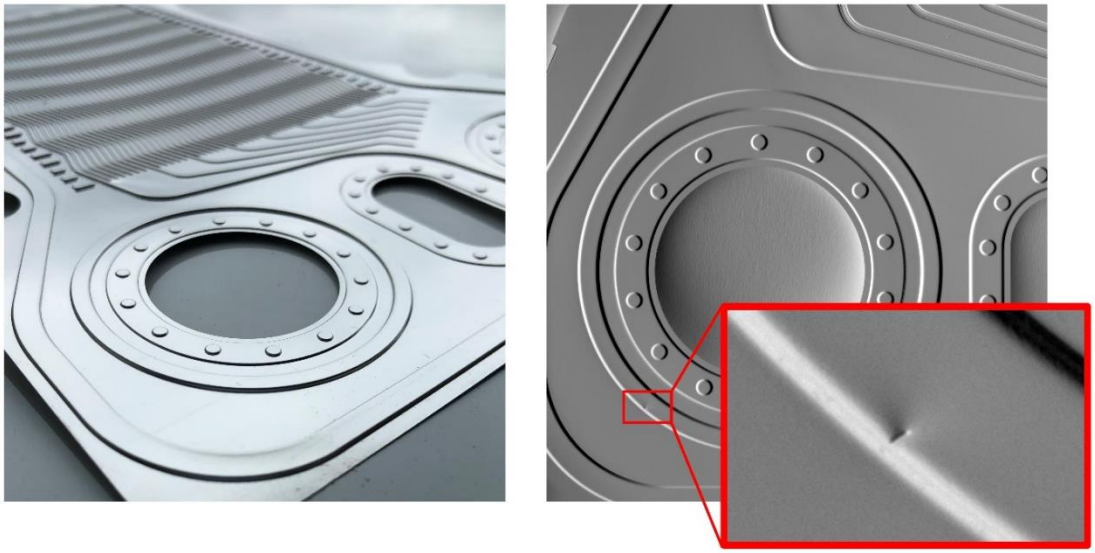

Fig. AIT Goehner GmbH: left bipolar half plate - right slope image, in the zoom window 100% view of a punching defect.

Hydrogen and fuel cells will make an important contribution to the electrification of drives in the future. As a key technology, they already play a decisive role in the transformation of the energy sector.

The quality of each individual bipolar plate has a significant influence on the function and performance of the entire fuel cell. Therefore, quality assurance within the complete production process via testing and identification systems is necessary.

Challenge

- ✓ Complex production process
- ✓ High vertical range of manufacture
- ✓ Components in different states

The demanding, meandering surface geometry of the active zone poses a particular challenge. Different brightnesses and highly specular properties of the component require special solution approaches that reliably detect all defined defects and still allow for a minimum pseudo-reject.

Solution

The specially developed sensors and testing concepts are designed to detect possible defects in bipolar plates during production.

AIT's testing concept is to accompany the entire production process of bipolar plate manufacturing and thus ensure the best part quality - from the stamped half-plate to the finished end product, which, when stacked, performs the essential function of a fuel cell.

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Typical test positions in manufacturing

Directly after the punching process

- ✓ Checking for material defects in the source material such as inclusions, damage, etc.
- ✓ Detection of punching process errors such as punch impressions, step errors, cracks

After coating

- ✓ Coating correctly executed, position, width etc.
- ✓ Check for coating defects, inclusions, missing coating etc.
- ✓ Testing for contamination of uncoated areas

After welding two half plates

- ✓ Checking the laser weld seam, position, width etc.
- ✓ Check for defects caused by the welding process such as holes, dents, weld spatter, etc.

End-of-line control

- ✓ Optical inspection of the bipolar plate, including contact area
- ✓ Deformations
- ✓ Correctly applied sealing elements
- ✓ Damage caused by process and handling
- ✓ Outer contour

Advantages

Enormous advantages of testing and end-of-line control

Systematic errors such as damage or wear of the punching tool, incorrect laser parameters can be detected quickly. This contributes directly to minimizing the risk of producing a larger number of defective workpieces.

Reliable detection of random defects

The 100% inspection also enables the reliable detection of random defects with a high influence on the functionality of the component, such as foreign particles in the tool. The early rejection of defective components has a significant influence on the added value of the entire production process.

Rapid feedback and troubleshooting

Another benefit of the procedure for checking at different points in the process is the direct feedback to a higher-level system. This enables the worker to quickly initiate the right measures to eliminate the cause of the error.

Elimination of time-consuming manual control

Automated inspection makes it possible to dispense with time-consuming, error-prone manual inspection. The inspection concept ensures optimum part quality on the basis of an objective, automated 100% inspection.

Summary

AIT provides a ready-made solution concept based on a modular principle for the process-safe detection of the smallest surface defects despite different material and texture properties, which is already available for many similar applications. A simple, intuitive set-up of the ProfiNet communication interface through "out-of-the-box tools" is guaranteed.

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