Laser-based production of corrosion protection coatings for PEM fuel cells

To meet the increasing demand for hydrogen technologies, industry needs to develop modern production processes with very high cycle rates. In this context, the PEM fuel cell (polymer electrolyte membrane) is currently the focus of current research and development. Bipolar plates (BPP) are a central component of a PEM fuel cell. They are made of either stainless steel or composite materials and, in addition to their function as structural components, serve as current collectors, distribute the gaseous educts (H_2 and O_2) and remove the resulting process water. However, the aggressive chemical conditions in a fuel cell lead to corrosion of the metallic BPPs. Coatings can be applied to counteract corrosion and thus extend the service life of the fuel cells. At the same time, however, high electrical conductivity must be maintained in order to enable high system efficiency. Conventionally, the coating is applied by means of chemical or physical vapor deposition in vacuum systems. Corrosion-resistant precious metals (e.g. platinum) or carbon are mainly used. Short cycle times and large quantities pose a particular problem in vacuum-based industrial production. Complex coating systems are required and high material costs generated.

Carbon-based corrosion protection coatings

As part of the H2GO research project, Fraunhofer ILT is developing a laser-based process that makes it possible to produce new types of carbon-based corrosion protection coatings. First, a precursor solution is sprayed onto the BPPs and dried. Subsequent processing with a laser converts this precursor layer into a conductive and corrosion-resistant carbon modification. In contrast to established vapor phase deposition, processing takes place in ambient air and does not require a vacuum. This considerably simplifies integration into a continuous production line.

Increased efficiency in PEM production

Since complex vacuum processes are not needed and inexpensive and readily available materials are used, the process can help serve the steadily growing market for PEM fuel cells.

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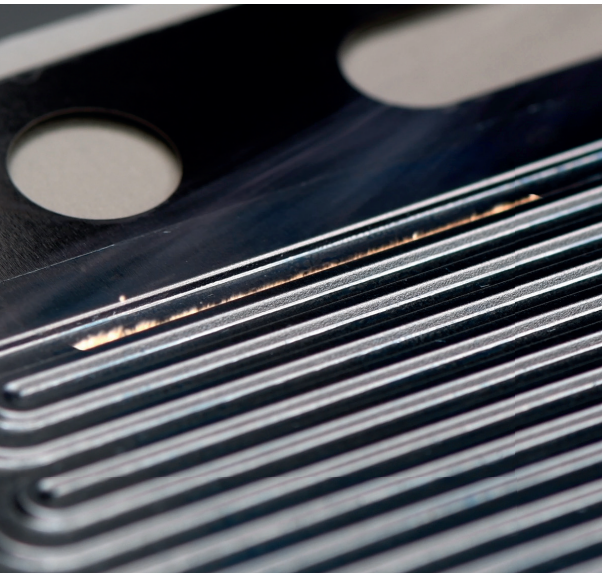
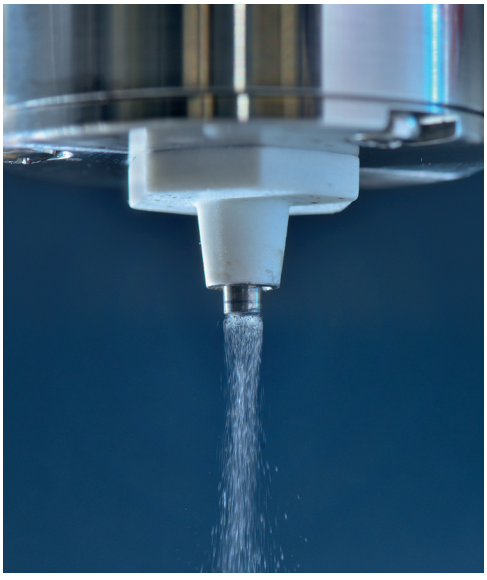
Author: Julius Funke M. Sc., julius.funke@ilt.fraunhofer.de





1 Laser functionalization of a coated bipolar plate. 2 Material output of the spray nozzle.