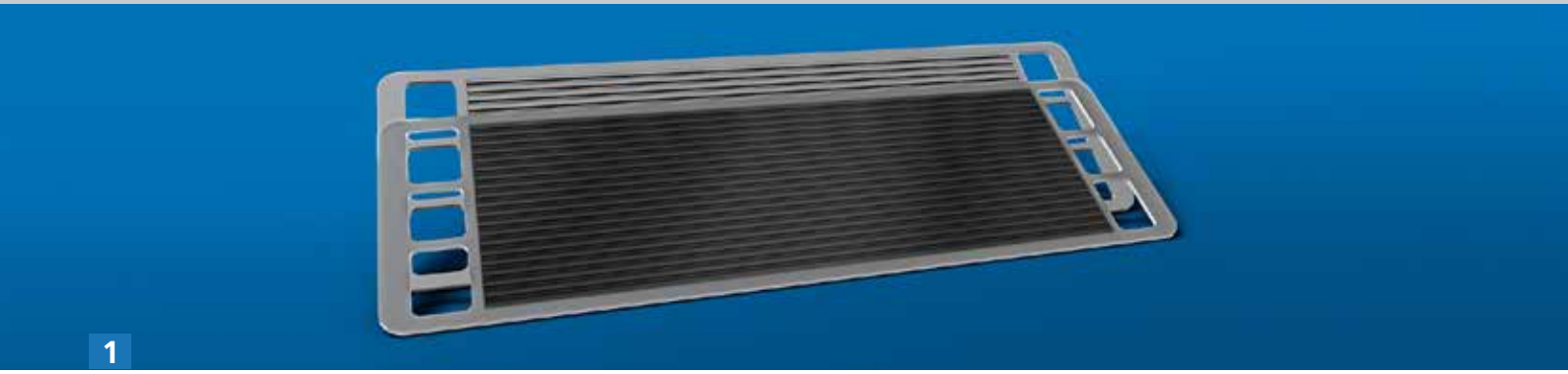
Fraunhofer
IWS

FRAUNHOFER INSTITUTE FOR MATERIAL AND BEAM TECHNOLOGY IWS



1

1 *The bipolar plate (top) is coated with a carbon layer (bottom) reducing contact resistance while increasing corrosion resistance.*

CONTIbip

COST-EFFICIENT STRIP PROCESSES FOR THE PRODUCTION OF BIPOLAR PLATES FOR FUEL CELLS

The development of alternative drive systems is an important research focus in the mobility sector. In addition to battery-powered vehicles, fuel cell vehicles will contribute significantly to reducing CO_2 emissions in the future. However, for the economic implementation of the technology it is necessary to transfer the conventional single-unit production to cost-efficient manufacturing processes suitable for mass production. In this context, the bipolar plate is a core component – and at the same time one of the fuel cell's cost drivers. Significant cost-saving potentials are provided by the patented CONTIbip production as well as innovative, precision-fit and mass production processes for coating, forming, joining and cutting. The essential part of the process is the so-called pre-coating of stainless steel strip by means of PVD coating. This is followed by the forming process and laser welding of one or more formed strips. In addition to possible performance improvements, the process focuses in particular on a drastic reduction in production costs.

Manufacturing principle

One of the key steps towards cost-effective fuel cells is the transformation of manufacturing processes from discontinuous or batch processes to continuous manufacturing processes. In comparison, these are characterized by less complex production processes and higher levels of automation. The CONTIbip concept takes up this basic idea. It uses a pre-coating process for metal strip, followed by continuous forming, joining and cutting of the bipolar plates.

Coil coating

The vacuum coating of steel strip with carbon-based coating systems does not only allow meeting the high requirements with respect to contact resistance and corrosion protection, but also to achieve adhesion-resistant and formable coatings. In addition to coating systems, Fraunhofer IWS has also developed the appropriate system technologies. In particular, this allows

Fraunhofer Institute for Material and Beam Technology IWS

Eberhardstr. 12
44145 Dortmund

Contact
Dr.-Ing. Teja Roch
+49 231 8443894
teja.roch@iws.fraunhofer.de

www.iws.fraunhofer.de

3 *Coil unit for the carbon coating process.*

4 *Coil coating process in a PVD vacuum chamber.*

- to coat metallic plain sheets, e. g. made of different steels,
- to improve the corrosion behavior of the starting material,
- to avoid flaking of layers after forming,
- to design contact resistances comparable to gold and
- to avoid coating failure in fuel cells in long-term tests.

Forming and joining

For the forming of coated steel foils, various industrially proven or currently developed processes can be used, such as roll forming or hydroforming. Metallic bipolar plates are typically joined by laser welding or adhesive processes. Fraunhofer IWS researchers are further optimizing both laser remote and laser roll-based joining processes (laserCONTIjoin) that exceed the current state of the art. Laser welding and adhesive bonding processes are to be combined in a single step for contacting and sealing. First successes are expected in an increased efficiency by joining in a continuous process.

Cost-effectiveness analysis

From the start, the patented CONTIbip process emphasizes reel-to-reel processes to increase production quantities and reduce costs. The researchers are aiming at cycle times in production processes of only one second.

Application areas

Fuel cells are not only interesting for applications in cars and trucks, but are also used in logistics. Other current developments involving such systems focus on the aviation and private household sectors. In addition to fuel cells, bipolar plates and the manufacturing techniques developed can also be applied to batteries and electrolyzers.

Production in a strip process