# Laser structuring of bipolar plates

The bipolar plate represents the heart of the fuel cell and enables the continuous supply and separation of the reaction gases, integrates cooling channels to remove the heat of reaction and establishes the electrical contact to the anode and cathode. Bipolar plates are usually made of metals or composites. Currently, the low corrosion resistance of metallic bipolar plates and the manufacturing-related resistances of composite bipolar plates pose an obstacle to large-scale industrial applications. To face such challenges, laser structuring of bipolar plates could become a key technology to fully exploit the potential of fuel cells. Indeed, the surface structure introduced by laser processing allows corrosive reaction products to be removed selectively, the flow properties to be increased locally and electrical surface resistances to be reduced considerably.

## New processes for large-area and continuous machining

Fraunhofer ILT uses a 5-axis processing system with an integrated femtosecond beam source to structure bipolar plates. On metallic bipolar plates, the structures produced can be characterized by means of contact angle analysis, which allows the scientists to draw conclusions about the surface energies and to specifically adjust the wetting properties. For bipolar plates made of composite materials, the institute is investigating the surface resistance using contact resistance measurement after the coating has been removed. In combination with highly repetitive beam sources and fast scanning systems, a large-area, continuous machining process can be implemented in production.

## Bipolar plates for PEM fuel cells

When metallic bipolar plates are structured, the wetting properties of the surfaces can be specifically adjusted and the contact to the gas diffusion layer increased. When composite bipolar plates are structured, the resistance can be reduced by a factor of five in direct comparison to grinding; area rates of 4,300 cm²/min are reached during laser processing. The coating removal and manufacturing processes developed are of great importance, particularly for products that need properties promoting or repelling wetting by liquids. The focus of the work carried out by Fraunhofer ILT is on the structuring of metallic and composite bipolar plates for low-temperature PEM fuel cells.

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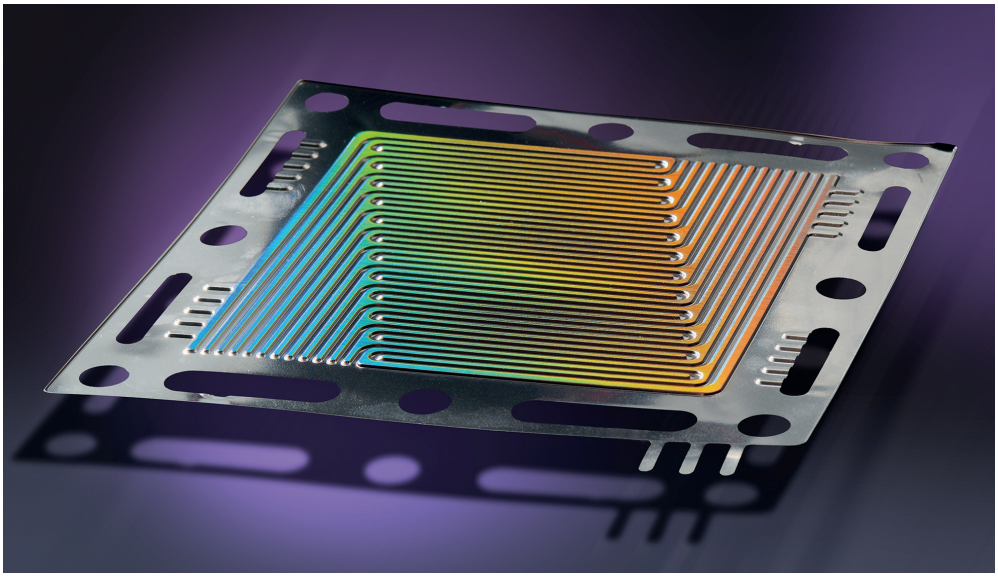

*Selectively structured metallic bipolar plate.*