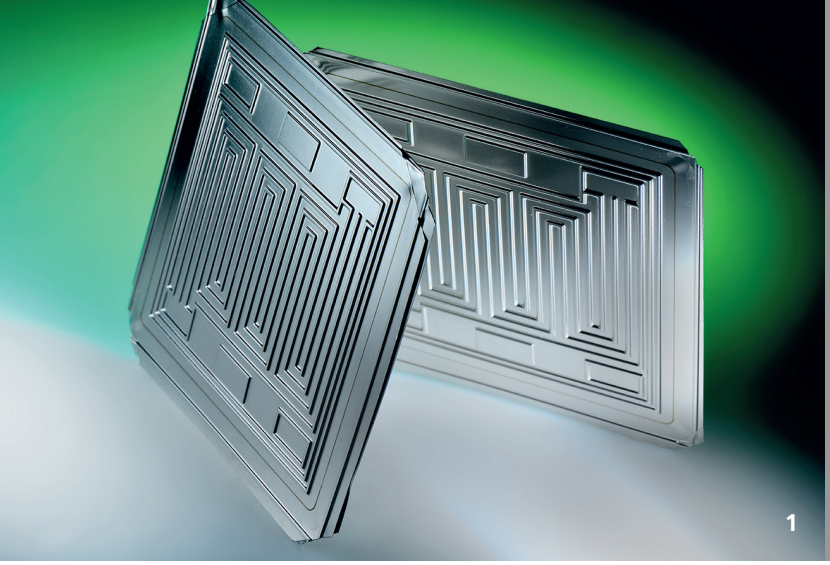

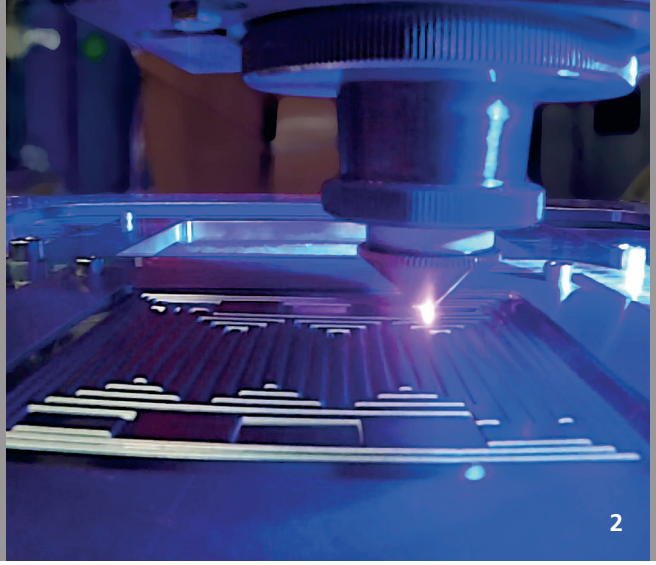



# HIGH-SPEED WELDING AND CUTTING OF STAINLESS STEEL BIPOLAR PLATES

## Task

In fuel cells, hydrogen and oxygen, spatially separated, are synthesized into water via electrochemical reactions that release electrical energy and heat. In addition to the membrane electrode unit, the bipolar plate is the central component of the repeating unit of a fuel cell stack. Overall, when a plate is produced, the steps required do not currently allow the use of a cost-efficient concept since the process involves manufacturing in batches and long transport distances. As a member of the CoBIP project, Fraunhofer ILT is developing and integrating a roll-to-roll laser welding and laser cutting module to create an innovative overall solution for manufacturing high-quality bipolar plates.

## Method

The challenge in using laser microwelding for this application is twofold: the welds of a bipolar plate must have a certain tightness and the feed rate must increase significantly. Fraunhofer ILT is investigating scanner-guided remote cutting as well as gas-assisted high-speed cutting with lasers to determine if they are suitable to cut bipolar plates in single layers, double layers or as a hollow structure in the area of the cooling channels. In addition, a newly developed clamping concept must make it possible to press formed sheets together without a gap forming.

## Results

The joining cross-section can be adapted to the technical requirements with the laser making an oscillating motion superimposed on the linear feed. By suitably selecting the various welding parameters, the institute is able to generate defect-free welds in an argon atmosphere at feed rates of up to 30 m/min. Cutting speeds of well over 100 m/min can be achieved without burrs, so that the dynamics of the axis system are the limiting constraint in the cutting process due to the small size of the contours.

## Applications

By reliably joining and contouring metallic double-walled bipolar plates in a gas-tight manner and at high process speeds, this process lays a foundation for efficiently producing bipolar plates or fuel cells.

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*1 Bipolar plates with welded outer contour.*

*2 Laser-beam cutting of bipolar plates.*