Press Release

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Fraunhofer IWU Opens New Pathways to Cost-Effective High-Volume Production of Heat Exchanger Plates

Increasing efficiency requirements, rising production volumes, and growing cost pressure are creating new challenges for heat exchanger manufacturers. The key question is: which manufacturing technology can deliver superior component quality while remaining economically viable for large-scale production? Fraunhofer IWU offers tailored answers to this challenge. In addition to established processes such as cavity embossing (stamping) and high-pressure sheet metal forming (hydroforming), the institute is placing particular emphasis on a technology with exceptional productivity potential: roll-based cavity embossing.

The Chemnitz-based Institute develops, investigates, and qualifies all three technologies for industrial applications. Such expertise enables companies to receive an objective, technology-neutral assessment of the manufacturing strategy best suited to their specific requirements. These competencies stem from many years of developing metallic bipolar plates for fuel cells and electrolyzers.

Three Technologies, Three Distinct Advantages

Metal heat exchanger plates require intricate flow channel structures, tight dimensional tolerances, and consistently high quality. At the same time, investment costs, material utilization, and production throughput must remain economically attractive. To meet these demands, Fraunhofer IWU offers three complementary forming technologies.

Hydroforming provides outstanding replication of fine channel geometries and excellent dimensional accuracy. Because the process requires only a single die cavity, tooling costs and lead times can be significantly reduced. The passive high-pressure sheet metal forming process developed at Fraunhofer IWU further simplifies the necessary equipment technology and shortens cycle times.

Hollow embossing is currently regarded as the industrial benchmark for manufacturing structured metal plates. The process combines high reliability, well-established production equipment, and cost-effective series manufacturing. For many applications, it remains the industry's reference technology.

When Productivity Becomes a Competitive Advantage

Fraunhofer IWU sees the greatest development potential, however, in hollow embossing rolling. Unlike conventional stamping, which operates as a discontinuous process, deformation takes place continuously between rotating forming rolls. This continuous forming principle substantially reduces forming forces while enabling significantly higher production rates. Whereas conventional technologies typically achieve outputs of up to 60 parts per minute, roll-based cavity embossing is expected to exceed 100 parts per minute.

For future high-volume markets, this represents a significant economic opportunity. Continuous manufacturing enables more compact production systems, high material efficiency, and attractive part costs. More importantly, hollow cavity embossing creates entirely new possibilities for fully integrated roll-to-roll manufacturing chains.

From Coil Stock Directly to the Heat Exchanger

Fraunhofer IWU pursues a holistic manufacturing approach. The focus extends far beyond forming individual plates. After continuous roll embossing, components can be separated directly from the strip, joined, and stacked in subsequent process steps. The result is a highly productive manufacturing architecture extending from coil stock to finished heat exchanger plates. At industrial scale, this can significantly reduce per-part investment costs, handling effort, and production times. The true strength of roll-based cavity embossing therefore lies not only in the forming process itself, but also in its outstanding suitability for highly automated production lines.

Hydrogen Manufacturing Expertise for the Next Generation of Heat Exchangers

The technological foundation for this work has already been established at Fraunhofer IWU. Through numerous research and development projects, the institute has investigated, evaluated, and qualified manufacturing processes for metallic bipolar plates used in fuel cells and electrolyzers. These projects focused on many of the same challenges that now define the development of advanced heat exchangers: highly precise channel structures, low forming forces, high production rates, and robust process chains.

The knowledge developed through these projects can be leveraged directly for heat exchanger plate production. In particular, experience gained in processing thin-gauge stainless steel strip, designing complex flow-field geometries, and developing continuous production systems provides a robust foundation for industrial heat-transfer applications.

From Initial Concept to Feasibility Study

Companies developing new heat exchanger concepts or seeking more cost-effective manufacturing solutions for existing products can evaluate these technologies together with Fraunhofer IWU. Feasibility studies can be carried out on sample components up to approximately 30 cm (12 in) wide, 1 m (39 in) long, and with sheet thicknesses of up to 0.5 mm (0.020 in). These studies provide valuable insights into formability, achievable component quality, the economic viability of potential process chains, and opportunities for scaling to volume production.

In Brief: Three Technologies and Their Key Advantages

Fig. 1 Unlike conventional hollow embossing (stamping), roll-based hollow cavity embossing forms the material continuously between rotating tooling rolls, significantly reducing process forces while enabling production rates of more than 100 parts per minute. © Fraunhofer IWU

The **Fraunhofer Institute for Machine Tools and Forming Technology IWU** is an innovation-driven partner for research and development in production engineering. Over 600 highly qualified employees work at our locations in Chemnitz, Cottbus, Dresden, Leipzig, Wolfsburg, and Zittau. We unlock potential for competitive manufacturing, across industries like automotive, aerospace, electrical engineering, and precision engineering. Our research and contract research encompass the entire manufacturing ecosystem, from individual components to processes, methods, complex machine systems and human interaction. As one of the leading institutes for resource-efficient manufacturing, we bank on highly flexible, scalable cognitive production systems using nature as an example. We take a holistic approach to the entire process chain, aligning with circular economy principles. We develop technologies and intelligent production plants and optimize forming, cutting, and joining manufacturing steps. Our services include innovative lightweight structures and technologies for processing new materials, functional transfer to assembly groups, and the latest technologies of additive manufacturing (3D printing). We provide solutions for climate-neutral factory operations and large-scale production of hydrogen systems, thus paving the way for the transition to renewable energies.

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