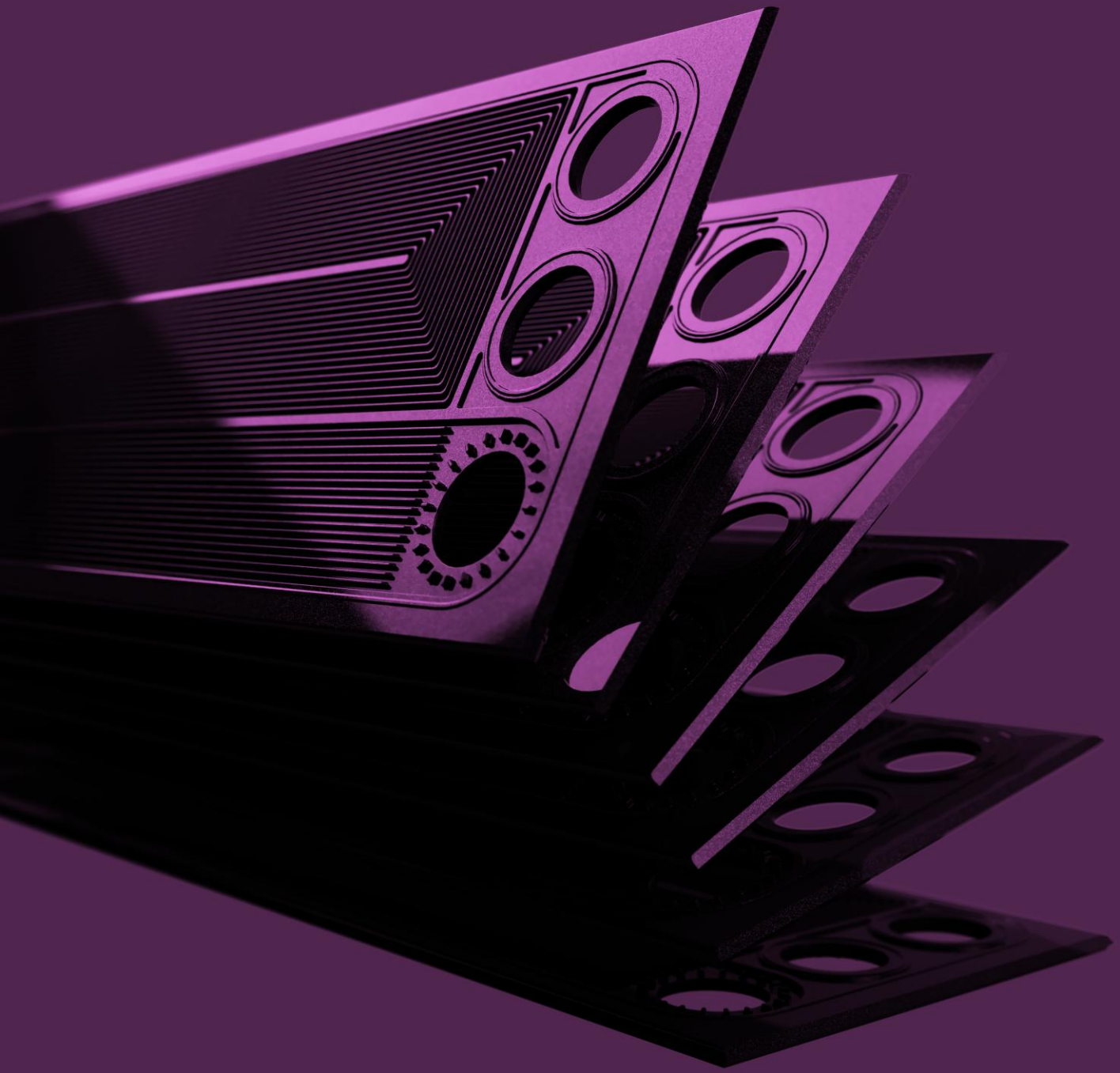
A new era of non-metallic flow plates with scalable manufacturing

reliefed

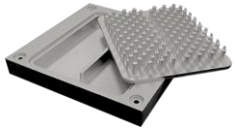


At Reliefed, we remove the barrier of prohibitive manufacturing costs, making non-metallic flow plates an affordable and sustainable alternative to traditional metal ones.

We transform non-metallic flow plates from niche applications into an industry-standard solution.

Who we serve

Customer



Heat transfer, cooling and electro-chemistry companies – and related fields – that seek to replace their metallic solutions or reduce cost of non-metallic alternatives.

Examples of use cases for flow plates

- Plate Heat Exchangers
- Cold plates
- Electronics cooling
- Liquid cooling plates
- Fuel cells
- Electrolysers
- Flow batteries

What we bring

reliefed



We use our proprietary 3D forming technology to make custom non-metallic flow plates that outperform the alternatives – tailored to our customers' specifications.

Examples of value-driven opportunities

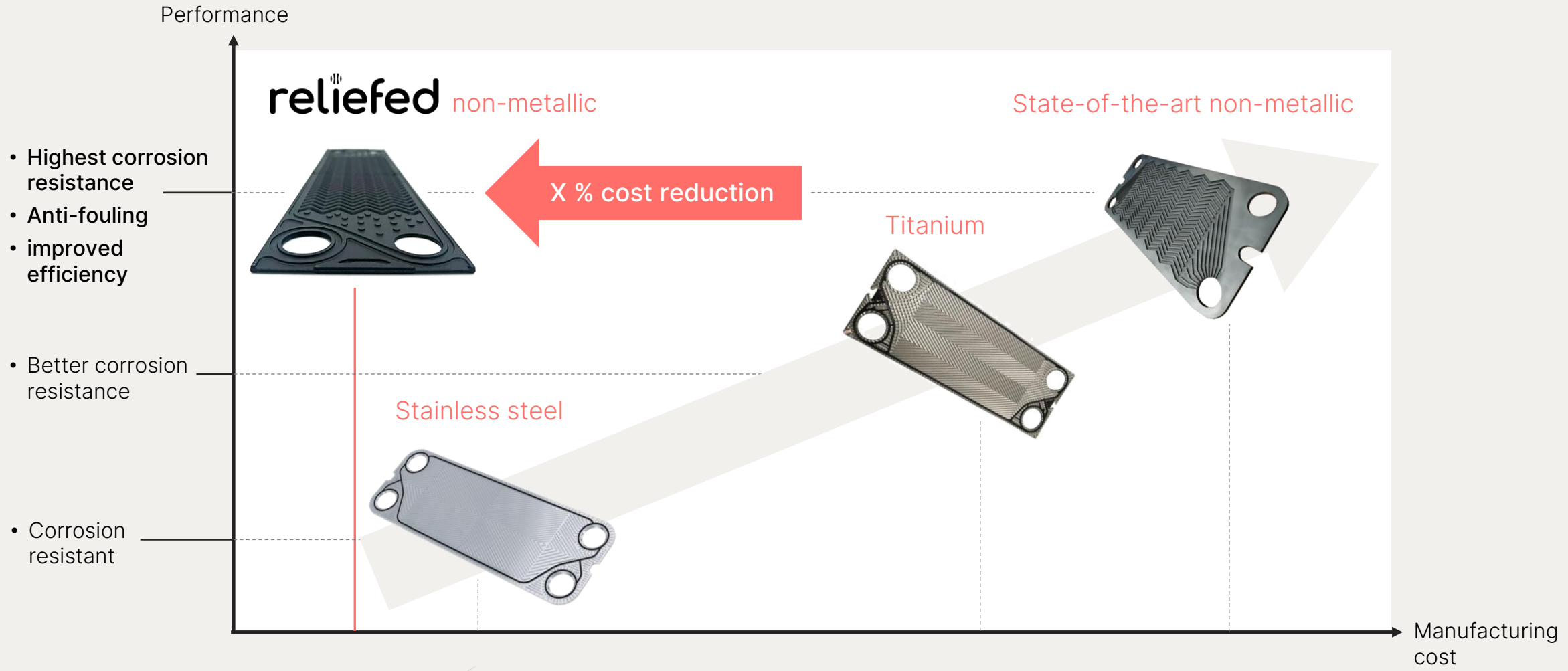
- Significantly reduced cost
- Material flexibility
- Improved corrosion and degradation resistance
- Improved fouling resistance
- Design freedom flexibility
- Rapid volume scalability and ROI
- Reduced environmental footprint

Developing, designing and manufacturing non-metallic flow plates – with and for customers

Customer	reliefed
Has already an existing flow plate design and chosen material	Manufacturing partner - Reviews the design - Adapts it for manufacturability if required - Manufactures and supplies the plates
Has system requirements but no defined design or material preference	Co-development and manufacturing partner - Helps design the flow plate - Optimises geometry - Identifies and source material with partners - Manufactures and supplies the plates


From inefficient and costly...
to efficient and scalable

Non-metallic flow plates are often superior but historically too expensive to scale

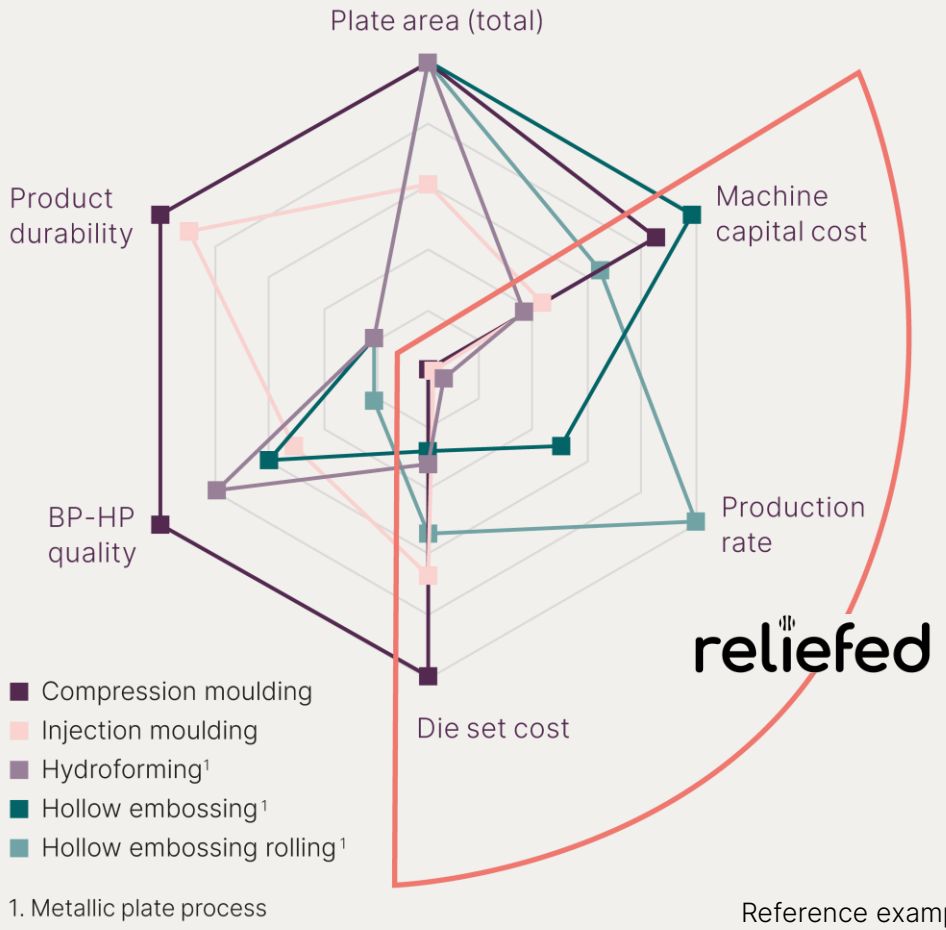


Why non-metallic flow plates have struggled to scale

- Cost
- Manufacturing scalability
- Environmental impact
- Market and product requirements
- Life length due to corrosion
- High efficiency (power density)

As a reference – for bipolar plates in fuel cells 80% of the non-metal plates are today manufactured using compression moulding with a cycle time of 3–5 minutes per plate.

Comparison of selected processes for the manufacturing of bipolar plates (fuel cells)

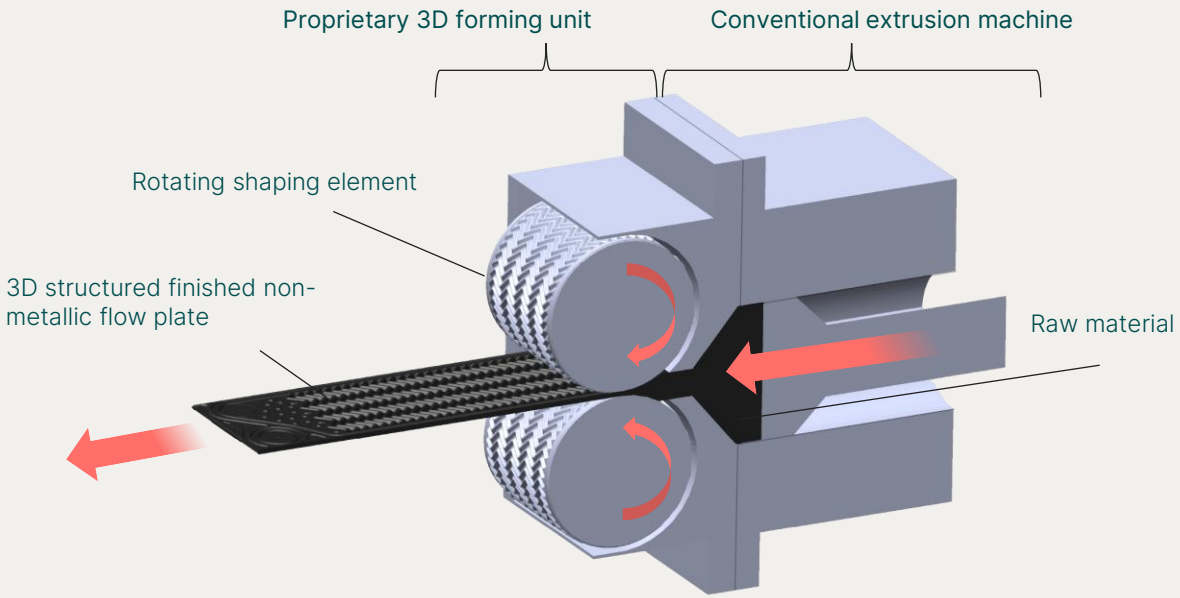


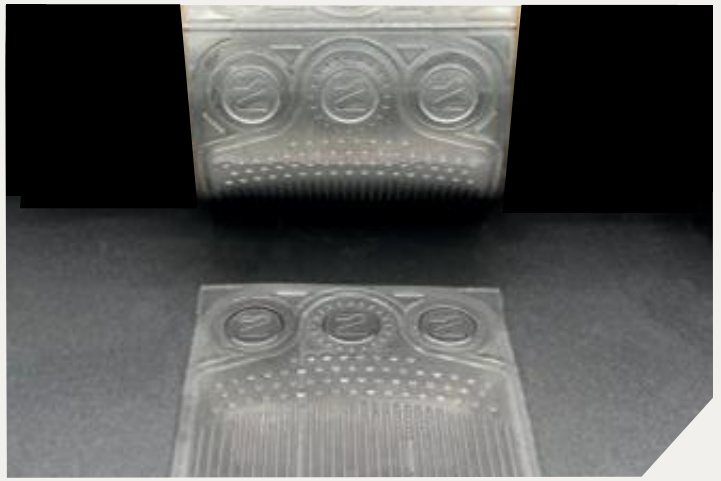
1. Metallic plate process

Reference example

The enabler

Supercharging ”2D” extrusion with groundbreaking 3D forming – a globally patented manufacturing innovation that transforms existing extrusion machines with Reliefed’s advanced 3D flow plate forming technology





- One-step inline process – shifting to a continuous process from a cycle-based or multi-step manufacturing, slashes costs, cut energy use and CO_2e emissions while increases product yield
- Piggy-backs already widely used extrusion machines by replacing the traditional 2D die head with a proprietary 3D forming unit → fast ramp up and scalability
- Tested and verified with excellent results by market leaders

The game changer for non-metallic flow plates

Key takeaways

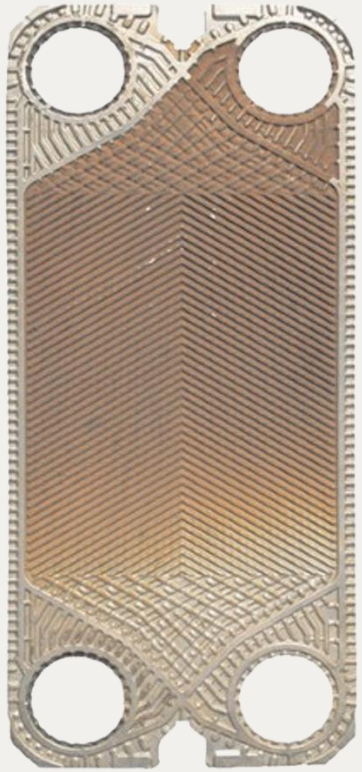
- Better corrosion resistance → Longer lifetime
- Less fouling → Less maintenance and higher efficiency
- Enhanced design freedom → Superior products

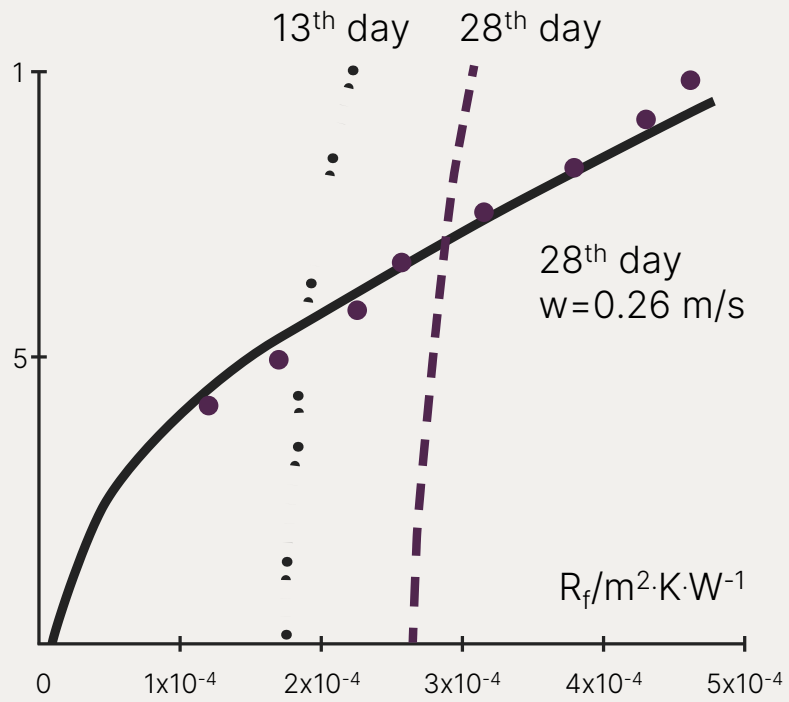
A flow plate challenge

Flow plates, as critical components in systems driving the energy transition, often operate in environments prone to corrosion and fouling..

This has generated a demand for innovative solutions that achieve cost and performance targets while maintaining effectiveness under such challenging conditions.

However, despite their ability to withstand these harsh environments, the use of non-metallic materials has remained limited to niche applications due to high manufacturing costs..





Great non-metal fit

Reliefed works with customers and material partners to define the optimal material.

Ultimately, the material flexibility is determined by the application requirements.

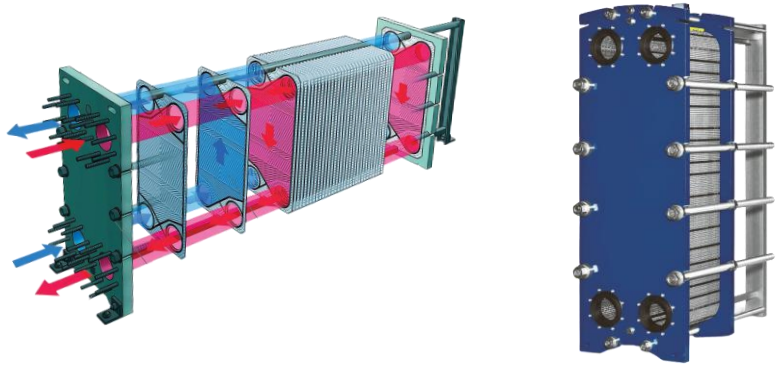
The technology is validated for a range of non-metal, highly filled and low carbon footprint materials including different compositions and composites of:

- Polymers
- Graphite composites
- Technical ceramics & composites: SiC, AlN etc.

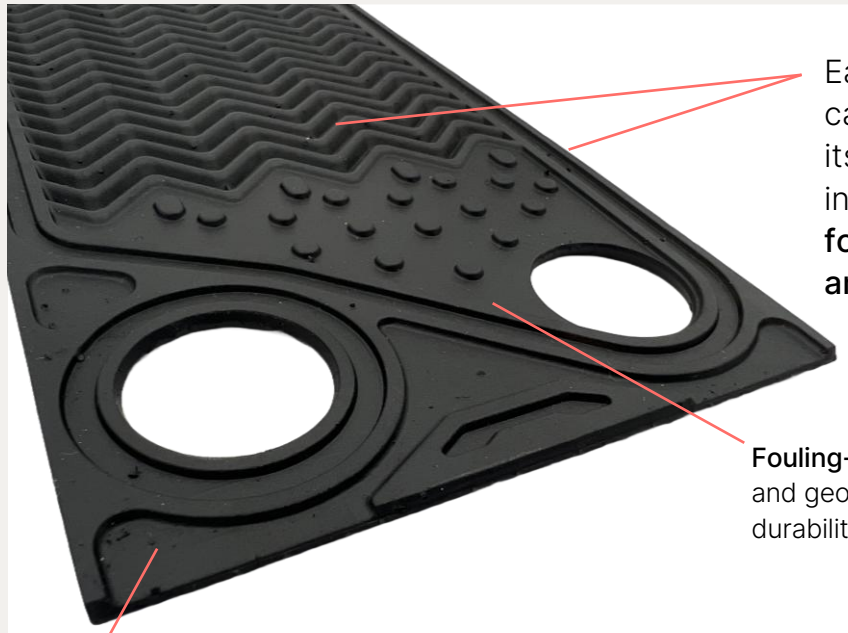
Sample plate available in 30% PP and 70% graphite

Reliefed flow plate example

Non-metallic graphite composite for heat exchanger application



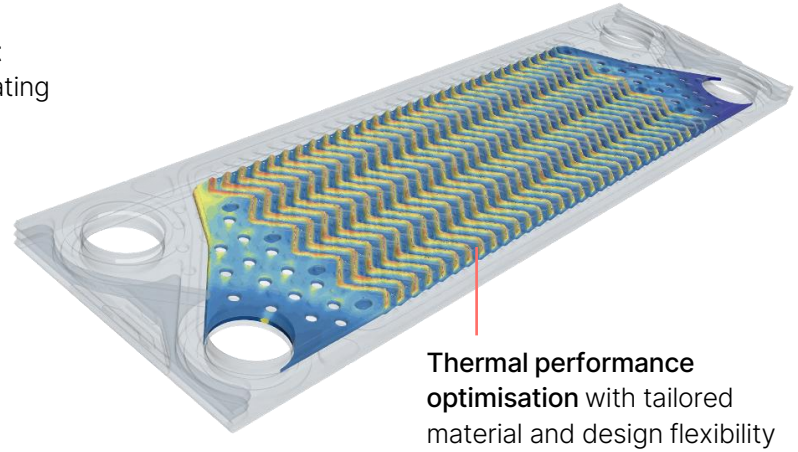
Typical flow plate stacking in finished product



Each side of the plate can be designed with its own flow pattern, independently **optimised for its specific function and use-case**

Fouling-resistant surface and geometry for enhanced durability and efficiency

Corrosion resistant surface without coating



Thermal performance optimisation with tailored material and design flexibility

Design and material freedom meets scalable manufacturing

Corrosion & fouling resistant material and surface without the need for coatings and costly after processes.

New flow design possibilities with asymmetric flow patterns, tailoring the design for each specific use-case. Tesla valves, pyramids, microchannels etc.

Great flexibility in plate size using a continuous manufacturing process.

Reduced carbon footprint with low embodied carbon in the material and low energy consumption in the forming step.

Material flexible platform validated for a range of non-metal materials:

- Composites (graphite)
- Technical Ceramics (SiC, AlN)
- Polymers

Thermal performance optimisation with tailored material and design flexibility.

How customers work with Reliefed

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Pre-evaluation

The process begins with understanding the customer's technical and operational specifications – whether that means working from a finished design or system requirements – followed by a feasibility assessment covering cost, performance and production.

1

Flow plate design

Reliefed supports the customer in adjusting plate geometry for optimal performance and manufacturability.

2

Tooling design

Reliefed designs and manufactures the production tooling, then validates it through initial prototype runs.

3

Sample testing

Samples are produced and handed over to the customer for validation of performance, durability and process stability.

4

Series production

Production is ramped up with quality assurance checks. Logistics and supply chain are aligned for consistent deliveries. Ongoing support is provided for future optimisations.

Reliefed battery pack

- An EIC funded project to showcase a combination of thermal and structural values in a cooling flow plate for EV batteries
- Produced in one rational and cost-efficient step; a modular tab cooled battery pack, combines cooling channels, lightweight structure and cell fixation

Graphite bipolar fuel cell plates

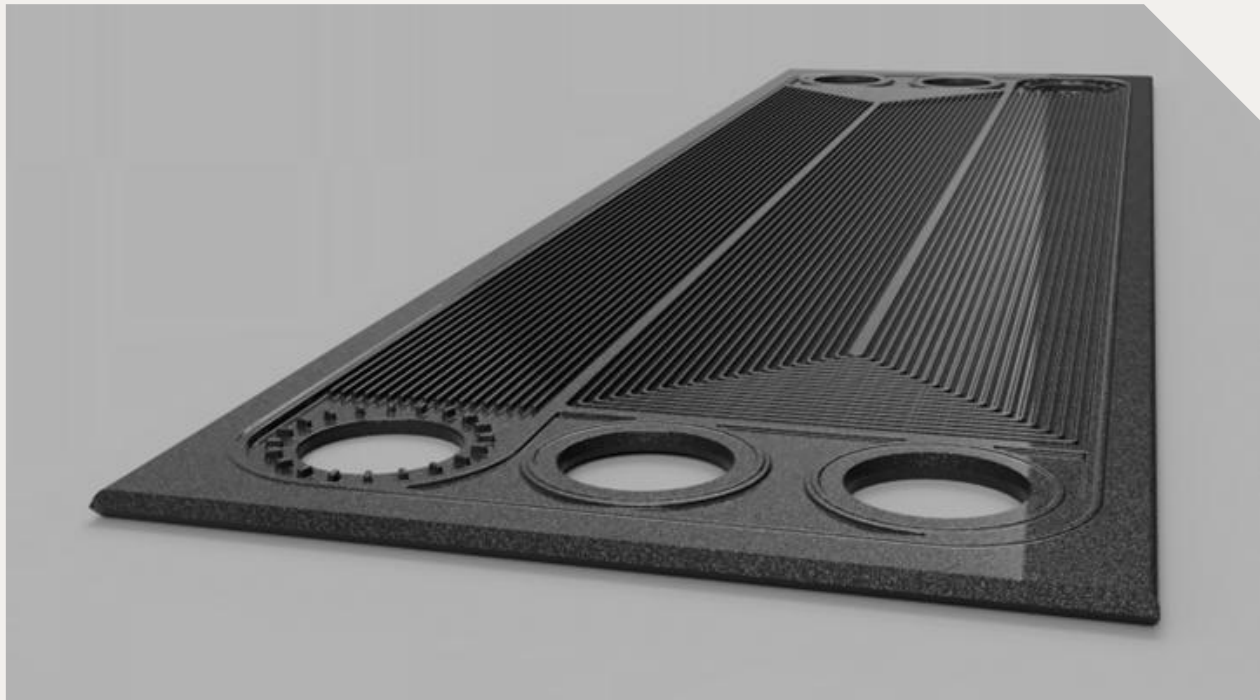
- Project to showcase design freedom, precision and production capacity for graphite based bipolar plates for fuel cells
- Produced in one rational and cost-efficient step; a disruptive way of cost-efficient scaling for mass production within the hydrogen sector

Swedish Energy Agency

ZBT

VOLVO

Volvo Group



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reliefed

On a mission to improve the global energy system, by unlocking mass-usage of superior performance flow plates through drastically reduced manufacturing costs