

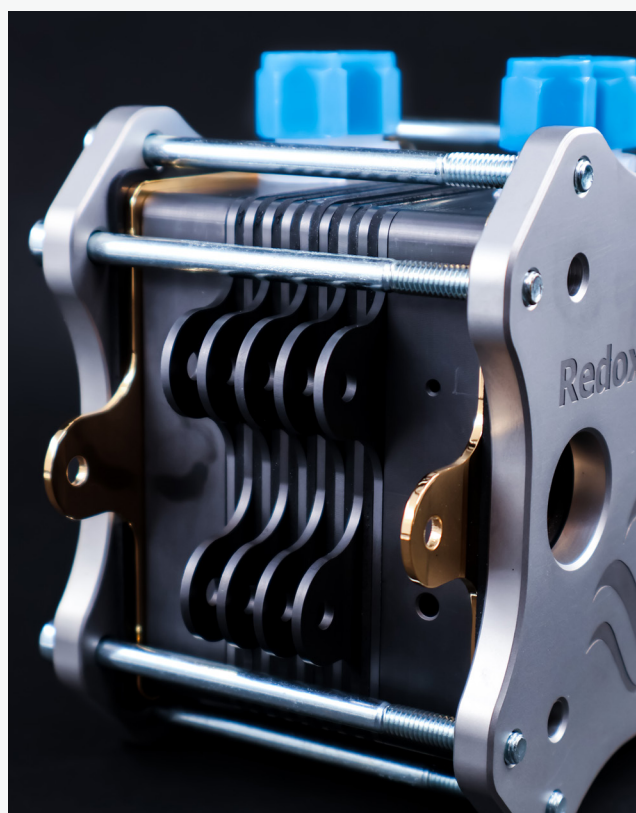


2026
FLOW BATTERIES



THE S-STACK

REDOX FLOW BATTERY TEST STACK



Configurable **Flow Battery Stack** for Scale-up *Studies*

2



The S-Stack

The S-Stack is a highly configurable flow battery research stack developed for controlled investigation of multi-cell behavior, component interactions, and scale-relevant performance in redox flow battery systems.

Its flexible stack architecture enables researchers to bridge the gap between single-cell testing and stack-level validation without complex custom assemblies. Designed with nearly a decade of expertise, the S-Stack is perhaps the most flexible research stack product on the market offering such a unique combination of features for optimizing electrodes, bipolar plates, and membranes, particularly for thick electrodes (> 1 mm), typically carbon felt.

What makes it a great choice for R&D?

- **Configurable from 1 to 9 Cells.** Allows for systematic scale-up studies, investigating performance across various cell numbers.
- **Supports Thick Electrodes.** Optimized for electrode thicknesses greater than 1 mm, accommodating a wide range of electrode materials and designs.
- **Individual Cell Voltage Measurement.** Enables direct measurement of individual cell voltages on bipolar plates, providing accurate stack diagnostics and intrinsic cell performance data.
- **Optimized for Component Testing.** Ideal for the optimization of carbon felt electrodes, bipolar plate materials, and membranes under stack conditions.
- **Flexible Electrode Compression.** Achieves different electrode compressions through various gasket thicknesses, allowing for precise control over experimental conditions.
- **Minimal Shunt Current & Pressure Drop.** It was specifically designed for minimizing shunt current effects and pressure drop.

Explore the most unique and versatile flow battery research stack for advanced R&D.

REDOX FLOW

Components & Configuration

S-Stack Frame



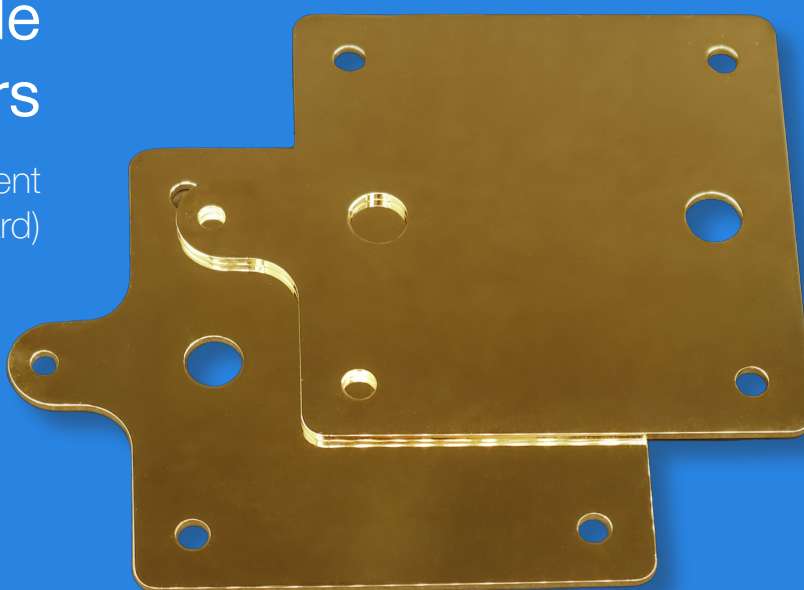
Flow Bodies

Impermeable graphite composite

Tight PFA Swagelok fittings installed

Anode and cathode current collectors

Material: Gold-plated current collectors (standard)





Repeating Cells



Graphite Bipolar Plates

Material: Graphite

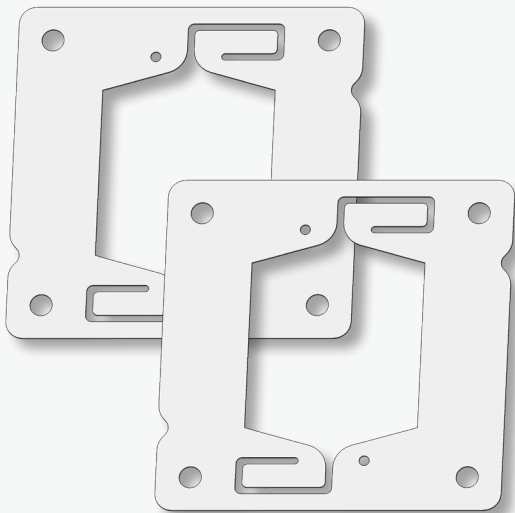
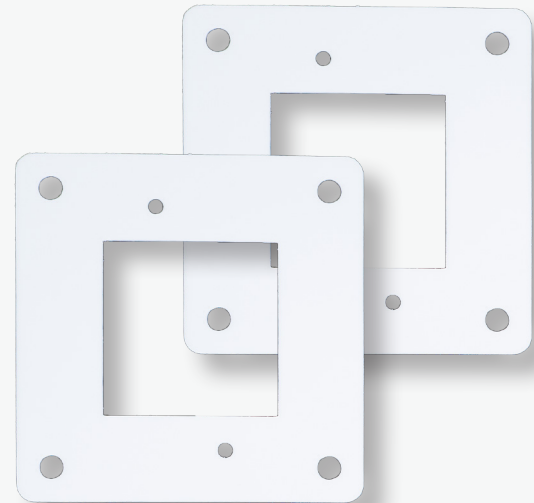
Thickness: 2 mm

Cover gaskets

Material: VITON, EPDM, PTFE

Active area: 5 x 5 cm

Thickness: 0.05 mm, 0.1 mm, 0.25 mm,
0.5 mm, 1 mm



Flow field gaskets

Material: VITON, EPDM, PTFE

Active area: 5 x 5 cm

Thickness: 0.25 mm, 0.5 mm, 1 mm,
1.5 mm, 2 mm



About the cell

Pioneering the Path to Scalable Flow Battery Solutions

The S-Stack is a testament to Redox Flow's commitment to advancing redox flow battery (RFB) technology from fundamental research to industrial application. Born from nearly a decade of specialized expertise and direct engagement with the research community, the S-Stack was developed to address a critical void in the market: a flexible, high-performance research platform capable of simulating and validating multi-cell RFB behavior. It serves as an indispensable tool for researchers and engineers striving to understand and overcome the complexities of scaling up RFB systems. By providing a robust and adaptable environment for testing components and stack configurations, the S-Stack empowers the development of more efficient, durable, and economically viable energy storage solutions, driving the transition towards a sustainable energy future.

Key Features and Flexibility

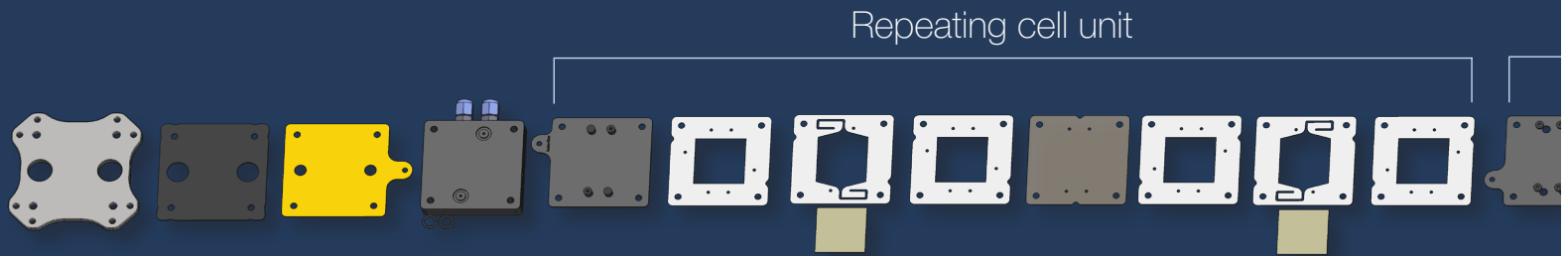
- **Enabling Scale-Up Insights** - Facilitates the crucial transition from single-cell experiments to multi-cell stack validation, providing data essential for industrial scale-up and commercialization.
- **Accelerating Component Optimization** - Offers a realistic testing environment for electrodes, membranes, and bipolar plates under stack-relevant conditions, speeding up material selection and design cycles.
- **Fostering Reproducibility** - Engineered for consistent performance and ease of use, ensuring that experimental results are reliable and comparable across different studies and research groups.
- **Driving Innovation** - Supports the exploration of novel RFB chemistries and architectures by providing a versatile platform for fundamental and applied research.
- **Trusted Expertise** - Backed by Redox Flow's extensive experience in electrochemical cell design, ensuring a product that meets the rigorous demands of cutting-edge energy research.



THE S-STACK



REDOX FLOW



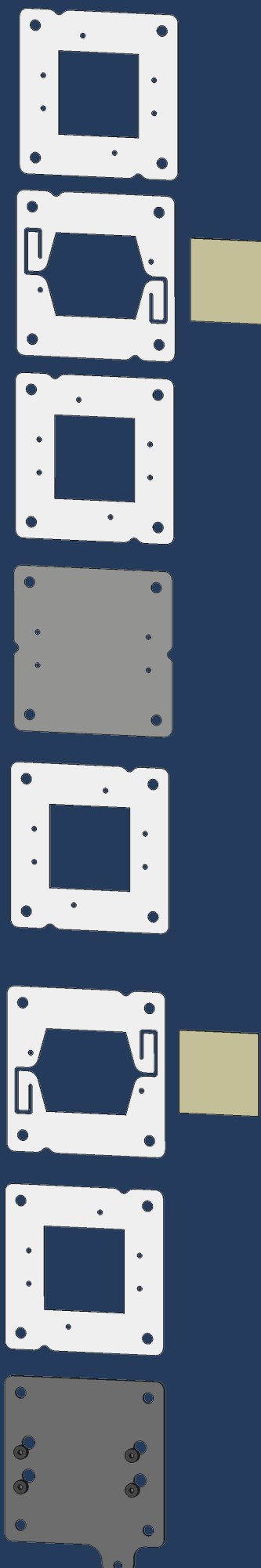
Flexible Cell Configuration

THE S-STACK

Repeating cell unit



The S-Stack is designed for precise control over electrode compression and electrolyte flow through a flexible gasket system comprising cover gaskets and flow-field gaskets. Gasket flow-channel designs are optimized to balance shunt currents and pressure drops, while accommodating thick electrodes (>1 mm) and ensuring consistent performance across carbon felt electrodes, bipolar plates, and membranes in a multi-cell environment. The modular approach allows researchers to fine-tune the stack assembly for specific experimental conditions, delivering reproducible and reliable results.



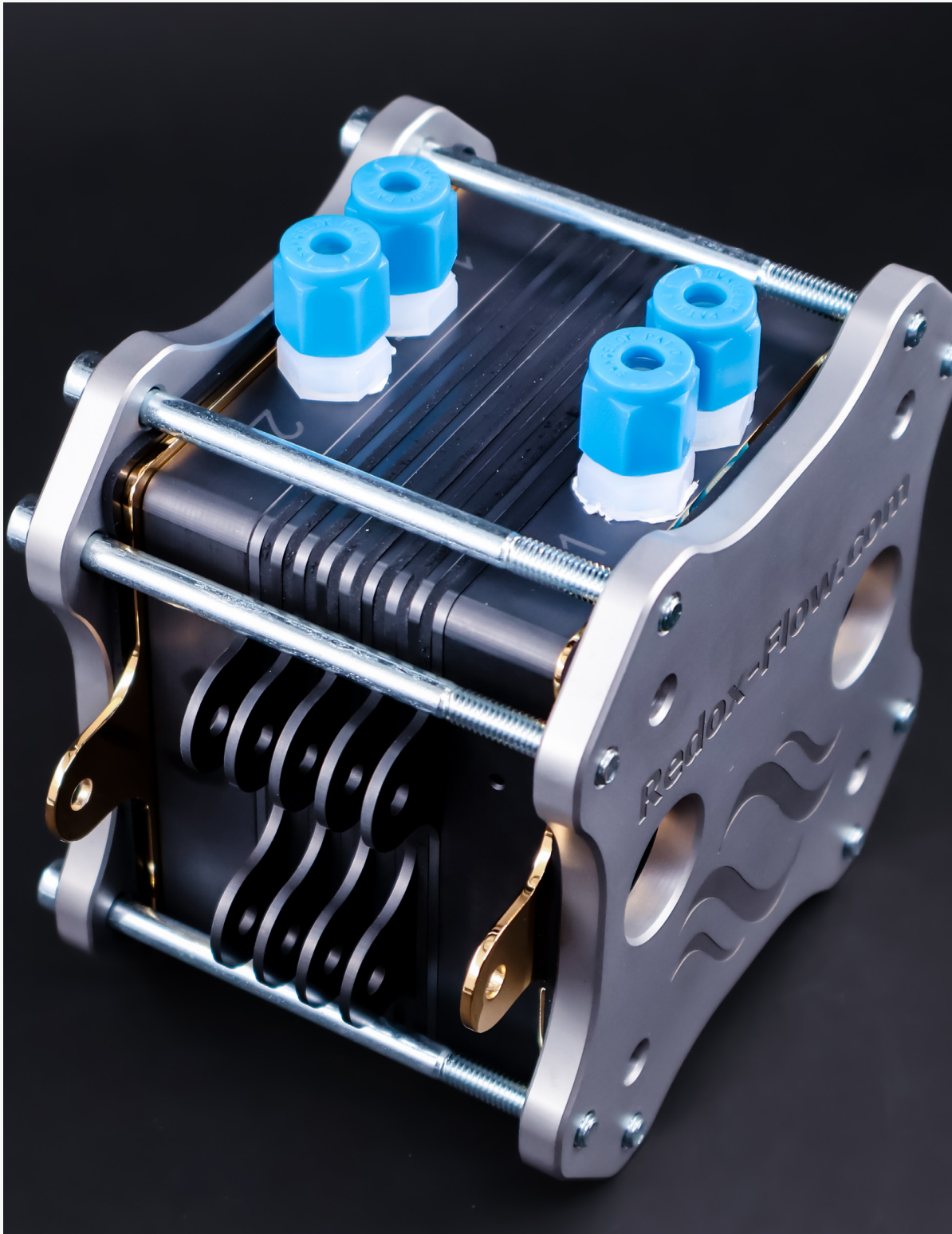
Repeating cell structure

For the S-Stack, which typically uses flat current collectors, both flow-field gaskets and cover gaskets are essential for each cell. Cover gaskets define the active area exposed to the membrane and control total electrode compression, while flow-field gaskets contain the electrode and direct electrolyte flow through the cell.

This modularity is particularly beneficial for experiments involving thick porous electrodes, gas diffusion layers (GDLs), and microporous layers (MPLs), where precise control over compression is critical for stack performance and reproducibility.



THE S-STACK

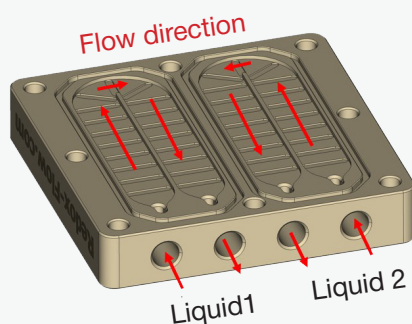


Temperature control

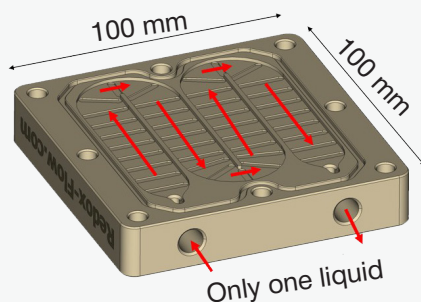
Temperature Control Unit

This system can be used in combination with a dedicated temperature control setup based on a flow heat exchanger principle. To the best of our knowledge, similar products cannot be found by any other companies in the field.

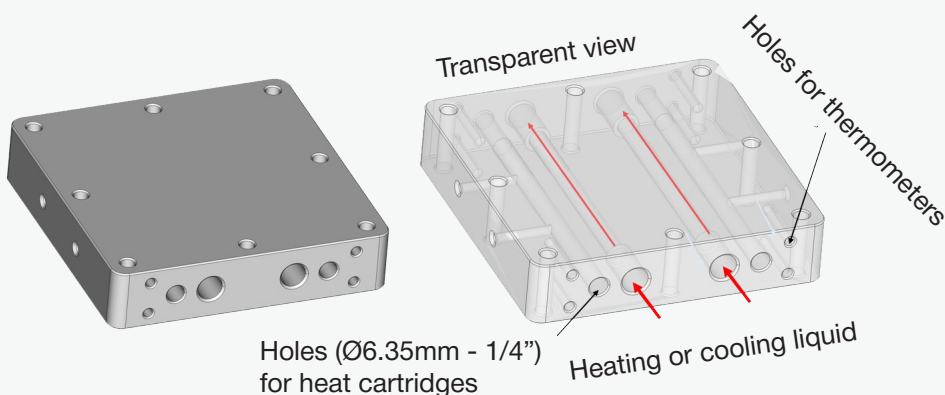
PEEK flow body variant



PEEK flow body variant 2



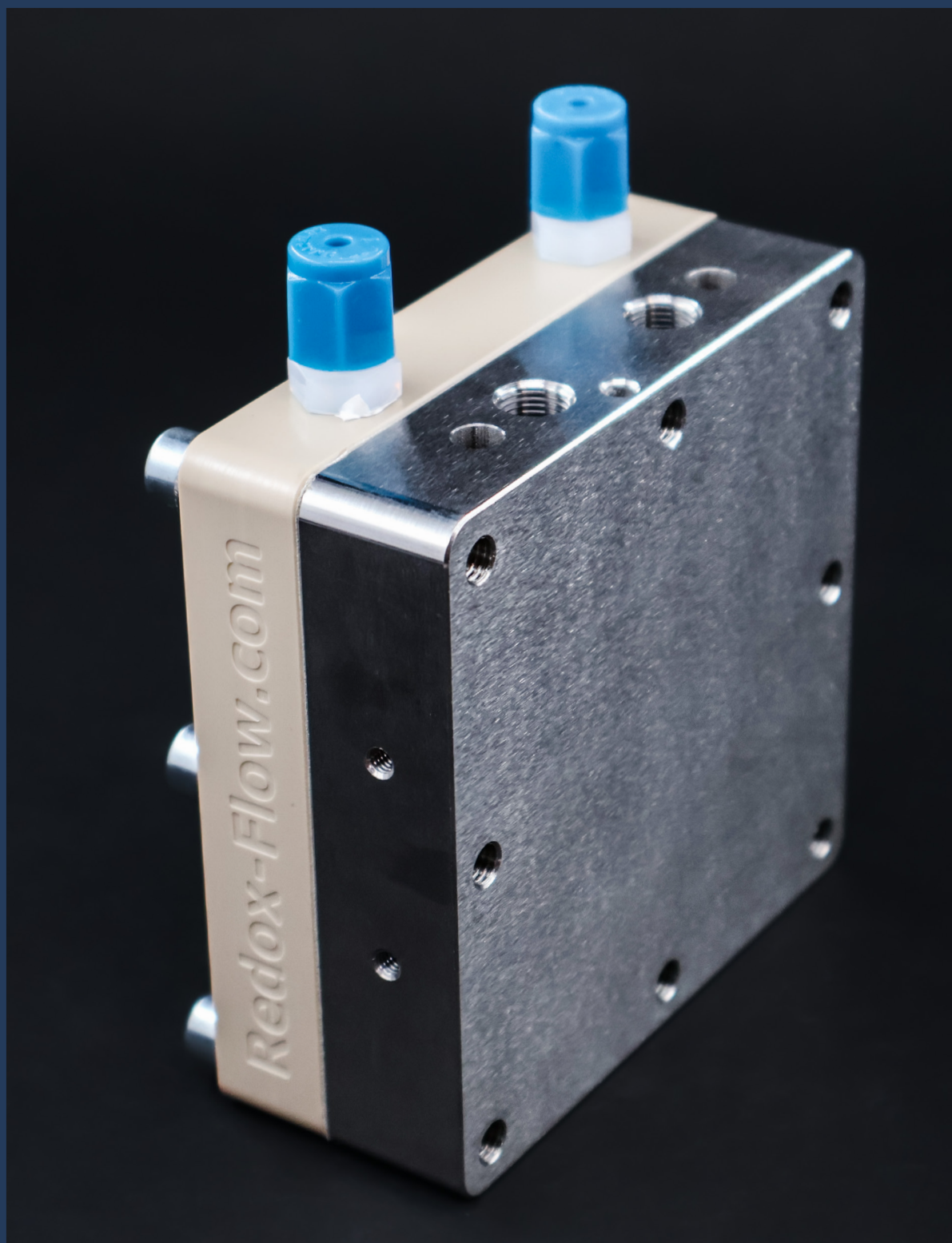
Metal heating/cooling block



Our solution comes as three different configurations that are based on the same components and can be interchanged. All options are based on a PEEK flow body and metal block shown above. The PEEK body contains one (variant 1) or two separate (variant 2) flow chambers for heating/cooling one or two independent liquids, respectively. The liquids in the experimental setup are circulated through the PEEK flow body and placed up against a metal heating/cooling plate, whereby heat is transferred to or from the liquids in the PEEK flow body. The metal plate is separated from the liquids by a thin PTFE sheet, whereby corrosive/oxidative solutions also can be heated without corroding the metal plate.

Besides the possibility for placing the metal block on a heating plate, it also comes with holes for heat cartridges, cooling liquids, and thermometers.

THE S-STACK



Accessories



Inline Pressure Unit

Differential Pressure Measurement Unit.

- Compact, inline design for direct differential pressure measurement
- Monitor hydraulic resistance of electrodes with high accuracy
- Integrated temperature sensing for added diagnostics
- Built from chemically highly resistant materials



Open Circuit Voltage Cell

Reference Cell For OCV & Potential Monitoring.

- For accurate anode/cathode potential measurement
- Multifunctional design for OCV and overpotential studies
- Easy integration into existing setups with internal reference electrolyte chamber
- Durable graphite flow bodies ensure chemical resistance and stability



UV/VIS Flow Cell

UV/VIS Fiber Optical Flow-Cell.

- Adjustable optical path length (0.05–8 mm) for maximum flexibility
- Supports high flow rates (>100 ml/min) with minimal pressure loss from unique design with hydraulic bypass
- Connects with standard fiber based spectrometers using SMA 905 connectors



Flow-through electrode holder

Inline Reference Potential Measurement Unit.

- Fits a wide range of electrode diameters (3–17 mm)
- Durable, chemically resistant construction
- Measures e.g. pH, ORP, or reference potential.

Compatibility

The S-Stack offers exceptional flexibility within the Redox Flow product ecosystem. While optimized for thick electrodes in multi-cell redox flow battery research, its modular design allows for conversion into other cell types, extending its utility across various electrochemical applications.

Easy Convertibility

The S-Stack can be readily reconfigured or integrated with components from S-Cells, A-Cells, or X-Cells, providing long-term versatility and adaptability for evolving research needs in single-cell or stack configurations.



Modular Design

As part of the Redox Flow family of electrochemical cells and stacks, it shares common design principles, ensuring ease of use, interchangeability of components, and seamless integration with other Redox Flow products.

Application Areas

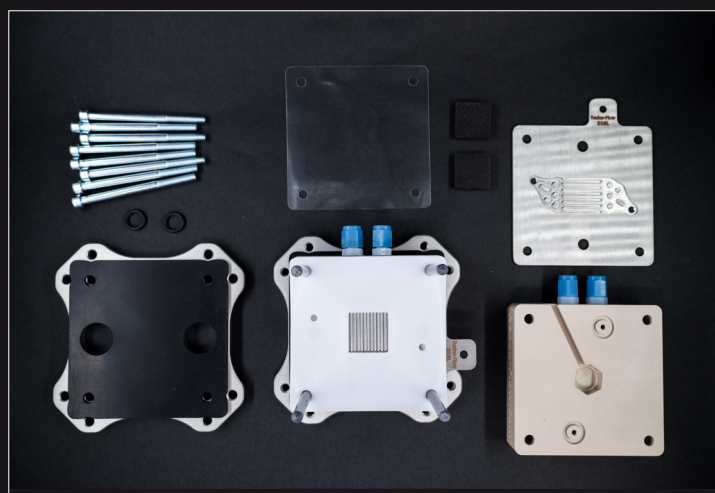
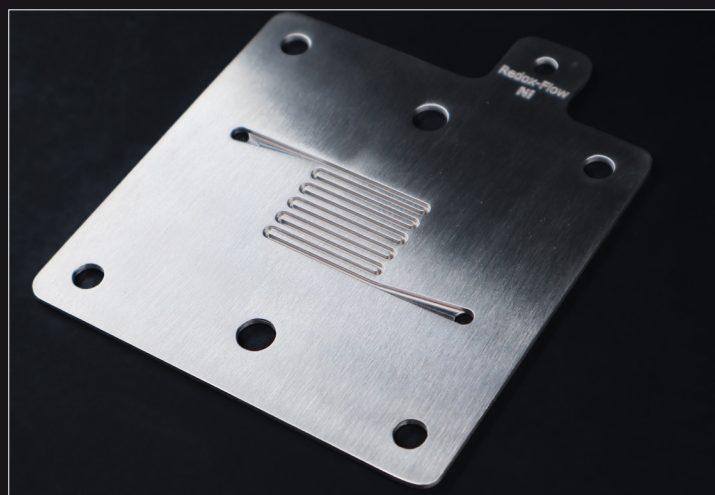
- Redox Flow Battery Component Optimization
- Multi-Cell Stack Performance Studies
- Upscaling and Demonstration of Flow Battery Systems
- Advanced Diagnostics of Stack Behavior
- General Electrochemical Energy Conversion Technologies

REDOX FLOW

Our Solutions

Born from PhD project that identified *the need for modular design* in flow cell R&D, we've grown in five years into a startup with *over 1,000 customers worldwide.*

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Custom

Electrochemical research is constantly evolving — and so are we. Whether you want to test a new material, explore a novel geometry, or build something entirely from scratch, we're here to help. Serpentine flow fields, BMED cell designs, custom gasket shapes — these are just a few of the projects we've taken on over the years. From small design tweaks to full custom builds, we've got you covered.

One-Stop



We sell Complete Flow Battery Setups — including the flow cell, pump, hydraulic connection pack, battery control unit, and all the fittings and gaskets needed for a classic R&D setup. Everything arrives ready to run, so you can skip the sourcing headaches and get straight to experimentation. If you're looking for an out-of-the-box solution, this is the easy choice.

Modular & Scalable

Our flow cells are built to be flexible and upgradable. Parts are compatible across our entire cell range, so switching to a completely different chemistry is as simple as swapping a few components — no need for a new cell. Assembly and disassembly are equally straightforward, giving you the freedom to experiment as your research demands. Add extra parts to upgrade a single cell into a stack, or order replacement flow bodies and gaskets for electrode and membrane testing. One cell really can do a lot.

REDOX FLOW

Redox Flow® Family

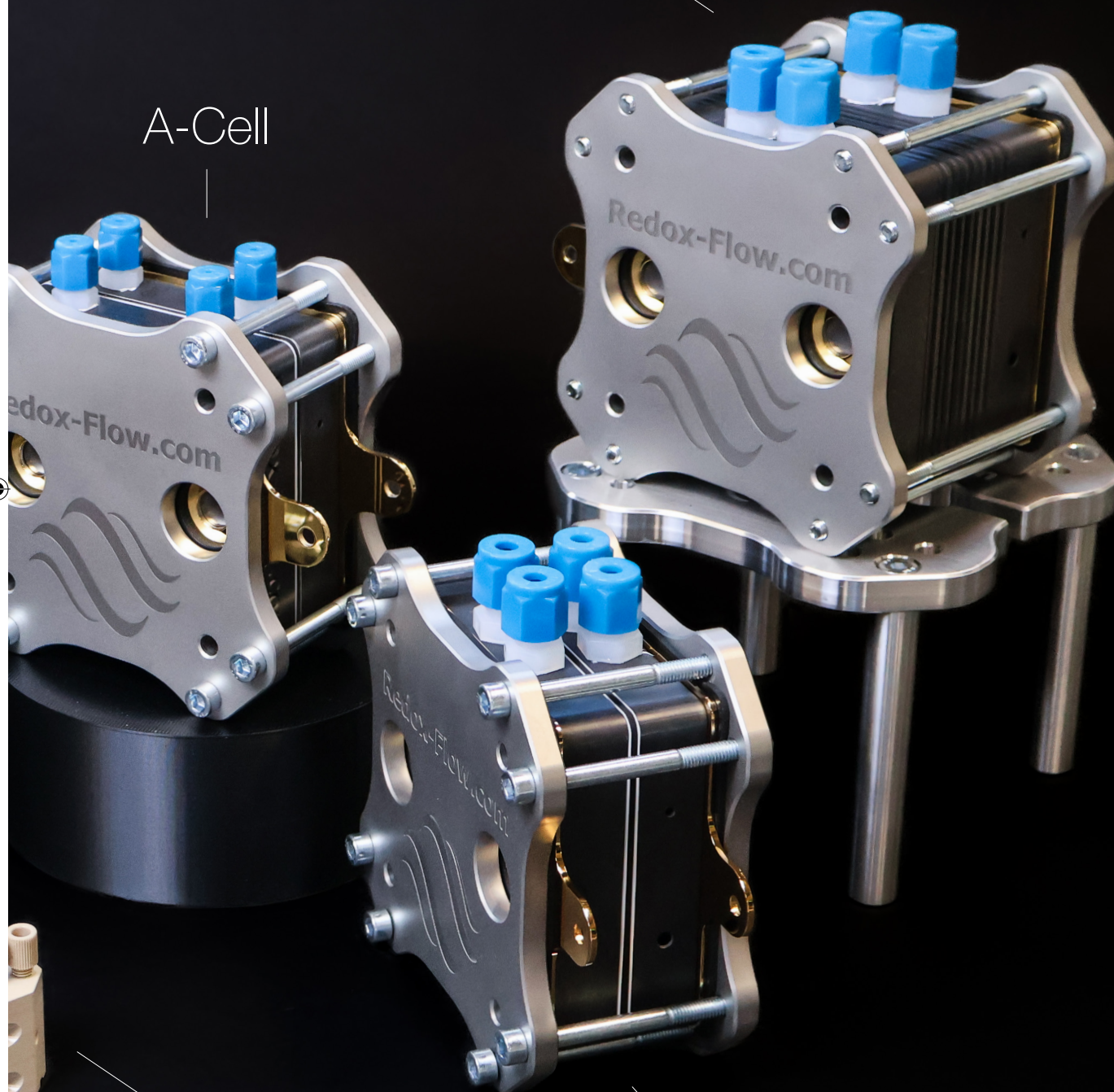
X-Stack

X-Cell

X-Cell with extra ports

S-Stack

A-Cell



M-Cell

S-Cell



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Any questions?
We're happy to hear from you.



MIKKEL KONGSFELT

CEO, HEAD OF SALES

+45 31 26 20 40

SALES@REDOX-FLOW.COM

WWW.REDOX-FLOW.COM



Redox Flow
Stokagervej 6H
8240 Risskov
Denmark
CVR/VAT: DK40042350