



OPEN TECH FORUM

# Improve Your Battery Design & Production Process

Here's a look at innovative companies with solutions that can improve critical aspects of battery design and production.



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## INTRODUCTION

# Improve Your Battery Design & Production Process

Here's a look at innovative companies with solutions that can improve critical aspects of battery design and production

By Michael Anderson, Editor-in-Chief, Battery Technology

When it comes to the design and manufacturing of batteries, the stakes are incredibly high as global players from China to South America vie for a share of a growing market expected to be worth almost \$424 billion by 2030. Governments are competing for supply-chain resources while research in alternative chemistries, designs and production technology accelerates at breakneck speed.

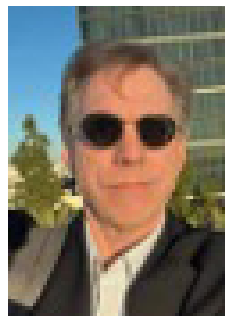
In this competition, followers and investors in the battery industry are constantly bombarded with updates about supply-chain issues, material acquisition challenges, the jostling of the industry's leaders for advantage, and the impacts of government and industry decisions around the world. It can be a lot for an individual battery company to keep track of while trying to improve its products and business.

In such an active news environment, it's not always easy to keep track of the many new technologies that can aid one's design and production development. (Example: As of this August, Battery Technology has published more than 175 articles on battery design and manufacturing this year alone.) The devil is in the details, they say: In the vast realm of battery technology, what are the developments that may specifically help your company?

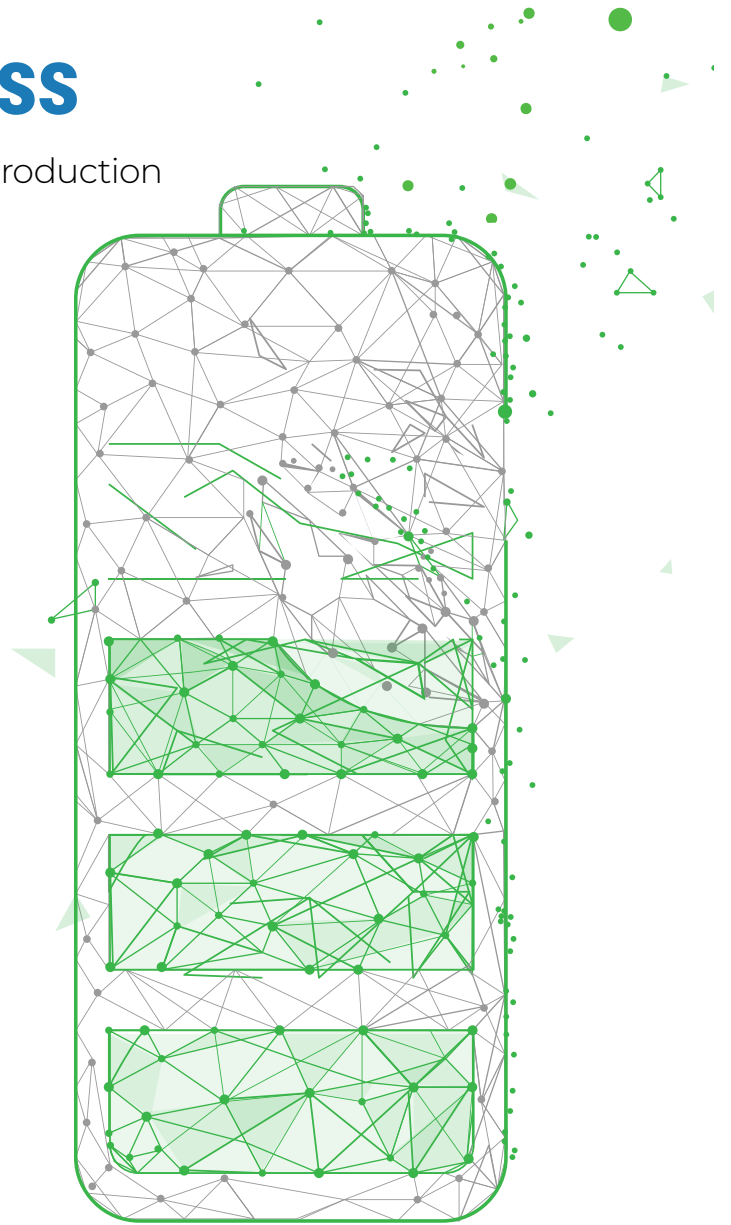
What follows may help: In these pages are details of a core group of technology solutions, each focused on aiding a different singular facet of the design and production process. They are presented by companies that know the value of sharing knowledge and learning from other industry players: That's why each is an official sponsor of the 2024 Battery Show North America Open Tech Forum.

In these companies' offerings may be the specific solution your organization can use to maximize its own production—and earn a larger slice of that burgeoning, busy battery market.

Read on!



*Michael Anderson has been covering manufacturing and transportation technology developments for more than a quarter-century, with editor roles at Manufacturing Engineering, Cutting Tool Engineering, Automotive Design & Production, and Smart Manufacturing. Before all of that, he taught English and literature at colleges in Japan and Michigan.*



# Small to Medium Volume Cell Design Verification, Validation, and Battery Pack Manufacturing Systems

Every CPS system is built to the highest quality standards and supported by dedicated service, underpinning our uncompromising commitment to the pursuit of complete client satisfaction

*By Anwar Master, Manager, Business Management, Control and Power Systems*

At CPS, we are open to working with businesses of all sizes from verifying any battery cell technology manufacturing processes to cell manufacturing validation systems for certifications and manufacturing machinery for commercialization.

We believe that true leadership is about sharing knowledge and fostering innovation. As pioneers in the Process System and Automation industry, we are dedicated to advancing not only our capabilities but also empowering current and prospective customers through collaboration and insightful expertise.

Our leadership is our commitment to cell manufacturing, battery pack manufacturing, and recycling processes to:

- Assist with both traditional and innovative approaches to cell and pack manufacturing process systems.
- Work together with the customer to realize their final engineering, certification, and manufacturing timing.

- Stepping into new ideas, we can unlock new opportunities, drive innovation, and create lasting value.

We provide a range of resources,

- Dive deep into the latest industry trends and strategic insights and navigate the intended process.
- Interactive sessions led by our experts for your solutions, offering practical knowledge.
- We can take the best practices from many other market segments and generate a fail-safe system.
- Explore detailed analyses and real-world applications and how these are applied to your challenges. This included using the cell in pack manufacturing and even recycling processes.
- Sharing perspectives from industry leaders and innovators.

We invite you to explore our thought leadership resources. Follow us on social media and visit our website



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*Control and Power Systems Inc.*

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Contact Us

Reach out to learn more about our initiatives, capabilities, and how we can support your growth.

Reach out to me [anwar.master@c-p-s.com](mailto:anwar.master@c-p-s.com) or feel free to call +1 973 886 9663.

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# Winding Cores for the Battery Cell Industry

Sensitive films and foils require high-quality winding cores – a closer look cannot only save costs, but also improve processes

*By Kilian Kunert, Executive Vice President - General Management, Paul & Co GmbH & Co KG*

For the production of electrode foils, separator films, anode and cathode, winding cores are indispensable. These are currently mostly made of plastic, fiber-reinforced plastic or metal. Such cores are so expensive they have to be reused several times. All too often, however, they end up as waste after a few uses. As they are usually not recycled, disposal costs can be considerable. Isn't there a more cost-effective and sustainable solution?

There is a solution that fully meets the battery industry's high requirements for geometry and cleanroom suitability: surface-refined cores made from certified renewable or recycled cellulose fibers.

Available in various finishes and colors, they can even outperform plastic and metal cores that cost twice as much. Thanks to the fiber structure and manufacturing processes, they provide unbeatable running properties and better force traction. Moreover, they are lighter and thus easier to handle.

Cellulose-fiber cores can be produced in large quantities. Easy to recycle, they can even be an alternative for single-use application. Especially with long distances between the film/foil suppliers and cell production, the return of cores is quite expensive. For multi-use, the cores have to be packed, unpacked, inspected, sorted and cleaned. Single-

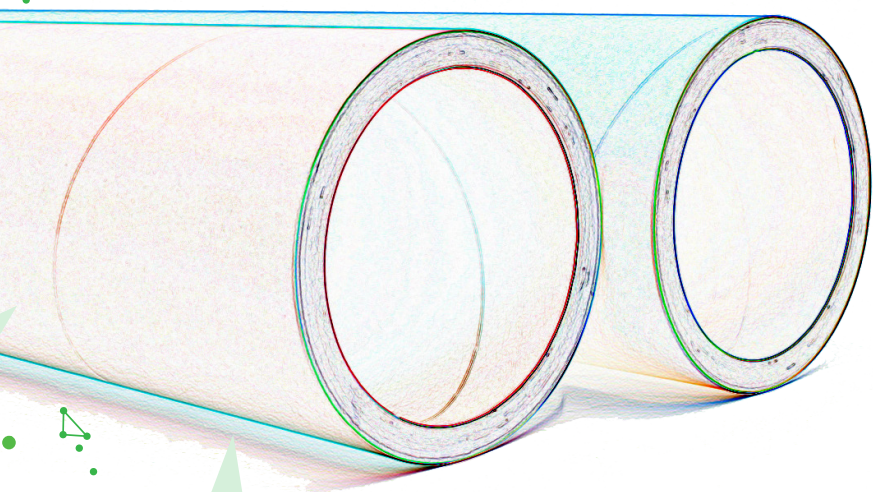


*Paul & Co GmbH & Co KG*

**Cellulose-fiber cores, especially developed for the battery cell industry.**

use cellulose fiber cores eliminate these difficult-to-calculate costs. The same applies to short-length cores in cell assembly. Instead of cleaning thousands of cores a day, single-use cores can be the most cost-effective solution.

The right winding core is essential for smooth operation and thus should be discussed at an early stage with machine suppliers and process engineers.



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# Thermal Management in Batteries

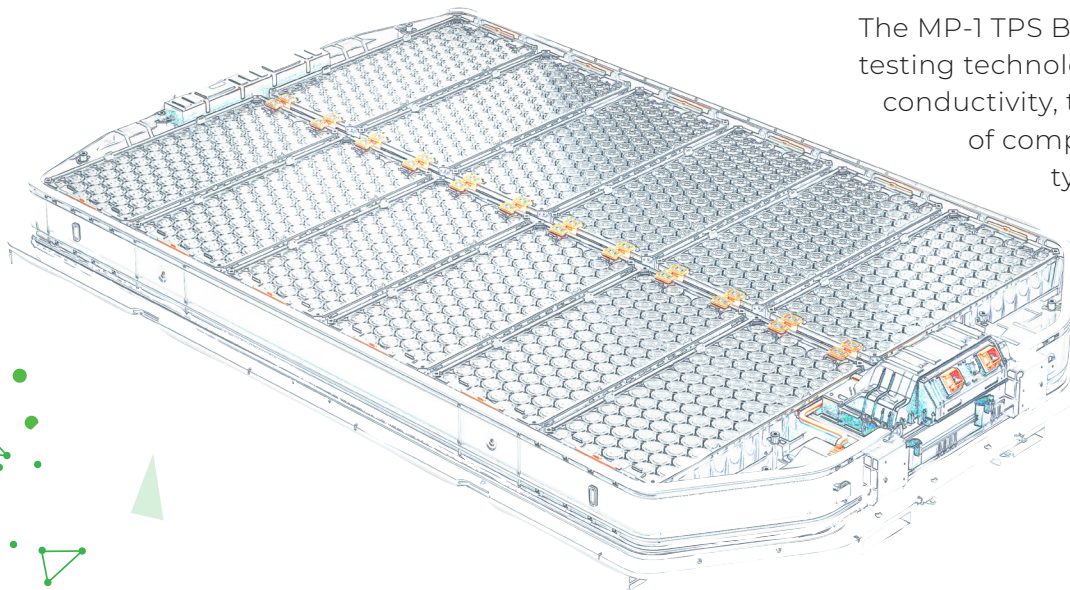
Measuring components and systems for improved understanding of thermal management in batteries

By Dale Hume, President and CEO, Thermtest Inc

With higher performance demands on batteries, a deeper understanding of how they manage heat is critical to efficiency and safety. For common applications, thermal performance of components and cells can be taken from specification sheets and reference sources for use in thermal simulations for a basic understanding.

For higher demand applications, errors associated with available references are not suitable for thermal simulations. Direct measurements of thermal conductivity, thermal diffusivity and specific heat of battery components and cells improve reliability in thermal simulations, improving accuracy and confidence.

The MP-1 TPS Battery Package combines unique testing technology to measure directional thermal conductivity, thermal diffusivity and specific heat of components and cells for pouch and cylinder type batteries. Cell components (like foils and separators) can be measured to optimize cell design and construction, while battery systems as a whole can be measured for design and evaluation of the thermal life, performance and safety.



Measuring components and systems for improved understanding of thermal management in batteries

These advanced measurements are possible with Thermtest's MP-1, which combines technology and intelligence for a unique testing experience while providing highly accurate results.

For more information on testing batteries, [contact us](#).

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# What Will the Next Generation eDrive Look Like?

The future of eDrive: High-speed, High-efficiency, Safe, and Smart

By James Ma, CTO, SF Motors, Inc.



**James Ma,**  
CTO of SF Motors, Inc.

High-speed capabilities are being significantly enhanced through advanced design, manufacturing techniques, and state-of-the-art cooling systems that manage thermal loads more effectively. Efficiency improvements stem from innovative motor, gear transmission, and inverter designs, alongside sophisticated motor control algorithms. Specifically, the adoption of silicon carbide (SiC) semiconductors and advanced power module packaging technologies

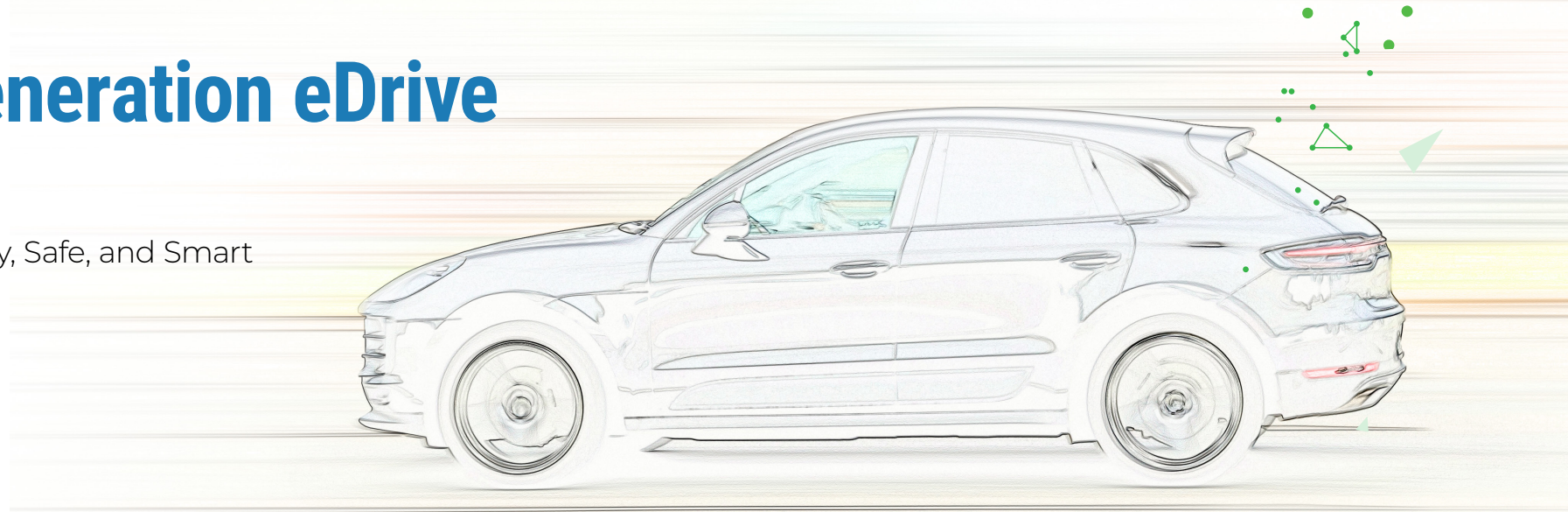
The next generation of eDrives is set to transform the electric vehicle (EV) industry with groundbreaking advancements in high-speed capabilities, efficiency, safety, and smart technologies.

enables faster switching speeds, better thermal management, and consequently, superior performance and longer range.

Safety is a critical focus, with efforts concentrated on developing advanced motors and inverters. More advanced control strategies and robust algorithms are essential for enhancing the synergy between motors and power electronics, improving system efficiency and safety. Smart technologies play a pivotal role, with IoT connectivity facilitating real-time monitoring and predictive maintenance. Advanced sensors provide detailed insights into motor

operations, while AI and machine learning algorithms analyze motor data to dynamically optimize performance.

These technological advancements promise to push the boundaries of electric motor capabilities, driving the industry toward greater performance, reliability, and sustainability. The integration of AI and IoT not only enhances operational efficiency but also contributes to predictive diagnostics, minimizing downtime and maintenance costs. The next generation of eDrives represents a significant leap forward, heralding a new era of high-performance, safe, and intelligent electric vehicles that cater to the growing demands of modern transportation and sustainability goals.



# Tektrasil: An Innovative Silicone for Thermal Runaway Prevention

Addressing the need for safety and performance in battery system sealing materials

By Geoff Valeriote, Vice-President, Marketing & Sales, Poly-Nova Technologies Corporation

In the ever-evolving landscape of electric vehicles, the demand for a multi-functional silicone material that combines exceptional sealing performance with extreme temperature resistance has become paramount.

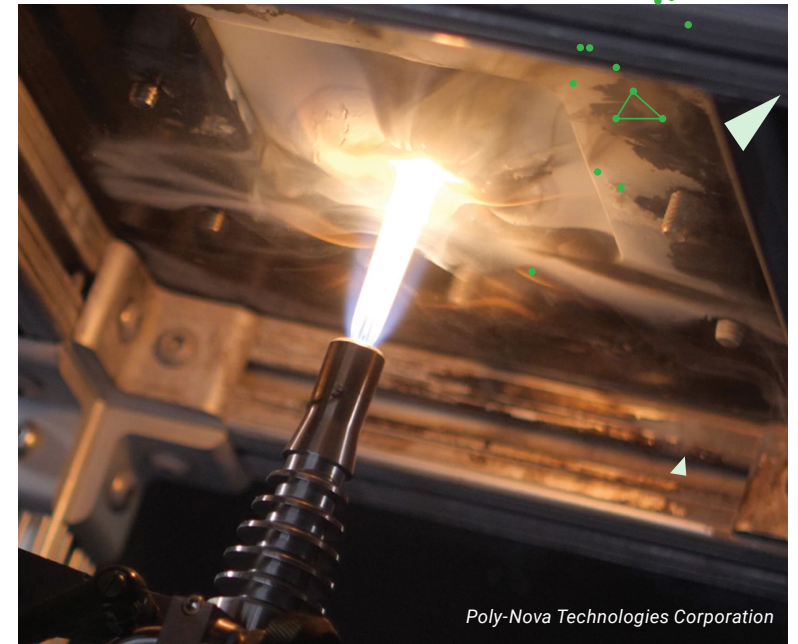
Recognizing this, Poly-Nova Technologies developed Tektrasil, an advanced silicone material that combines excellent sealing properties with unmatched flame and heat resistance, serving as a vital safeguard against catastrophic

thermal events. It has been rigorously tested, including UL 2596 and proven capable of withstanding temperatures up to 1,400°C for over 30 minutes without burn-through.

By integrating Tektrasil into their EV applications, Engineers can offer a comprehensive sealing solution that safeguards against both thermal runaway events and environmental hazards, ensuring a safer and more reliable solution vs. traditional sealing materials.

**Extended Flame Exposure:** Tektrasil offers an extended safety window for thermal event mitigation and effective containment of potential battery fires by withstanding over 30 minutes of 1,400°C flame exposure.

**Enhanced Safety:** By preventing the spread of fire within lithium-ion battery modules, Tektrasil significantly reduces the risk of catastrophic incidents. This safeguard provides passengers with an extended timeframe to exit the vehicle during a thermal propagation event.



Poly-Nova Technologies Corporation

**Tektrasil under 1,400°C flame test.**

**Superior Lifetime Performance:** Tektrasil maintains excellent sealing properties throughout the extended operational lifespan of EV's. This ensures long-term sealing reliability and protection of critical components.

**Versatile Applications and Manufacturing:** Tektrasil can be molded, extruded, and calendared into various custom shapes and geometries. This manufacturing versatility enables engineers to expand the range of potential applications when designing sealing and fire protection solutions for electric vehicles.



# Model-Based Design - why don't we use it?

Model-based design is used heavily throughout structural design, aerodynamics and manufacturing - why not then for batteries?

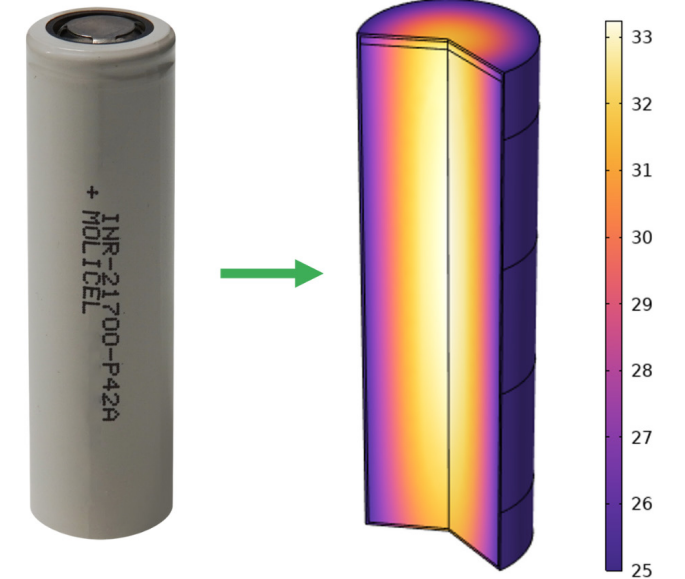
By Dr. Gavin White, About:Energy Limited

Battery manufacturers often provide sparse and complex data, making it difficult to interpret and utilise effectively during various stages of battery development, such as cell selection, pack design, and battery management systems. This lack of detailed and accessible information poses significant challenges for companies striving to build the most efficient and reliable products.

To successfully engineer a high-performance product, comprehensive data on electrical performance, heat generation, battery degradation, and more is essential. However, acquiring this data is a time-consuming process, often taking months or even years. Compounding the issue is the fact that much of this effort is duplicated across the industry, with multiple companies conducting similar tests on comparable cells.

In this context, model-based design becomes increasingly critical. By leveraging advanced simulation and modelling techniques, companies can significantly accelerate the development of new products. Model-based design allows engineers to predict battery behaviour under various conditions, reducing the need for extensive physical testing and enabling quicker optimisation of battery systems.

However, the challenge remains: without robust and comprehensive data from the outset, even the most



About:Energy Limited 2024

Model-based design with high-performance batteries such as Molicel P45B.

sophisticated models can fall short. Therefore, the industry must push for greater transparency and standardisation in battery data to unlock the full potential of model-based design, ultimately leading to faster innovation and improved battery performance across the board.

# Internet of Packaging: A boost for batteries

Enhancing supply chain visibility for the battery technology industry with IoP

By John Dwyer, Sr Director Business Development, Smurfit Westrock

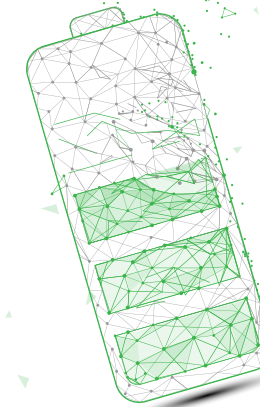
The Internet of Packaging (IoP) is enabled by applying smart technologies like labels, tags and sensors to packaging materials to create a network of connected objects that can communicate with each other and with external systems. It can also provide near real-time data on the location, condition, quality, and authenticity of products throughout the supply chain, from production to consumption.

The battery technology industry faces increasing challenges in terms of safety, sustainability, and efficiency. Batteries are essential for the operation of various devices and vehicles, but they also pose risks of fire, explosion, or leakage if they are damaged, misused or counterfeit.

IoP solutions can help the battery industry overcome these challenges by enhancing the visibility and traceability of packaged battery products throughout the

supply chain. For example, smart labels or tags can store information on the origin, specifications, and expiration date of batteries. They can also monitor conditions such as temperature, humidity, pressure and shock during transportation and storage. This can alert for damage, discourage counterfeiting or tampering, and provide data to help validate that the batteries meet the quality and safety standards of different markets.

The IoP is not only an innovation, it's a strategic opportunity for the battery industry to improve performance, reputation, and competitiveness. By adopting the IoP, battery manufacturers, distributors, and users can gain more insight, control, and value from their products, and contribute to a more sustainable and circular economy. [Click here](#) to learn more about the benefits of IoP.



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Precision. Crafted. Metal.

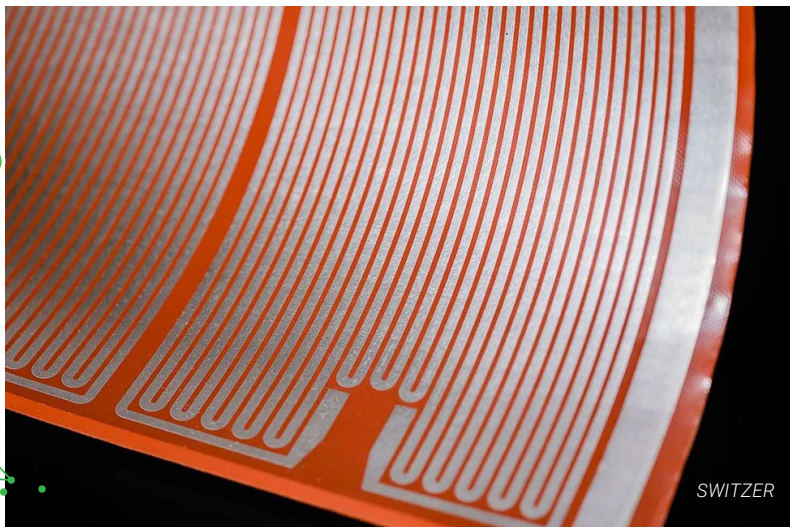
# Flexible Heaters, Flow Field & Cooling Plates for Thermal Management

Your product development and production partner for multiple thermal management component applications

By Bernie Switzer, President & CEO, SWITZER

## Flow Field & Cooling Plates

When compared to stamping, laser cutting, or CNC machining, photochemical machining technology provides efficiencies and capabilities to best fit your custom technology requirements.



*Custom flow field channel designs and configurations*

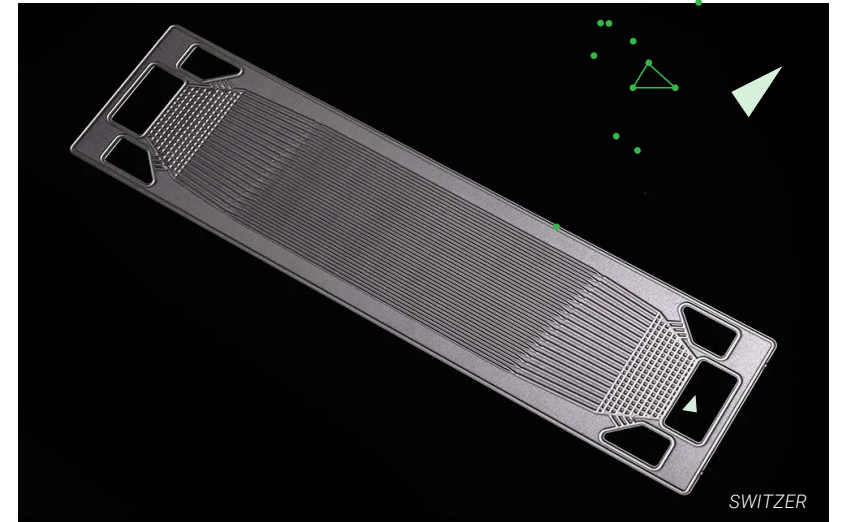
- Channels on one side of the plate
- Symmetrical channels on both sides of the plate
- Asymmetrical channels on both sides of the plate
- Channel surfaces within the US DOE's roughness standards
- Tight channel radiuses
- More land available for adherence to other components
- Straighter side walls
- Rounded channel bottoms

## Flexible Heater

Switzer's process for etching foil heating elements for flexible heaters enables better temperature control, while also meeting both dimensional and resistance requirements.

*Customization for Even Heat Distribution*

Though etched foil heating elements require wider widths to achieve the equivalent resistance and wattage of wire, they



Flow Field & Cooling Plate

allow a tighter patterning of elements. Traces in etched foil heating can be as close to each other as 0.004", which results in a more even heat distribution.

A wire wound element only transfers heat through a tightly spiraled coil, but an etched foil heating element offers a greater surface area. This allows them to run cooler and last longer with the same power.

## Our Process

- Low-cost tooling
- Rapid Prototyping
- Scales seamlessly up through high volume production

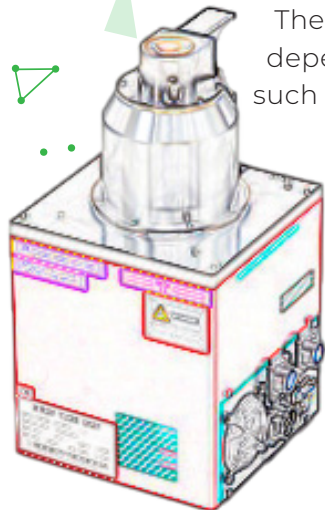
# X-ray Non-destructive Products for Battery Inspection

Microfocus x-ray source tubes and high-speed, high-resolution detectors for in-line and off-line battery inspection

By Andrew Fay, Product Manager, Hamamatsu Corporation

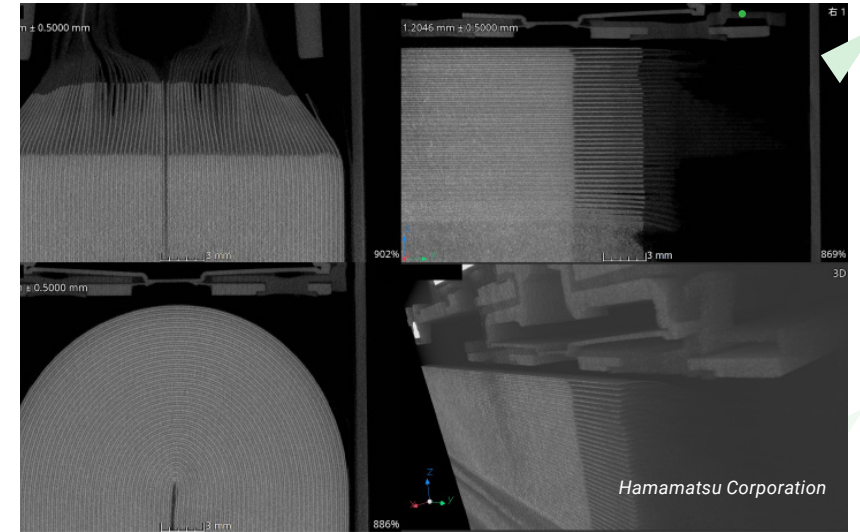
In recent years, the demand for lithium-ion batteries (LiB) has been increasing due to the rapid spread of HVs, PHEVs, and BEVs against the backdrop of environmental concerns and the strive towards carbon neutrality. With this growth the automotive industry is investing to improve the safety and quality of LiBs by conducting inspections of the finished products, the raw materials and throughout the manufacturing process.

There are several types of LiBs, depending on their constituent parts such as electrodes and their shapes. Since the optimal inspection method differs for each type,



the choice of inspection method is important for quality control. For example, the three most common battery shapes are “cylindrical”, “square”, and “pouch”. The internal x-ray inspection method differs depending on the internal electrode structure (stacked or wound). The X-ray source and detector are selected depending on battery structure and whether in-line or off-line inspection is needed. High-resolution x-ray TDI-line scan detectors and microfocus x-ray sources combine to meet the speed and detectability for in-line production scanning.

As the causes of LiB failures gradually become clearer, there is a growing demand to inspect more complex structures and find very minute defects. Currently,



Imaging example of In-line CT inspection

3D images are required for off-line and spot-check inspections, however in some cases 3D images might be needed for in-line inspection as well. Importantly, microfocus x-ray sources bridge the needed focal-spot resolution requirements of both off-line and in-line battery inspection. High-speed X-ray flat panel detectors are also needed for obtaining high-definition X-ray CT images.

For more information, please [visit us online](#).

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# About SPX Cooling Tech, LLC

Cooling Tower Performance

By SPX Cooling Tech, LLC Staff

SPX Cooling Tech, LLC has a proven track record as a cooling solutions partner to the battery industry. It is a leading global manufacturer of cooling towers, evaporative fluid coolers, air-cooled heat exchangers, evaporative condensers and industrial evaporators from brands that include Marley®, Recold® and SGS Refrigeration. Its range of cooling systems and components, coupled with technical services, support power generation, industrial process, refrigeration, and heating, ventilation and air conditioning (HVAC) applications. SPX Cooling Tech and its product brands are part of SPX Technologies, Inc. For more information, [visit us online](#).



The Marley NC Class Crossflow Cooling Tower