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Solid-state batteries

Solid-state battery technology innovation

BTRY's solid state battery technology and its potential in and energy storage for electric vehicles

Pam Poulin, Market Development Manager at Thermo Fisher Scientific, and **Dr. Julian Renpenning** conducted this interview with Mortitz Futscher, CEO and Co-founder of BTRY AG.

BTRY introduction

BTRY is an innovative Swiss start-up based in Dübendorf, Switzerland, that's reshaping the energy storage technology. As a spin-off from EMPA and ETH Zurich, BTRY is developing a next-generation solid-state battery technology that promises to be sustainable, customizable, and incredibly fast-charging. The company was founded by Dr. Moritz Futscher, the CEO, a physicist passionate about advancing energy storage solutions, and Dr. Abdessalem Aribia, the CTO, a chemist with extensive experience in developing new materials for battery applications. Together, they are leading BTRY's vision to create energy-dense solid-state batteries using advanced semiconductor manufacturing methods. In this interview, we had the privilege of speaking with Dr. Moritz Futscher about BTRY's unique approach of stacking thin-film solid-state battery cells to enable fast charging, high-energy storage, and customizable battery characteristics.

Tell us the story behind the founding of BTRY and its connection to EMPA and ETH Zurich?

The founding of BTRY is closely linked to both EMPA and ETH Zurich. All of our founders worked together in the same laboratory at EMPA, which is a research institute affiliated with ETH. One of our co-founders recently completed his Ph.D. at ETH Zurich.

There has been over a decade of research and development at this laboratory, specifically the thin-film battery group ofs the laboratory for thin-films and photovoltaics, focused on thin-layer batteries, with a special focus on new materials. Over time, we observed the excellent performance of these batteries in the laboratory, and we noticed growing interest from industry. The combination of these factors led to our decision to start the exciting journey of creating a startup.

In your own words, what is BTRY all about? What drives you?

BTRY is about commercializing a sustainable, reliable, one-minute rechargeable lithium-ion solid-state battery. Our key differentiator is our manufacturing process, which comes from the semiconductor industry, an area where Europe has historically been strong. What drives me is the potential impact of our technology, both in terms of sustainability and taking our innovation from the lab to the market, enabling new applications. In addition, the opportunity to build a company from the ground up is very motivating. It allows us to build the right values and team culture for sustainable growth from the beginning.

We arecurious about your solid-state battery technology. Can you explain the method of stacking thin-film cells and how it improves energy storage and charging time?

Thin-film batteries have been around since the 1980's. They are really robust and have exceptional cycle life and fast charging speeds. However, they typically have low-energy density because they are only a fraction of a hair thick and are often placed on a thick substrate. Our innovation is to stack several of these thin-film cells on a thin substrate. This method allows us to retain the unique properties of thin-film batteries while increasing the energy density to match that of other Li-ion battery technologies.

What are the key advantages of your solid-state batteries compared to traditional lithium batteries?

Our batteries, like all solid-state batteries, offer improved safety over traditional lithium-ion batteries due to the absence of flammable organic liquid electrolytes. The key difference in our batteries is that our layers are much thinner, allowing for faster charging and high-power applications, as well as extended temperature stability, both below freezing and above boiling. In addition, thin-film batteries have demonstrated ten times the cycle life of today's batteries.

Your battery cell manufacturing process involves vacuum technology. How does it work and why is it more sustainable?

Our battery manufacturing process relies on vacuum technology from the semiconductor industry. These processes are highly scalable and are used, for example, in the coating of glass windows. In terms of sustainability, there are two main factors. First, we do not need any liquid solvents during fabrication, which are often toxic and require high energy for recycling. Second, the primary energy input we need during fabrication is electricity (in contrast to heat), which can be sustainably produced from renewables.

What are the primary applications for BTRY's solid state batteries? Are there specific industries or applications where they're making a big difference?

Absolutely. Our battery cells can improve devices ranging from robots and drones to medical implants by reducing downtime and enabling new applications that require high energy density or operation over a wide temperature range. Initially, we are focusing on IoT applications such as edge computing, where our solid-state batteries meet capacity requirements, provide high-power pulses and offer increased temperature stability. In the long term, we aim to bring our fast-charging batteries to consumer electronics, reducing the need for frequent recharging.

How flexible are you in terms of size, energy capacity, and other features? Can you customize your batteries for different needs?

Absolutely, our batteries are highly customizable. We can adjust both the shape and power characteristics to suit different needs. If a customer needs high power, we can tune for that. If they need high capacity instead, we can do that too. The great thing is, we can make these adjustments even using the same production equipment. Looking ahead, we're planning for our battery production lines to be versatile enough to produce a variety of cell types, all tailored to what our customers need. It's all about flexibility and meeting specific requirements.

Let's talk about sustainability. How does your solvent-free battery manufacturing help the environment?

Our vacuum-based manufacturing process offers significant environmental advantages over traditional manufacturing. Typically, battery manufacturing relies on solvents that are classified as Substances of Very High Concern. These solvents pose potential reproductive health risks and can be harmful to unborn children. In addition, the process of evaporating and recovering these solvents is one of the most energy-intensive steps in battery manufacturing, significantly increasing the overall environmental footprint.

By eliminating the need for these solvents, our process does two important things. First, it reduces the health risks associated with exposure to these substances. Second, it significantly reduces energy consumption during manufacturing. This approach makes our manufacturing process not only safer, but also more environmentally friendly.

Beyond the manufacturing process, what other steps are you taking to keep your production process energy-efficient and eco-friendly?

For economical and ecological reasons, we are continuously improving our production processes to be as energy efficient as possible. One key initiative we are exploring is renewable Power Purchase Agreements (PPAs) to procure our electricity from low-carbon sources, such as wind and solar power.

As an added benefit, our manufacturing process is extremely material efficient. It generates minimal waste, and any waste that is produced is easily recyclable because the raw materials remain dry and separated throughout the process. This allows us to effectively recycle materials, further reducing our environmental impact.

Finally, one of the most important aspects for us is the long life of our batteries. They can withstand up to 10 times more charge cycles than traditional batteries, which means they last much longer. This extended lifespan dramatically reduces the environmental footprint by reducing the frequency of battery replacement and the associated manufacturing and disposal impacts.

Your team has a strong background in physics and chemistry. How does this expertise drive innovation at BTRY?

Abdessalem and I are material scientists trained in both chemistry and physics. At Empa, we have worked on all parts of the battery - cathode, anode and solid separator - to develop new and improved materials for battery applications. This expertise drives our scale-up process. We focus on adapting materials to use standard semiconductor industry equipment, rather than developing new machines. This approach allows us to produce on industrial-scale equipment and enables rapid growth.

How do you work with industry partners and other battery research institutions to advance the technology you are developing?

We have an ongoing partnership with Empa, financially supported through personal grants and funding from the Gebert Rüf Foundation. This collaboration allows us to work closely with the research group and use world-class equipment for battery fabrication and characterization. On the industry side, we've made some good progress too. We have entered into a joint development with a equipment manufacturer to further scale up our production. So between our academic connections and our industry partnerships, we're advancing our technology on multiple fronts.

Looking ahead, what do you see as the biggest hurdles in developing and commercializing your solid-state batteries?

One of our main challenges is that vacuum technology is known to be expensive. We are working to demonstrate how it can be scaled cost-effectively, and we're planning to establish pilot production within the next two years. Additionally, we are focusing on finding the right partners who need our batteries for their products. We are taking a customer-centric approach here, where we want to develop directly to customer needs and use our pilot line to produce batteries at scale for a customer.

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