Battery research

Fraunhofer FFB's battery innovation hub—bridging research and industry

Exploring the future of batteries in Europe

Pam Poulin, Market Development Manger at Thermo Fisher Scientific, and **Dr. Julian Renpenning** conducted this interview with **Dr. Kristina Borzutzki**, Group Leader of Process Engineering at Fraunhofer FFB.

Fraunhofer FFB introduction

The Fraunhofer Research Institution for Battery Cell Production FFB (Fraunhofer FFB), located in Münster, Germany, is dedicated to the advancement of battery cell manufacturing technologies. The facility, which aims to establish Germany and Europe as leaders in battery cell technology, has received substantial funding from the German federal government and the state of North Rhine-Westphalia. Working with the Fraunhofer-Gesellschaft, RWTH Aachen University, the University of Münster, and the Forschungszentrum Jülich, the Fraunhofer FFB will help bridge the gap between research and large-scale production. In this interview, we had the privilege of speaking with Dr. Kristina Borzutzki, group leader for process engineering, about the new Fraunhofer battery research factory and her role in the advancement of battery technology.

Tell us about the Fraunhofer Research Institute for Battery Cell Production FFB and the role it plays in German battery research?

The Fraunhofer FFB is a new but important player in the German battery technology landscape. We are essentially a bridge between laboratory research and industrial production. Our main goal is to take promising new materials and processes that show potential in the lab and figure out how to scale them up for large-scale industrial production. This includes work across multiple domains, from advanced technology development and process optimization to certification processes.

Our scope includes novel materials research, innovative metrology techniques and advances in cell design. We also focus on sustainability initiatives, flexible cell architecture tailored to customer specifications or application requirements, and improving overall cell performance metrics. In short, we are helping to accelerate Germany's capabilities in battery technology and sustainable energy storage solutions.

Fraunhofer recently inaugurated its new "FFB PreFab" open battery cell factory in Münster. What is the significance of this factory?

The "FFB PreFab" serves as a key incubator for innovative approaches to battery manufacturing. We are talking about a 6,450-square-meter facility packed with the latest European machinery. But what really makes it special is its role as an open battery cell factory for research and development. This place is an enabler for new technologies. We can test innovative processes, experiment with equipment design and work with new materials. This approach also creates opportunities for new companies to enter the battery industry, particularly equipment manufacturers looking to expand into battery production.

We can do pilot-scale production testing, which is critical to scaling up new ideas. There is space for focused research and development, and we provide industrial consulting to help companies navigate this complex field. We are also running training courses to build expertise in the industry. Overall, the "FFB PreFab" is a major step forward in battery research.

Can you explain how your work bridges the gap between laboratory research and industrial production?

Our focus is what we call "scaling research," which is a bit different from what you might see in other research institutions. Essentially, our role is to bridge the gap between laboratory innovation and practical industrial implementation. We evaluate the feasibility and scalability of promising concepts as they move from controlled experimental settings to full-scale production environments. We have got the facilities and infrastructure that allow us to recreate or reproduce industrial conditions. This means we can spot potential issues or challenges that might only show up when you are trying to produce batteries at a much larger scale.

We have close partnerships with research institutions and industry players. Our goal is to provide actionable insights and recommendations for our partners and the industry. We are looking at how to take promising research and turn it into something that can be commercially viable. Our goal is to accelerate the transition from conceptual research or scientific innovation to commercial product realization, effectively optimizing the research-to-market pipeline.

Europe's battery production needs are growing rapidly. How is the Fraunhofer FFB helping to meet this demand?

We approach this challenge from several angles. The battery market is growing, so we are working hard to support this growth. One of our key strategies is to help new players enter the market. We are talking about companies that aren't traditionally associated with battery production—machine manufacturers, material suppliers, sensor manufacturers, you name it. We are giving them the support and knowledge they need to get involved in this expanding market and industry.

Unfortunately, there is a real shortage of skilled workers in battery manufacturing, not just in Germany but across Europe. We are addressing this gap. We have developed a wide range of battery-specific training programs. These aren't just theoretical—we are talking hands-on experience in our production facilities. Our trainees get to work with real equipment and deal with real challenges.

This dual approach—helping new companies enter the market and training the workforce they will need—is our way of supporting the growth of battery production in Europe, but also preparing for the future of this rapidly evolving industry.

Tell us about your role at Fraunhofer FFB and the new junior research group you are heading?

My main role at Fraunhofer FFB is as a group manager in process engineering. Essentially, within our group I am working on optimizing all the processes along the battery production chain. But it is important to emphasize that we all work in a multidisciplinary framework. We interface with various departments and teams. This collaborative structure includes manufacturing operations, quality assurance, cell design, materials research, sustainability management, digitalization and technology management. Through this integrated approach, we drive key initiatives and perform comprehensive analysis and optimization of both processes and products.

We have just secured funding from the BMBF (the German Federal Ministry of Education and Research) for a new junior research group. This is a big deal for me professionally because it allows me to work more independently and dive deeper into some specific areas. The focus of this project is on innovations within electrode production. The electrodes are crucial components—it's where the actual energy storage happens. So, any improvements we can make here could have significant impacts on battery performance and production efficiency.

What are the key areas of the battery value chain or battery sector that your research group will focus on?

Our group is primarily focused on innovations in electrode production. We are working towards more sustainable production methods, aiming to reduce toxic compounds and energy demands. This isn't just about making better batteries, but also about making them in a more environmentally friendly way.

Much of our work involves understanding the relationships between processes and products. To gain deeper insights, we look at the phenomena that occur during production. This knowledge isn't just useful for current processes—it enables us to quickly optimize production for future materials, such as sodium-based batteries, or new compositions as battery formulations evolve.

How is the Fraunhofer FFB addressing sustainability and environmental concerns in battery production?

We focus on collaborative recycling initiatives with partners to ensure the efficient reuse of materials. To guarantee that battery materials are effectively recycled, we are actively researching and developing innovative recycling methods. In addition, we prioritize sustainable manufacturing practices, which include minimizing waste and reducing resource consumption. Furthermore, we are investing in research on green energy solutions to power our facilities, aiming to reduce our environmental impact. Our scientists are also working on developing more sustainable cell chemistries.

Are there specific battery chemistries or materials you are focusing on? What is the reasoning behind these choices?

We are currently focused on lithium-ion batteries, specifically those that use graphite- or silicon-based anodes paired with LFP (lithium iron phosphate) or NMC (nickel manganese cobalt) cathodes. These are the workhorses of today's battery industry, powering everything from smartphones to electric vehicles. We are focusing on these materials because they are the most commercially relevant right now. By improving their production processes, we can have an immediate impact on the efficiency and sustainability of the battery industry.

Looking ahead, we are also preparing to work with sodium-ion (Na-ion) systems. These are promising alternatives to lithium-ion batteries, potentially offering lower costs and using more abundant materials. While they are not yet commercially dominant, we believe they could play a significant role in the future of energy storage.

What unique infrastructure does the Fraunhofer FFB provide, and how does it facilitate research and development?

Our "FFB PreFab" facility has some really exciting features, especially our innovation modules. These are dedicated spaces that partners can rent to install their own machines. It's a unique facility that allows companies to test their technologies in the context of a complete production chain. It gives our partners a real-world environment to evaluate their innovations without the massive investment of building their own full-scale facilities.

Looking ahead, our upcoming "FFB Fab" building will take things even further. It will have the capacity for a full range of cell formats and for the production of cells at different scales. This flexibility is critical because it will allow us to mimic different levels of production scale-up. We will basically have the infrastructure to replicate everything from small prototypes to full industrial production.

Who are the main partners and collaborators working with the Fraunhofer FFB?

We have a diverse network of partners in both academia and industry. On the research side, we collaborate with various institutions throughout Germany and Europe. This academic connection keeps us at the forefront of battery science and helps us bridge the gap between basic research and practical applications.

Our industry partnerships are even more diverse and international. We work with:

- OEMs (Original Equipment Manufacturers)
- Material suppliers
- System and device manufacturers
- Sensor manufacturers
- Software companies

Each partner brings unique expertise, whether it's in materials science, manufacturing processes, quality control, or data management. By bringing together this mix of academic institutions and industry players, we are creating a collaborative ecosystem. It allows us to look at challenges from multiple angles. It also accelerates the process of turning innovative ideas into practical, commercially viable solutions.

How do you envision the research and collaborations at Fraunhofer FFB contributing to future battery technology developments?

We are positioning ourselves as a critical link in the battery innovation chain. Our work, collaborations and projects are like pieces of a complex puzzle that, when put together, help to develop, scale and bring innovations to market. We see our role primarily as a facilitator and accelerator of innovation. By bridging the gap between lab-scale research and industrial production, we are helping to accelerate the process of turning promising ideas into marketable solutions.

What potential breakthroughs or advancements in battery technology do you foresee in the next 5-10 years?

It is difficult to predict specific breakthroughs because the path from innovation to industrial application is complex and time-consuming. What looks promising in the lab doesn't always translate to large-scale production due to unforeseen scaling challenges.

That said, we are seeing exciting developments in several areas, such as "New high-performance and sustainable cell chemistries" and "Resource-saving technologies". Many of these developments and innovations are in the pipeline, and some are even competing with each other. While it's hard to say which will become the new standard, we expect to see several of these advances in industrial operation within the next decade.

At Fraunhofer FFB we keep an open mind. We are working on goal is to be ready to support the innovations that prove to be the most viable on an industrial scale.

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