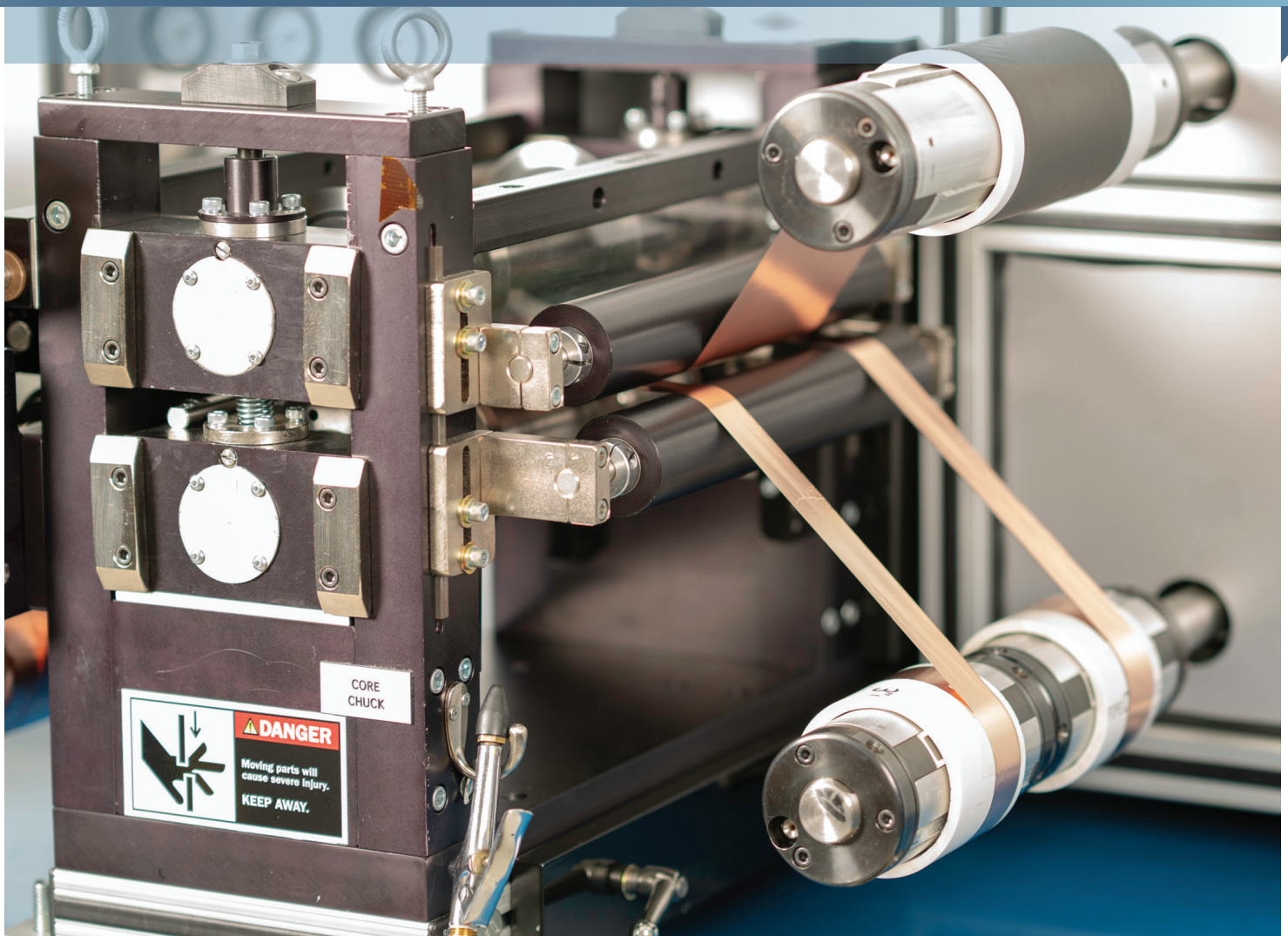


ELECTRODE MANUFACTURING EQUIPMENT HELPS THE BATTERY INNOVATION CENTER ACCELERATE THE PROMISE OF ENERGY STORAGE



TESTING ENVIRONMENT BRIDGES GAP BETWEEN R&D AND FULL COMMERCIALIZATION

The promise of energy storage is bookended by the continued development of the technology and the wide array of end-use applications.

From phones to electric vehicles to power tools, balancing product use with battery performance, all in the context of safe deployment, is the mission and vision of the Battery Innovation Center (BIC). Located in Newberry, Ind., about an hour southwest of Bloomington, the BIC is an R&D center of excellence focused on the rapid development, testing, and commercialization of safe, reliable, and lightweight energy storage systems.

The BIC has approximately 25,000-sq.-ft. dedicated to battery cell and pack development. From exploring just an idea to investigating a new material for a battery cell, manufacturing electrodes to testing a complex energy system, the facility is an open lab with deep capabilities.

"Work at the BIC is focused on R&D to full commercialization of battery technology in a broad range of applications," notes Ashley Gordon, cell fabrication project manager. "Some of the more popular include electric vehicles, cell phones with longer-lasting batteries, etc. But basically, it can involve any product application that is a good fit and can benefit from better battery technology."

The facility is designed to be highly flexible and IP secure, whereby every project is literally customized to the client's specific needs. The researchers work closely with clients on materials development, such as anode and cathode material, electrolyte, etc.

"The goal here is to determine both the viability of the material and the potential chemistry pairing for the other cell components," Gordon said. "From there, we assist with developing the manufacturing process from the lab environment to deploying at a full-scale manufacturing facility."

A critical part in bridging the gap from just an idea on paper to early scale-up steps in formulation development is an electrode manufacturing line. The lab-scale equipment includes equipment for slurry mixing, electrode coating and drying, calendaring (pressing), and slitting. The electrode coating and drying system was manufactured by Dürr Megtec, De Pere, Wis., which also sourced the mixing, calendaring and slitting equipment.

"As a new start-up, officials from the Battery Innovation Center were understandably concerned about making the right choice for process equipment," noted David Ventola, Business Development Director Engineered Products, Dürr Megtec. "They were aware the industry was strongest in Asia, which is why they were surprised to find lithium-ion machinery expertise in the US."

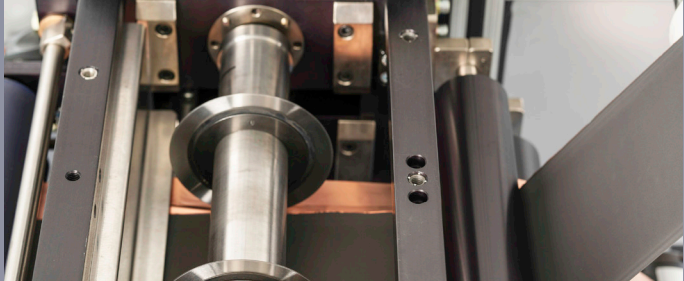
Dürr Megtec is an OEM. Its patented technologies have made it a global leader in providing engineering and manufacturing solutions that optimize advanced manufacturing methods.



» Mixing conditions and the related equipment have a strong impact on the electrode slurry.



» The BIC lab coater is easy-to-use and designed specifically for short production runs.



» *To ensure optimum battery performance, every step in the coating process must be tightly controlled.*



» *Dürr Megtec offers turnkey coating lines that are fully integrated.*

ADD ONE/Dürr Megtec—Battery Innovation Center Profile

"We've pioneered industrial web coating and drying processes for a broad variety of market sectors, including advanced battery electrode manufacturing," Ventola said. "As a turnkey OEM, Dürr Megtec engineering and R&D teams help pilot new technologies, optimize production processes, and minimize raw materials waste. We help customers effectively go to market, and that aligns with what the Battery Innovation Center is working to accomplish."

The Dürr Megtec lab coater at the BIC is designed specifically for short production runs. The coating line can produce coated electrodes up to 250-mm wide running at speeds up to 3 meters/minute. The line coats via comma bar and features a roll-support dryer system.

To help convince BIC officials of the contribution it could make to fulfilling their mission, Dürr Megtec gave BIC the chance to see its technology in use by providing access to its Development Center in De Pere, Wis., where it has a larger-scale pilot coating line. The in-house pilot coating line is available to test, develop and improve web-based processes without having to invest in full-scale production. BIC officials saw firsthand how Dürr Megtec process knowledge and equipment could help prepare electrodes for their research.

"Dürr Megtec engineers walked through a range of equipment solutions for producing lithium-ion battery electrodes, from R&D trialing to high-volume manufacturing," Ventola said. "We demonstrated how electrode coating lines are matched to specific production needs, from single-pass coating to a simultaneous two-sided coating tension-web system. Though smaller in scale, the BIC laboratory coating line captures key information for timely process design decisions."

There are a lot of variables in the development process for advanced battery electrode manufacturing, which is why customer feedback is so critical.

As Gordon notes, some do well with test results, but there are BIC customers that have unrealistic expectations. "We try to carefully not burst or shrink their bubble. But, we have to be mindful of the R&D process, the hope of commercialization, the scale-up process, and everything in between. It's about helping them clearly see what they can expect the outcome to be. This is all about managing R&D expectations."

Not only is there expectation on the development side, there is the added push of expectation from end-users. For consumer goods, the product simply must work as promised, without issue. For most consumers, that's top-of-mind. Beyond that, the rest is secondary.

"Aside from battery life between charging periods, consumers really don't think too much about the issues that might arise if a battery fails," Gordon said. "There have been multiple reports or examples of products bursting into flames. The resulting damage can be catastrophic depending on the environment."

"Unfortunately, the typical approach is 'All this is no big deal.' But, that's the wrong approach to take. BIC looks at battery performance from the standpoint of consumer safety, because if XYZ does happen, you need to be aware. It's about trying to make things more consistent, because once the development is confirmed, viability of the end-product is enhanced when there is manufacturing consistency. That's the key."

ADD TWO/Dürr Megtec—Battery Innovation Center Profile

The BIC and the Dürr Megtec Development Center are similar in what each is working to accomplish in finding the right chemistry and process for validating battery performance, then scaling up from there. The close working relationship between the BIC and Dürr Megtec fosters a creative/working environment where problems get solved.

"We have a lot of opportunity to collaborate," said William Kays, Dürr Megtec Senior Process Engineer. "The Battery Innovation Center is an open lab. We both start from the same premise, which is determining what technology and approaches are needed to derive the best results. For both of us, it's not an off-shelf-approach. We proactively exchange knowledge and engineering perspectives. Collaboratively solving problems and working towards a shared goal."

The Battery Innovation Center officially opened in August 2013. Since then, lithium-ion battery adoption has steadily expanded, and so has the affiliation with Dürr Megtec.

"As the market continues to grow, so has our relationship and the opportunity to bring innovation to fruition and commercial viability," Ventola said. "While we've been able to directly assist the Battery Innovation Center, they're providing input and materials to us as we develop new offerings for lithium-ion customers. We're bringing a tremendous amount of process knowledge together to influence the development of improved energy storage solutions."

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