A photograph of a modern industrial facility, likely a battery manufacturing plant. The scene shows large, white industrial machines with glass safety enclosures and yellow safety bars. The floor is highly reflective, showing bright reflections of the overhead lights. The overall atmosphere is clean and high-tech.

Nexceris Helps Metal-Air Battery Company Increase Production with Premium Electrode Materials

Nexceris collaborated with a developer of ground-breaking micro-grid and energy storage products to create high-quality, high-performance, cost-competitive battery electrode materials. The alliance has grown from an initial intensive research effort to full scale production to achieve a common goal of a robust materials production stream with diversified raw materials and process flexibility.

The client has developed an energy storage platform that stores and delivers energy on demand at a cost point that transforms how energy is distributed and consumed. Their technology improves energy security today with 4, 8, 12, 24 hour and longer back up power solutions for those impacted by weak and unreliable grid and has started to deliver 24-7 power, through remote microgrids, to some of the world's 1.2 billion people who remain without any form of electricity.

THE CHALLENGES:

Paving the Way for New Battery Chemistries Through Scaled Production

Metal-air batteries are widely accepted as the lowest cost way to store and discharge electrons. However, rechargeable metal-air batteries have not been commercially feasible until the client solved the problems historically constraining this attractive, low-cost battery technology.

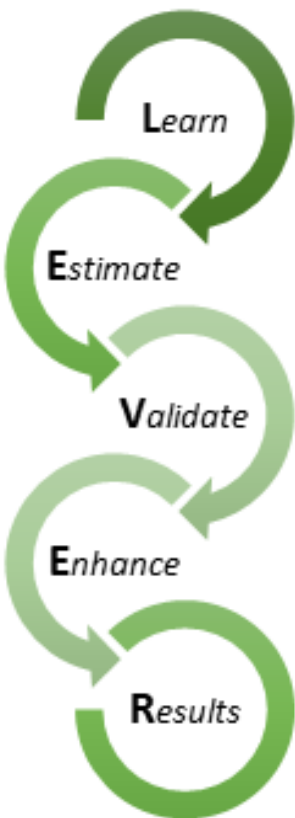
In pioneering a new technology, it was recognized that a robust supplier of premium electrode materials was key to consistent battery performance when scaling production. Surveying the field of potential partners, Nexceris was chosen based on its experience in oxide materials synthesis, its ISO 9001 certified operations, and its reputation as a reliable technology developer in the advanced energy market.

THE SOLUTION:

Using Nexceris' Proven Method to Optimize Resources and Accelerate Success

Nexceris used its LEVER (Figure 1) approach for the work completed on this project. The team identified the key customer needs, including discussions of the material crystallography, potential compositions and economic targets all took place before the first steps in the lab. Nexceris then tackled process scale-up by developing an experimental matrix that would produce the breadth of experimental discovery required while maintaining a cost-effective scale of production. Together, an ideal batch size was identified and production schedule for a range of materials for evaluation.

Over the course of an initial research effort, our teams **Learned** which electrode materials were best from physical characterization at Nexceris and in-cell performance testing. Together, we evaluated relative product performance and manufacturability and down-selected materials for scale-up.



Nexceris engineers leveraged their experience in synthesizing materials for the solid-oxide-fuel-cell market to provide high-fidelity **Estimates** of manufacturing costs and the best options for cost reductions in moving from laboratory to commercial production.

Nexceris estimated the labor, capital equipment and materials costs to show how as materials production was scaled the product cost would drop while maintaining product quality. By evaluating alternative starting materials and developing a diversified supply chain, risks associated with raw materials pricing could also be managed, a critical hurdle in scaling a new technology.

Through a series of careful performance assessments of scaled materials production, the team **Validated** that recommended process modifications paid off in battery trials using pilot-scale trial runs and delivery of powder for testing. Each process modification was tested to confirm the crystal structure, physical properties and performance of the

"Nexceris was a great asset to us when we were developing our electrode technology. They worked with us to create and evaluate a number of materials with different crystal structures and surface properties. This allowed us to determine the best materials for our application. They then worked with our supply chain team to ensure a robust and reliable supply of high quality, repeatable material that met our cost targets and delivery schedules."

Principal Engineer, Research and Development

Figure 1. Nexceris' LEVER Process for Product



resulting powder met the required specifications. The validated modifications were then adopted into the Nexceris pilot production to reach manufacturing cost targets.

To Enhance the value of the work, the scaled process line was used to confirm process reproducibility and identify process control limits. These **Results** were used to update the cost model to identify the best remaining opportunities for process enhancement.

THE RESULTS:

Increased Production and Quality Maintained with Nexceris

The work accomplished by Nexceris helped the client quickly increase production without sacrificing quality or IP. According to the client, "Nexceris has always been very responsive to our needs and provided great service for us, both with their technical support and advice, and with their manufacturing cost and quality. Their quality control and ability to scale material from lab-based evaluation size to full scale production without changing the characteristics and quality of their material is exceptional. I fully endorse working with Nexceris on any oxide-based material development or manufacturing projects."

Grow with a partner that protects your quality, protects your process, and protects your IP.

GROW WITH NEXCERIS

