SIEMENS

AUTOMOTIVE AND TRANSPORTATION

HCM

Increasing efficiency by automating a full-line factory for battery cathode material production

Product

Tecnomatix

Business challenges

Rapidly achieve maximum production capacity

Enhance efficiency by automating production

Lower energy and nitrogen consumption

Speed up development of customer-specific equipment

Keys to success

Use Tecnomatix Plant Simulation to simulate existing production line

Optimize sequence of automated production system

Validate results in various circumstances

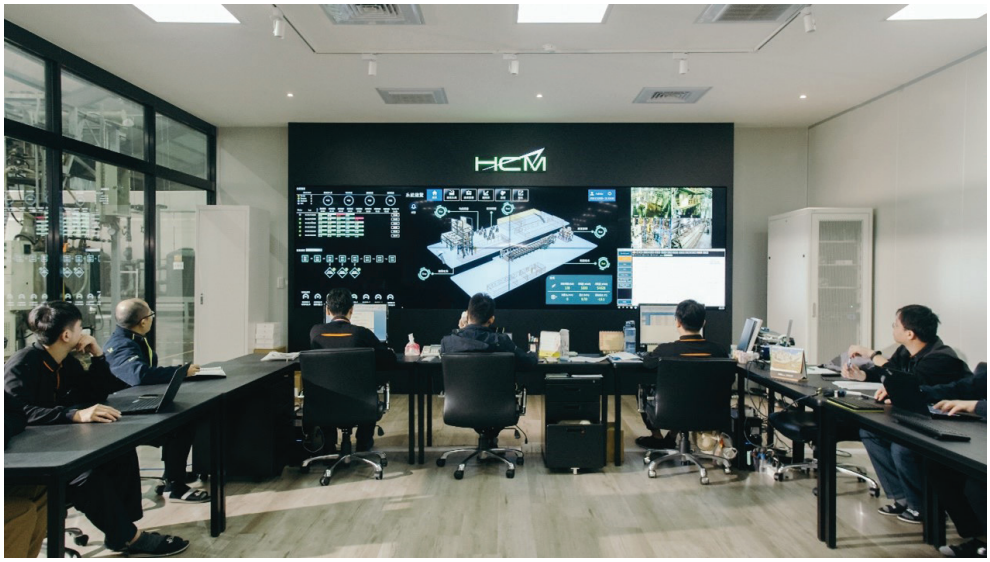
Create standard equipment modules for database

Engineer customer projects with validated modules

Results

Increased efficiency by automating the full-line factory for battery cathode material production

Reduced design time for customer-specific, turnkey production lines by 50 percent



HCM leverages Tecnomatix Plant Simulation to reduce design time for turnkey, customized plants by 50 percent

Seizing a global market opportunity

Established in 1997 in the city of Taoyuan in northern Taiwan, HCM supplies lithium ferrum (iron) manganese phosphate (LMFP) secondary material for lithium ion batteries. With green energy thriving, the electric vehicle (EV) is a worldwide trend. Battery technology plays a significant role in the EV industry, where cathode material is a key to success. Among popular cathode materials, LMFP stands out because of its unique characteristics – safety, lower cost and higher energy density. HCM works with Tier One customers in the United States, Europe and Japan, mostly in the electric vehicle and battery industry, to deliver their customer-specific powders.

The advantages of LMFP compared to other materials are offset by disadvantages such as a higher degree of complexity and a greater effort in production. “LMFP production definitely requires a flexible manufacturing system,” says Vincent Huang, senior manager of research and development (R&D), HCM. “In this fast growing market, the only way to make the company more competitive is to develop equipment with low-energy consumption, an efficient manufacturing system and maximum capacity in the shortest time possible.”

Results *(continued)*

Decreased electricity consumption by 5 percent

Cut nitrogen consumption by 10 percent

Validated design with customer early in the process

HCM's unique advantage has proven to be the ability of one of its business divisions to develop the required manufacturing system equipment. Therefore, the company can quickly respond to new requirements, adapt the production process and achieve the capability of mass producing products.

Further, the HCM Equipment Business Division provides turnkey solutions for other manufacturers of materials with similar production processes, such as ceramics materials for multilayer ceramic capacitators (MLCC). The only way to fulfill customer-specific requirements without testing and redoing the equipment inhouse before commissioning is using a comprehensive digital twin of the equipment and a capable simulation system.

Heading for higher efficiency

This is where Plant Simulation in the Tecnomatix® portfolio comes into play, one of the solutions of the Xcelerator portfolio, a comprehensive and integrated portfolio of software and services from Siemens Digital Industries Software. The system was implemented by HCM in September 2021. The first step after implementation was to simulate the existing production line and adjust the differences to the real outcome, delivering simulation results that were consistent with the

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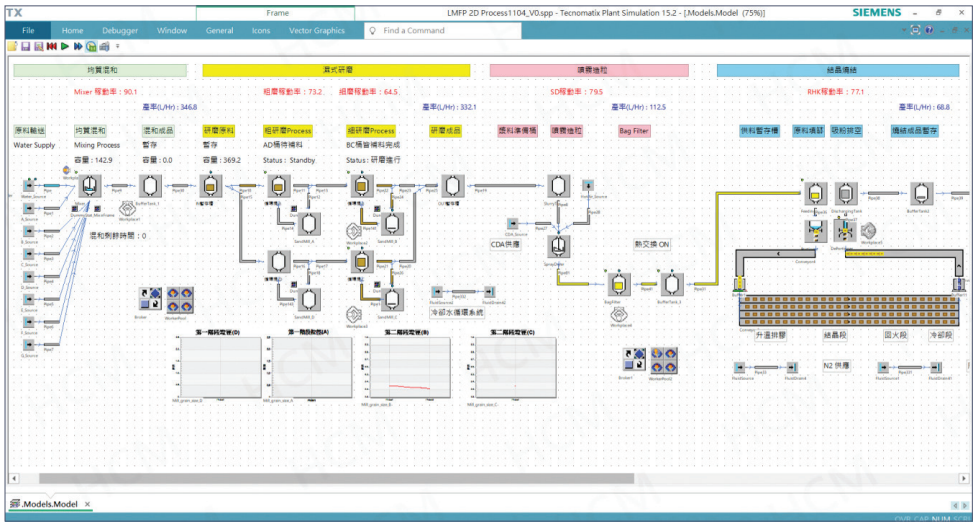
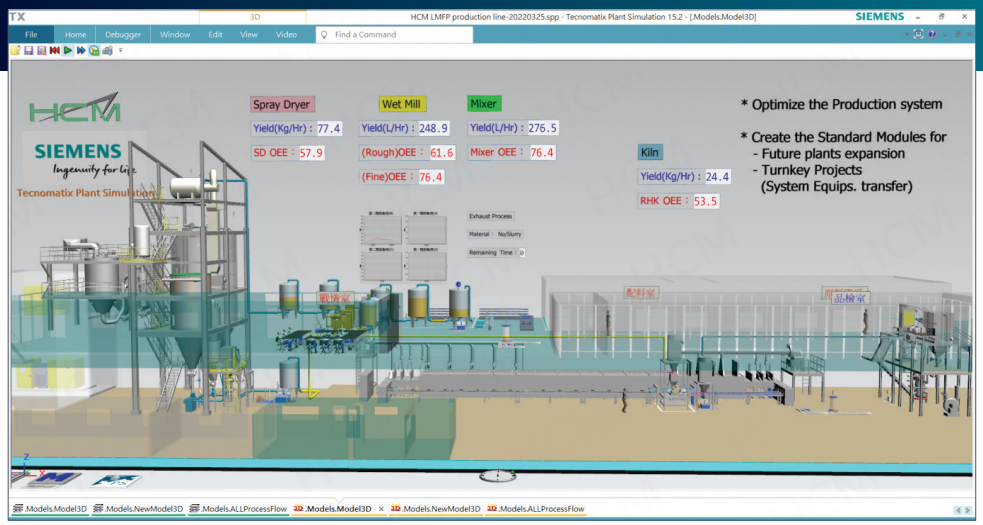




behavior of the production processes. “Tecnomatix accurately simulates the output, energy consumption, labor and production cost, helping us transfer from lab scale to industrial scale,” says William Chen, assistant vice president, production technology and quality control, HCM Material Business. “The system also helped us analyze manufacturing bottlenecks and improve the energy consumption and cost, which addresses the core value of the EV industry – reducing carbon emissions.”

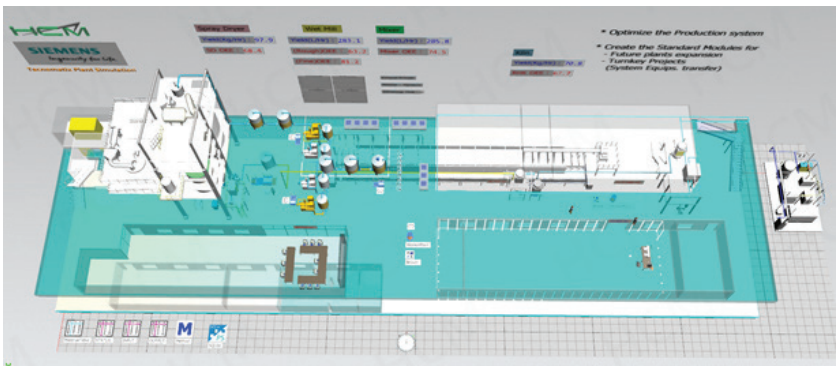
After this first phase of verification, HCM used the software to simulate the best deployment for each working station. Because some of the stations were working in cycling processes and others in batch processes, it was critical to deploy each working station properly. Otherwise, the equipment idle time would greatly reduce the production efficiency. Using Tecnomatix greatly reduced the equipment idle time and improved the production efficiency. For example, using Plant Simulation increased production efficiency of its sand mill by 15 percent, the utilization rate of the Roller Hearth Kiln (RHK) by 10 percent and reduced nitrogen consumption by 10 percent and electricity by 5 percent.

But this application was only the first step. HCM was aiming to become a full-line automated and unmanned factory. So, in the next step, the manufacturing company optimized the sequence of the production process by simulating the automated manufacturing system. Whenever changes have to be applied to the automated flexible production system, conducting simulations prior to lead in can confirm whether all design requirements are met. This saves labor for quality control and adjustments.

Plant Simulation can be interfaced with the central control of supervisory control and data acquisition (SCADA)/manufacturing execution system (MES), which HCM calls its “smart manufacturing system.” In addition to the display of real-time information, the system can also perform predictive simulation, analyze abnormalities or problems and confirm the effects in advance.

Cutting engineering times by 50 percent

After repeated verification, the optimized equipment units have been built using



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HCM Material Business

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Jack Lee
Senior Assistant Vice President
Equipment Business Division
HCM

Plant Simulation modules. When the standard user objects have been built, they can be used as a design database. Once there is a new process requirement, it can be realized in the Plant Simulation system to simulate the operational results. HCM can reallocate or adjust the design to meet their needs using this tool. It eliminates a lot of modifications. Instead, it provides reliable and predictable performance data with less effort and time and lower costs.

"Our manufacturing modules for all working stations are used as a manufacturing database," says Jack Lee, senior assistant vice president of the HCM Equipment Business Division. "This shortens the design time by at least 50 percent. The system accurately simulates the process and shows the results in various circumstances, saving us many modifications we executed in the past."

So for every customer-specific material HCM offers, the required changes in production can be executed rapidly and safely. Plant Simulation can be applied to new product manufacturing process planning, which can be used in advance to simulate the output, energy consumption, manpower requirements and production cost. It can also reduce the time required and

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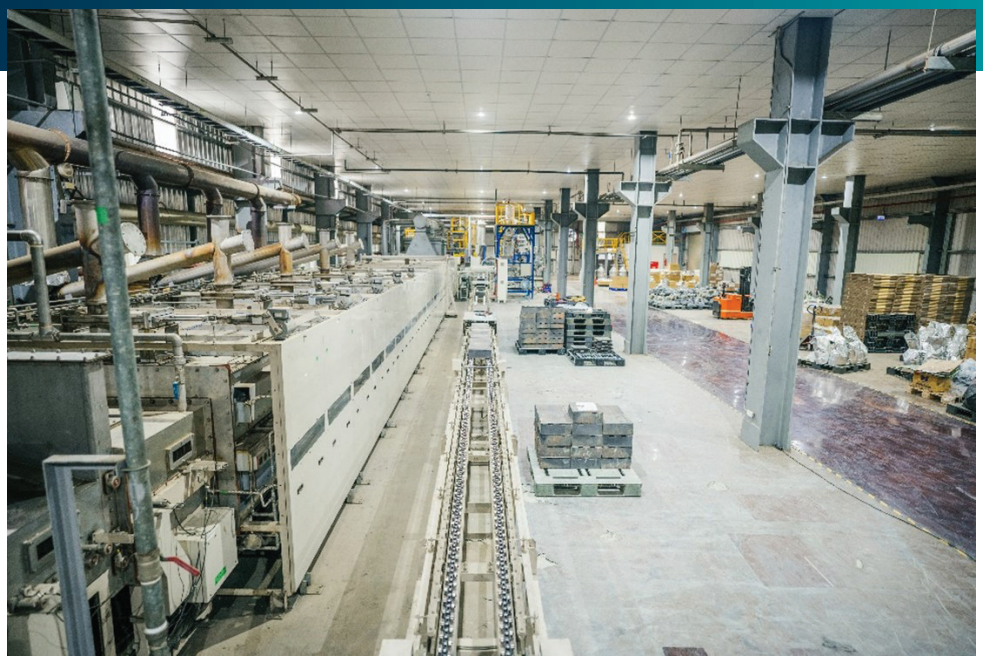

Solutions/Services

Tecnomatix Plant Simulation
siemens.com/plantsimulation

Customer's primary business

HCM Material Business supplies lithium ferrum (iron) manganese phosphate (LMFP) cathode material for lithium batteries. The Equipment Business Division provides turnkey solutions for other manufacturers of materials with similar production processes.
www.hcmaterial.com.tw

Customer location

Taoyuan
Taiwan

Solution Partner

Wisdom Engineering Services Corp.
www.wisdom.com.tw

the risk of failure and cost for new products from the research and development (R&D) stage to mass production.

Engineering automated production lines for similar materials

The HCM Equipment Business Division also designs customer-specific equipment and complete production lines for other manufacturers of materials with similar production processes, such as lithium titanate (LTO) or ceramics materials for MLCC. In addition to the design advantages of the manufacturing database, Tecnomatix can also be used to drive sales: "During the project planning stage, we can provide customers with simulation results that are close to the actual situation to reduce misunderstanding and convince them about our solution," says Lee. "Plant Simulation is the best tool for turnkey project system integration."

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