

Optimising Battery Performance with Hosokawa Micron Powder Processing Equipment

The global battery market is competitive and developing rapidly, thanks to the expanding electric vehicle market and unprecedented demand for consumer electronics and portables. As a world leader in powder processing technology, we are ideally placed to help existing and emerging battery producers to strengthen their competitive edge.

Battery manufacturers are under intense pressure to be cost competitive and reduce their carbon footprint as macroeconomic trends develop. End users want faster charging, a longer-lasting charge, and a longer useful battery life, while the OEMs want batteries to be smaller and more compact, with an increased energy density. And, of course, the batteries need to be reliable and safe.

High-quality processing and containment equipment are required for numerous steps of the battery production process, from drying and classification, to rounding, ultra-fine milling, mixing, and coating.

Drying slurries or filter cakes for precursors

For drying and milling precursor materials for the cathode, a continuous flash dryer is ideal, achieving end moisture levels below 1%. A continuous drying process is usually the best solution, but if even lower moisture levels are needed, or the required capacity is small, a batch dryer may be better. For difficult volatiles, a paddle dryer offers full vacuum at temperatures of up to 325°C, enabling extremely low moisture levels.

Creating 'active magic' for the best battery performance

For optimum battery performance, it is important for the active battery materials to have well-defined particle size distribution and small particles. Ultra-fine milling of the powders creates a smaller particle with a larger surface area, which enables the 'magic' to happen inside a battery. The result is a higher usable capacity, faster recharging, and longer battery life.

Common milling solutions for battery production are air classification mills and fluidized bed jet mills, which can achieve extremely fine and narrow particle size distribution. These mills can be used for cathode and anode materials.

The capability to spheroidize graphite is a game-changer. Graphite is naturally flaky with low bulk density, which decreases the battery capacity. Spheroidizing the graphite increases its bulk density and 'wettability', enabling the manufacturer to pack more material into the same volume for better battery performance. Natural graphite is cheaper to source, but synthetic graphite is already more spherical, so it requires less energy to round it off during milling, ultimately saving time and costs.

High-shear coating to improve conductivity

Reducing the particle size in the precursors to create a bigger surface area reduces their flow properties and causes 'sticking'. For the precise mixing of fine particles, battery manufacturers can use a high-shear mixer for batch or continuous mixing. These create a homogeneous material blend with a strong coating of carbon black and binders around the precursors for better conductivity. For even better battery performance, 'mechanical fusion' embeds the particles of the coating in the host particle.

Using more shear is always a trade-off and is not suitable for all products; it reduces the volume that can be handled, plus it increases energy consumption. It is a matter of finding the optimum level of shear for the customer's requirements. High shear is not always needed, however. A gentle, but highly efficient conical mixer can be used for batch homogenisation, for example, or lot adjustment after milling.

Safety first

Operator safety is an important consideration when handling battery materials. Downflow booths and horizontal laminar flow booths are relevant for the manufacture of solid-state batteries, which have to be produced in extremely dry air conditions, but where a higher level of OEB (Occupational Exposure Banding) is required to protect operators from breathing in or having direct contact with battery materials in a process system, a glovebox is perfect. Gloveboxes can also provide a controlled, CO₂-free, internal atmosphere to protect the product from deterioration.

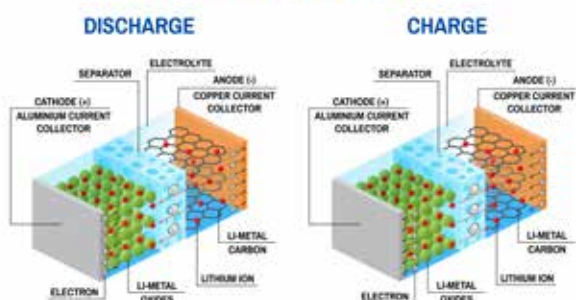


Glovebox

Hosokawa Micron Ltd.'s wide range of powder processing equipment puts it in a very strong position to offer suitable technology to manufacturers of all types of batteries as they continue to develop their products, now and in the future.

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LITHIUM-ION BATTERY



Lithium-ION battery discharging and charging using Li-metal oxide powder