Energy storage devices such as lithium-ion batteries play a crucial role for electromobility and energy transition. The growing demand for these means is met by Gigafactories which are equipped with efficient and highly automated production technologies.

In order to optimize the battery production, sensors are required which monitor the production line to the highest accuracy and dynamic. Micro-Epsilon offers reliable solutions from high precision distance sensors to infrared temperature measurement technology and 2D/3D profile sensors for multiple measurement tasks involved in battery production. These sensors are used in diverse fields from electrode manufacturing to assembly and forming processes.

**confocalDT**
Confocal chromatic sensors for high precision distance measurement
One-sided thickness measurement of transparent materials
Synchronous 2-channel measurement with only one controller
Ideal for dynamic measurement tasks due to high measuring rate

**interferoMETER**
White light interferometer for high precision distance and thickness measurements
Absolute distance measurement with nanometer accuracy
Distance-independent thickness measurements
Best-in-Class: Resolution < 30 picometers
Ideal for industrial measurement tasks

**capaNCDT**
Capacitive sensor system for non-contact displacement and distance measurements
Measuring ranges from 0.05 to 10 mm
Nanometer resolution
High frequency response for dynamic measurements
Ideal for long-term stable measurements

**scanCONTROL**
High-end laser scanner for high precision 2D/3D measurements
Inline measurement of gaps, profiles, steps, angles
Models with red and patented blue laser line
Measurement on numerous surfaces, also reflecting and matt
Thickness measurements
Measuring the thickness of wet layers
Confocal chromatic sensors from Micro-Epsilon monitor the coating thickness of wet materials. These sensors provide both extremely high resolution and high measuring rates. Installing several sensors next to each other enables concurrent determination of the homogeneity of the coating over the complete strip width.

Sensor: confocalDT

Thickness measurement of electrode coatings
White light interferometers arranged on two sides detect the thickness of coated electrodes according to the differential thickness method. They respectively determine the distance from the film while a constant distance between the sensors is maintained. The white light interferometers enable a measurement resolution in the nanometer range. The thickness values are used to control the application of the coating and for quality assurance purposes.

Sensor: interferoMETER IMS5400

One-sided thickness measurement
Thickness measurement from one side is possible using confocal chromatic sensors, white light interferometers and a combiSENSOR. One-sided thickness measurements are normally used in monitoring and controlling of coating processes.

Sensor: confocalDT

Metallic ground electrode
combiSENSOR: One-sided thickness measurement of electrically non-conductive objects, e.g., coatings
confocalDT: One-sided thickness measurement of transparent objects, e.g., films or coatings
interferoMETER: One-sided thickness measurement of objects, which are optically translucent in the near-infrared range, e.g., films or coatings

Minimum thickness 40 µm
Minimum thickness 5 µm
Minimum thickness 35 µm

Measuring the thickness of wet layers
Confocal chromatic sensors from Micro-Epsilon monitor the coating thickness of wet materials. These sensors provide both extremely high resolution and high measuring rates. Installing several sensors next to each other enables concurrent determination of the homogeneity of the coating over the complete strip width.

Sensor: confocalDT
Thickness profile evaluation
If the sensor is traversed via the strip material, thickness profiles can be evaluated.
Thickness measurement using capacitive sensors
Two-sided thickness measurement of electrically conductive materials can be performed by installing the capacitive sensors opposite each other. Strip thicknesses in the µm range can be measured using this method. Each of the two capacitive displacement sensors provides a linear distance signal which is calculated by the controller as a thickness measurement value. The measuring spot of the sensors is larger than that of the optical methods, which averages out any structures and anomalies on the surface.

Sensor: capaNCDT 6200

Turnkey measuring systems
As well as sensors, Micro-Epsilon provides turnkey measuring systems for integration in production lines, which enable high mechanical stability and measurement accuracy. Robust mechanics and innovative software evaluation enable the optimization of temperature stability and linearity. The measurement can be performed in fixed tracks or while traversing over the film web. Depending on the film or strip material and metrological specifications, the measuring systems are equipped with the sensors which fit best.
2D/3D Profile measurement

3D Surface inspection
Due to high resolution and stable signals on different measurement objects, the scanCONTROL sensors are used for 3D inspection of coated films. Defects with the smallest geometries – e.g. spalling and inclusions – are reliably recognized and output by the scanners.

Sensor: scanCONTROL
**Position control of battery cells**

After the battery cells have been assembled, laser scanners from Micro-Epsilon inspect their completeness and position. Therefore, a 3D image is generated which is then compared with the CAD data.  

*Sensor: scanCONTROL*

**Detection of curved edges after cutting**

Films may have curvatures and deformations after longitudinal cutting. In order to detect these deviations reliably, laser profile sensors from Micro-Epsilon are used. Due to their extremely high resolution and insensitivity to reflecting surfaces, these sensors provide stable measurement results.

*Sensor: scanCONTROL*

**Inspection of adhesive beading and applied sealants**

ScanCONTROL laser scanners inspect the presence and dimension of adhesive beading. They are mounted on the dispenser in order to control the quantity applied and the distance from the dispenser. Their high resolution enables them to reliably detect even the finest of beads. This is how breaks and flaws can be reliably detected regardless of the type of application or the color applied.

*Sensor: scanCONTROL*

**Coating application on edges**

Electrodes must be coated with extreme precision. Therefore, laser scanners from Micro-Epsilon inspect the coating profile on the edge. This is how anomalies and undulations are detected.

*Sensor: scanCONTROL*
Non-contact measurement of temperature and edge
Temperature monitoring during initial charge
Thermal imaging cameras monitor the first charging process of batteries. They provide an insight into the temperature distribution and any possible short circuits. The automatic hot-spot detection feature automatically recognizes and outputs deviations from the target temperature.
Sensor: thermolMAGER

Web edge control of electrode film
During the production of battery cells, electrode and separator films must be guided reliably. Optical optoCONTROL micrometers detect the required edge position for web edge control with high accuracy. Operating several micrometers enables the concurrent detection of the web width.
Sensor: optoCONTROL 2520
More Precision

Whether it is for quality assurance, predictive maintenance, process and machine monitoring, automation or R&D – sensors from Micro-Epsilon make a vital contribution to the improvement of products and processes. High precision sensors and measuring systems solve measurement tasks in all core industries – from machine building to automated production lines and integrated OEM solutions.