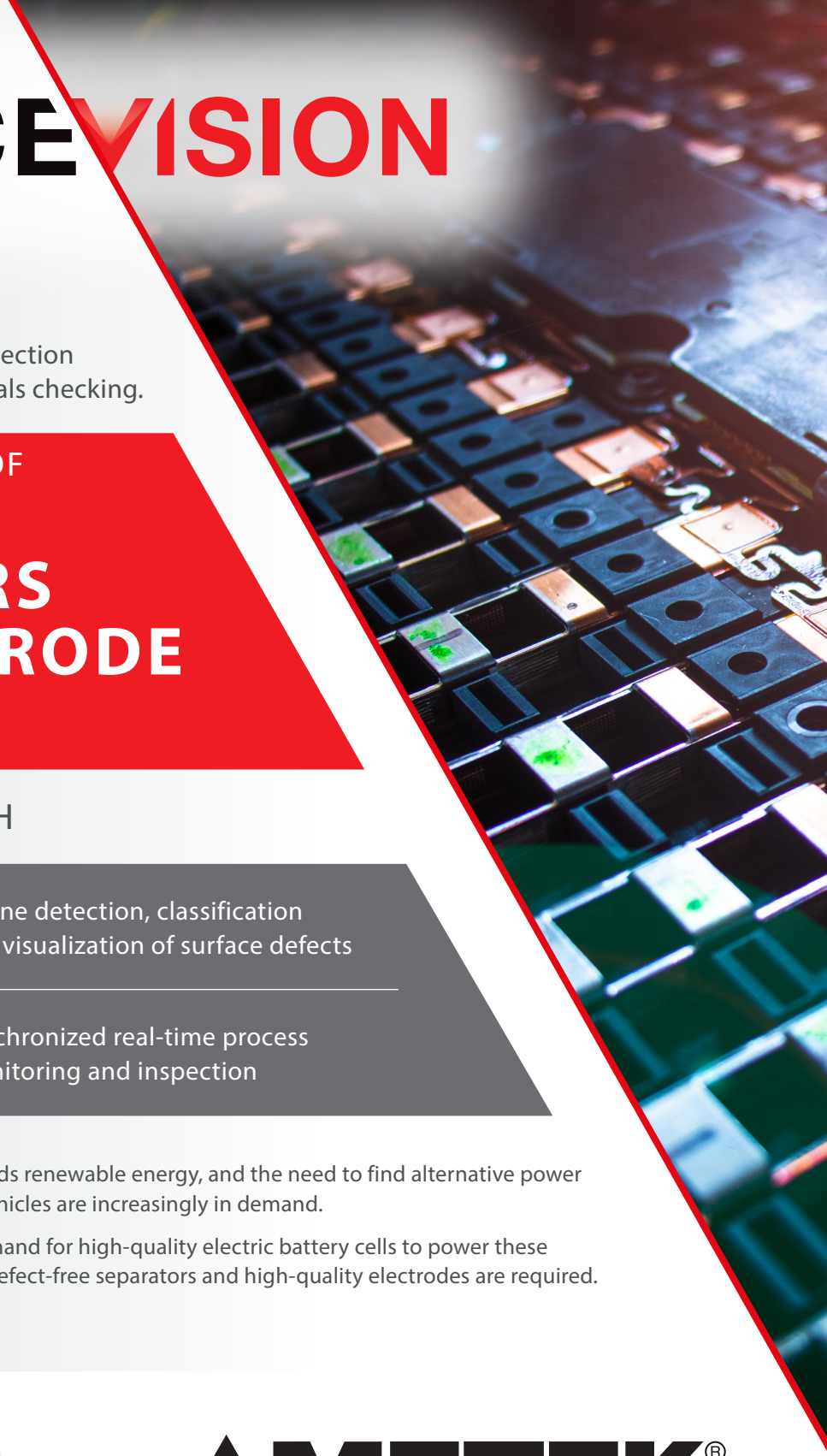
SURFACEVISION



The leading automated surface inspection partner for fast and accurate materials checking.

SURFACE INSPECTION OF BATTERY SEPARATORS AND ELECTRODE MATERIAL

DELIVERED THROUGH

SMART VIEW® Online detection, classification and visualization of surface defects

SMART ADVISOR® Synchronized real-time process monitoring and inspection

With the growing global movement towards renewable energy, and the need to find alternative power sources to fossil fuels, electric-powered vehicles are increasingly in demand.

This, in turn, has led to a rapidly rising demand for high-quality electric battery cells to power these vehicles. To ensure a high-grade battery, defect-free separators and high-quality electrodes are required.

AMETEK®

SURFACE VISION

GIVING YOU THE WHOLE PICTURE

The leading automated surface inspection partner for fast and accurate web inspection and monitoring.

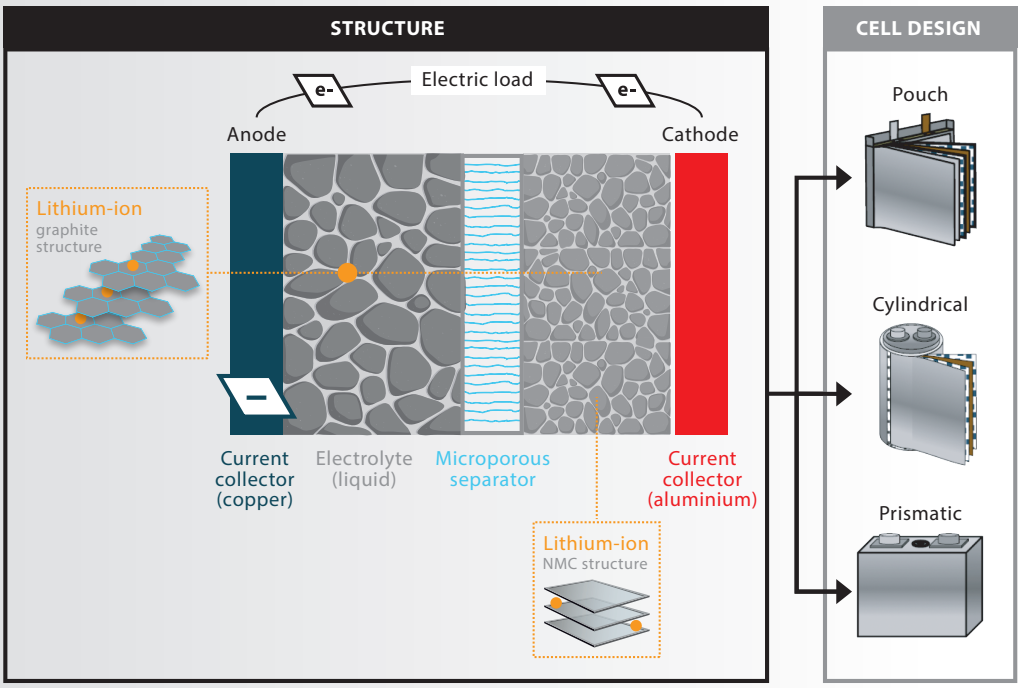
LITHIUM-ION BATTERY PRODUCT INSPECTION

Coating on an aluminum (cathode) or copper (anode) substrate is a challenging operation. Good coating quality is critical to avoid defects and failures of the battery.

Achieving this can be challenging, as the production process operates at high speed and the defects can be extremely small.

Manual inspection is out of the question if the necessary rate of productivity is to be maintained, so highly accurate, automated surface inspection is needed.

OPERATING PRINCIPLE OF A LITHIUM-ION BATTERY CELL



PRODUCTION PROCESS LI-ION BATTERY CELLS

1	2	3	4	5	6	7
INPUT MATERIAL	**CUTTING**	**CELL ASSEMBLY**	**TAB WELDING**	**PACKAGING**	**FILLING**	**OUTPUT MATERIAL**
Anodes, cathodes and separators on a roll.	Separation and stamping of electrodes.	Laminating, stacking of individual electrodes or winding of stamped electrodes.	Welding of electrodes and contacts.	Incorporating stacks in aluminum cans or pouches and deep drawing of pouches.	Filling with electrodes into pouches or hard cases and sealing of pouches.	Cylindrical, prismatic hard case or pouch cells.
		Cylindrical				**Cylindrical Cell**
Cathode Separator Anode		Radial Flat Winding	Tab Welding	Can Insertion & Can to Cover Welding	Can Filling	**Hard Case Can**
	Progressive Notching	Flat Winding				
	Mech, Notching & Cross Cutting	Lamination & Bi-Cell Stacking				
		Lamination & Dual-Cell Folding				
	Laser Notching & Cross Cutting	Lamination & Flat Folding				
	Laser Cutting	Stack Winding		Deep Drawing & Packaging	Pouch Filling	**Pouch Cell**
		Z-Folding				
	Laser Ablation & Laser Cutting	Single Sheet Stacking				

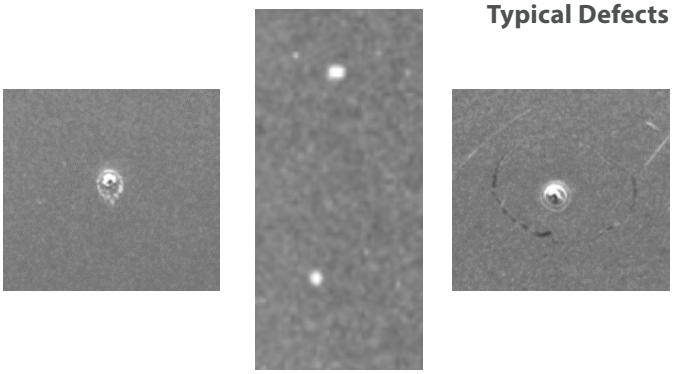
COMPONENTS FOR SURFACE INSPECTION

COATED SEPARATORS

The separator is an essential component for safety in the lithium-ion battery. It separates the electrodes, preventing them from short-circuiting. Charging and discharging the battery places thermal and mechanical stresses on the separator, and if it fails, the battery will discharge spontaneously, potentially leading to a fire or explosion.

Coated thin-film separators increase the resilience of this component, but they must be defect-free to ensure safe and effective operation, which requires accurate inspection during the separator production process.

Typical Defects

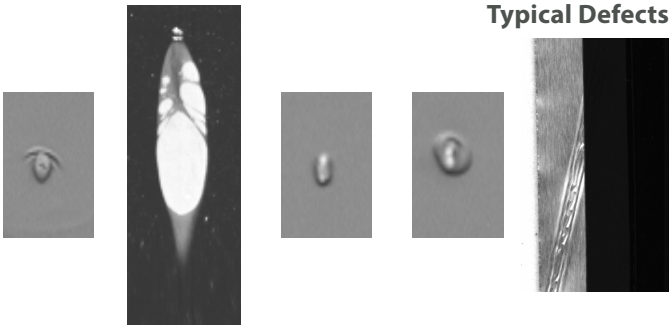


SOLID-STATE BATTERY COMPONENTS

A typical solid-state battery consists of multiple layers: an aluminum substrate foil as the base for the cathode coating and current collector, and solid separator/ electrolyte layers, combined with lithium metal anodes.

Each of these layers is manufactured separately and must be defect-free and of the highest quality, so multiple inspections are required throughout the production process.

Typical Defects

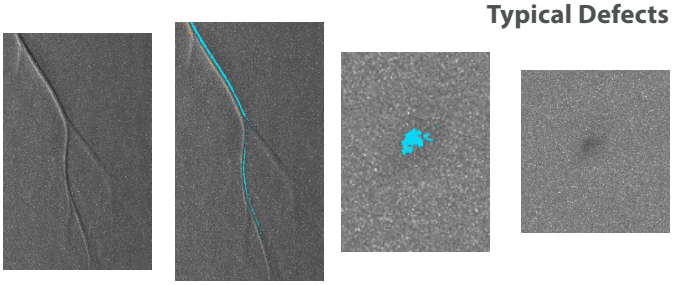


FUEL CELL COMPONENTS

The fuel cell contains many polymer-based components which need to be defect-free. They are: gas diffusion layers (GDL), the catalyst layer (CL), the micro-porous layer (MPL), and a polymer electrolyte membrane (PEM).

The anode and cathode are composed of four layers each: the bipolar plate with the gas channels, GDL, MPL, and CL. The polymer electrolyte membrane is located in the center of the cell.

Typical Defects



TYPICAL DEFECTS DURING SLOT DIE COATING

PINHOLES AND DIVOTS

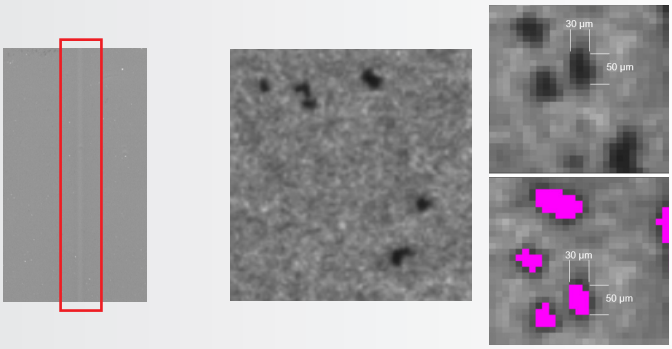
Formed by air bubbles in the slurry popping during coating, these can cause localized over-charging of the cathode.

AGGLOMERATES AND BLISTERS

Caused by improper mixing, these lead to non-homogenous conduction and binding, which can cause localized impedance rise and capacity loss.

NON-UNIFORM COATING

Including strips, holes, folds, and relief material, these are typically formed when there is an obstruction on the coater, and can cause an uncoated line on the electrode or localized over-charging of the cathode.



Particularly in the case of high electrode compression, various mechanical effects occur in the calendering process. Foil embossing is observed on the uncoated collector edge as wrinkles in the running direction form at a specific angle.

SURFACEVISION

THE AMETEK SURFACE VISION SOLUTION

SMARTVIEW® | SMART ADVISOR®

A highly sophisticated optical set-up, combined with a powerful detection algorithm and a multi-step classifier, can help ensure that battery producers can distinguish non-quality-related optical effects from defects in battery production.

The world leader in automated online surface inspection solutions, AMETEK Surface Vision offers a broad product range optimized for the monitoring and inspection of webs and surfaces, and for process surveillance applications.

With hundreds of customers and more than 3,000 installations worldwide, our systems have become vital to increasing efficiency, streamlining operations, improving product quality, and reducing costs and waste in industrial processes.

Manufacturers in the metals, paper, plastics, and nonwoven industries rely on our solutions to detect surface flaws or defects, and optimize process efficiency, at their production facilities across the globe.

AMETEK Surface Vision's SmartView® detection technology reduces the need for manual intervention, and can adapt to the huge variety of separator membrane types.

The industry-leading surface inspection solution, SmartView is trusted worldwide to detect, identify and visualize surface defects in real time for a range of materials.

Merging state-of-the-art software and hardware into an advanced surface inspection platform, SmartView provides total vision integration for high-speed defect detection, monitoring, and reporting. It delivers robust features, flexible operation, and proven, high-quality results.

Installed on the coating and slitting processes in most applications, SmartView's high-speed inspection system delivers high-resolution image acquisition of the following defect types: contamination, strips, relief material, cutaways, coating defects, insects, pinholes, folds, foreign particles, and pollution.

SmartView technology is quick and easy to install and designed with a user-friendly interface to support customer needs. Real-time notification technology allows operators to add control labeling systems to high light defect positions which optimize yield management and increase throughput.

It can be supported by our versatile, easy-to-use SmartAdvisor® vision system, designed to maximize machine efficiency and yield rates. This provides high-speed, multi-dimensional video monitoring and process analysis, helping to optimize processes, find defects, and detects process upsets.

Using the inspection and monitoring solution provided by AMETEK Surface Vision, battery cell manufacturers can be assured of adaptable defect detection that supports quality and reduces the need for manual intervention.

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