TECHNICAL ARTICLE

ISRA VISION

Release: No. 844, 17.02.2022
Contact: Larissa vom Lehn
E-Mail: lvlehn@isravision.com
Phone: +49 / 2366 / 9300-287

Leading solution for automatic inline inspection of electrode coatings, separator foils, and pouch cells

Li-Ion batteries: 100% quality inspection along the entire process chain

Battery technology, which is rapidly expanding worldwide, forms the core of several innovative future technologies. In particular, the high energy density lithium-ion battery has established itself as the leading power storage technology of recent years. This constantly refined battery technology is considered to be particularly efficient, low-maintenance and, safe. Without powerful lithium-ion batteries, there would be no smartphones, laptops, and electric cars. With its extensive experience in all fields of machine vision applications, ISRA VISION offers the right technology for all process stages in battery component manufacturing with its SMASH inline inspection system. This advanced all-in-one solution now has over 1,000 installed systems worldwide in the battery and separator foil industry.

The high-precision SMASH inspection system ensures consistently high quality along the entire value chain. It is designed for automatic inspection in the production line, e.g., for the extrusion of wide material webs, in the coating line, or in the winder as the last processing step before delivery. The system provides real-time information about the material quality and shows to what extent the given specifications have been met. Costly and time-consuming laboratory tests can thus be largely avoided. The SMASH system performs inline quality assurance in the area of aluminum and copper coating of electrodes, in the production and coating of Li-ion foils, and in the manufacture of battery pouch cells.

Electrode inspection: Reliable quality control of the aluminum and copper coating

Powerful battery electrodes are an important component of lithium-ion cells. The coated electrode materials for cathodes and anodes have to meet high requirements in terms of energy efficiency, storage density, and safety. Especially after the demanding processing in the roll press, the aluminum and copper-coated electrode plates must be subjected to a precise quality inspection. In this production step, a particularly smooth and closed coating is desired. The SMASH inspection system reliably detects the entire material quality for damage such as streaks, holes, impurities, and air bubbles. In addition, precise edge detection and alignment within the calendering process is guaranteed. All relevant error sources can be directly eliminated by the 100% inspection, thus preventing later complaints.

ISRA VISION AG
Industriestraße 14
64297 Darmstadt
Germany
Tel.: +49 (6151) 948-0
Fax: +49 (6151) 948-140
info@isravision.com
www.isravision.com

Release: No. 844, 17.02.2022
Contact: Larissa vom Lehn
E-Mail: lvlehn@isravision.com
Phone: +49 / 2366 / 9300-287

100% error detection in the production of lithium-ion separator films

Another indispensable component of the lithium-ion battery is the separator film. This membrane separates the anode and the cathode, thus enabling the lithium ions to be exchanged. The separator film is an essential safety element to prevent a short circuit in the battery. It also plays a key role in the speed and service life of the cells. After extrusion, stretching, and coating, the demandingly treated material of the separator foil must be carefully inspected. In particular, the porosity and uniformity must be perfect for use in a battery cell. In addition, the separator film must have good chemical stability and heat resistance and be tear-resistant despite its low thickness. The ISRA-SMASH inspection system detects and classifies typical production defects in the PVDF fluoroplastic coating such as holes, stains, oil drops, water drops, and scratches. A precise distinction is also made between small holes and thin spots. This intensive defect detection is made possible by a sophisticated inspection system with high-resolution 8 and 16k monochrome and color cameras and a unique multi-scan technology with up to three scans.

During electrode and separator film production, the ISRA camera system detects and classifies the smallest defects in real-time using ISRA's advanced real-time MultiScan High Dynamic Range (HDR) technology. Here the HDR enables a high contrast range. Due to the high contrast achieved with HDR, even the smallest thin spots and holes can be detected. With the HDR process further developed by ISRA, the inspection system offers high-precision defect detection. ISRA's inline inspection systems also inspect the films at the other stages of the process chain, such as the cutting process - known as slitting. Web defects, dust, and foreign particles are detected in real-time. This ensures the highest possible quality of cut and cleanliness in production.

Inspection of the metalized pouch foil bag

The so-called pouch foil with its hermetically sealed aluminum-plastic composite foil packaging forms the outer shell of the batteries. The reduced installation space, low weight, and low manufacturing costs are among the advantages of the pouch cell. In addition, pouch cells offer excellent heat dissipation and high energy density.

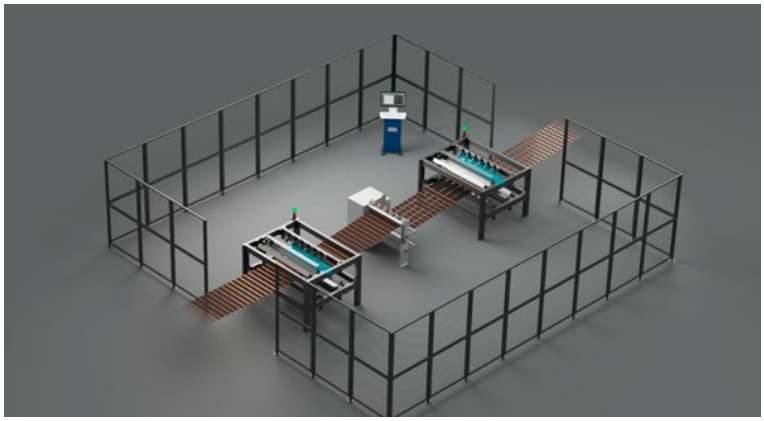
Here, ISRA has developed an innovative solution for the inspection of pouch cells for comprehensive process and quality control. The highly refined pouch film must have the correct contour and size, and the sealed seam must also be flawless. In addition to dimensional monitoring, cosmetic inspection also detects surface defects and contamination. The system can also reliably check barcodes and data codes. Automatic camera calibration and an integrated GigE-Vision high-speed interface make it particularly easy to set up the inspection system and integrate it even in a fully networked Smart Factory.

ISRA VISION AG
Industriestraße 14
64297 Darmstadt
Germany
Tel.: +49 (6151) 948-0
Fax: +49 (6151) 948-140
info@isravision.com
www.isravision.com

Release: No. 844, 17.02.2022
Contact: Larissa vom Lehn
E-Mail: lvlehn@isravision.com
Phone: +49 / 2366 / 9300-287

Data analysis and evaluation: The key to an efficient value chain

The high level of competence of the ISRA inspection system in data analysis and processing is particularly noteworthy. ISRA's self-developed Production Analytics Software EPROMI, now in Version 2, brings together the most isolated data from inspection systems and all communication-enabled components of the production systems, creates intelligent correlations, and clearly displays the results in individual ECOCKPITs. By implementing the obtained analysis results, the production of Li-ion batteries is optimized to reduce costs and the yield of the production lines is significantly increased.

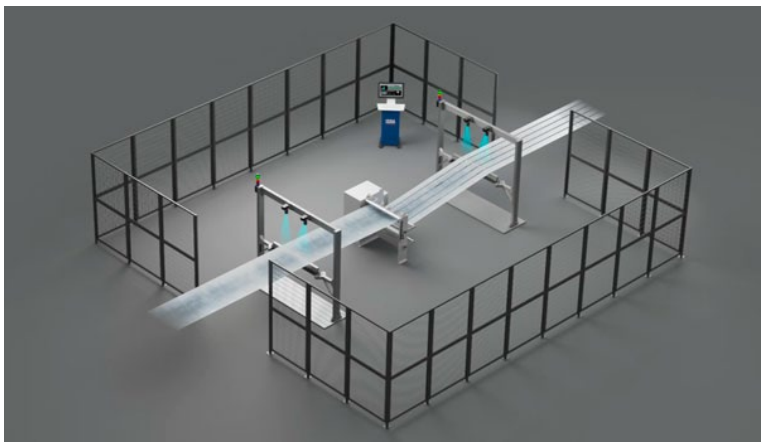


844-1.jpg

Powerful battery electrodes are an important component of lithium-ion cells. The coated electrode materials for cathodes and anodes have to meet high requirements in terms of energy efficiency, storage density and safety. The SMASH inspection system reliably detects the entire material quality for damage such as streaks, holes, impurities and air bubbles. In addition, precise edge detection and alignment within the calendering process is guaranteed.

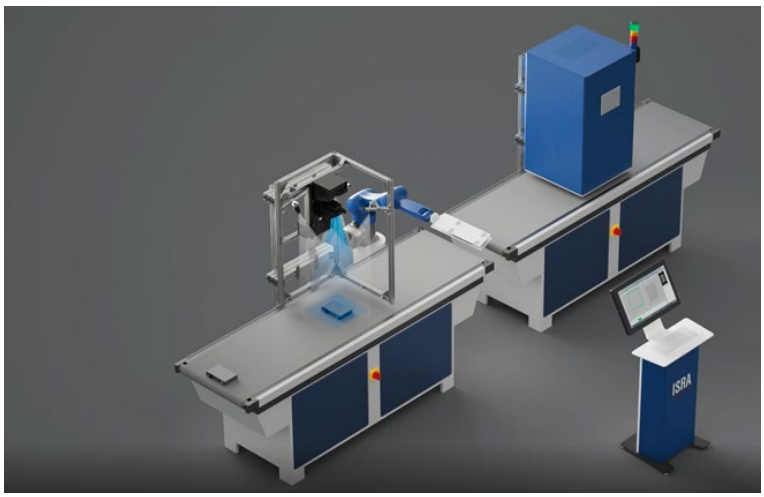
ISRA VISION AG
Industriestraße 14
64297 Darmstadt
Germany
Tel.: +49 (6151) 948-0
Fax: +49 (6151) 948-140
info@isravision.com
www.isravision.com

Release: No. 844, 17.02.2022
Contact: Larissa vom Lehn
E-Mail: lvlehn@isravision.com
Phone: +49 / 2366 / 9300-287



844-2.jpg

The separator film is an indispensable component of the lithium-ion battery. This membrane separates the anode and the cathode, thus enabling the lithium ions to be exchanged. During separator film production, the ISRA camera system detects and classifies the smallest defects in real time at full web speed.



844-3.jpg

ISRA has developed an innovative solution for the inspection of battery cells for comprehensive process and quality control. This in-line and off-line inspection solutions performs a compete 360° of the cell to ensure 100% inspection and the delivery of only flawless cells.

ISRA VISION AG
Industriestraße 14
64297 Darmstadt
Germany
Tel.: +49 (6151) 948-0
Fax: +49 (6151) 948-140
info@isravision.com
www.isravision.com