EV BATTERY CELL ASSEMBLY

Fast, accurate, and scalable battery cell assembly solutions

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Electric vehicle (EV) battery cell assembly is a critical step of cell manufacturing. The process involves aligning EV battery cell sheets, welding their tabs, placing them in a cell housing, and filling the cell housing with liquid electrolyte. EV battery cell sheets are critical lithium-ion battery components, consisting of separator material inserted in between sections electrode-coated anode and cathode. In battery cell manufacturing, two primary methods of aligning cell sheets are stacking and winding.

During cell stacking, also called "Z folding," an alignment machine picks up a single piece of electrode anode or cathode, wraps it in separator material, and then places the remaining anode or cathode on top of the separator. EV battery cell sheet winding involves aligning the cathode, separator, and anode on top of one another and merging them as they pass through a cylindrical roller.

In both processes, machine vision is essential to align the cathode, anode, and separator accurately.

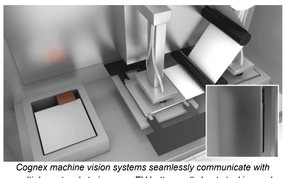
An automation solution welds their tabs together after the electrodes are aligned and assembled. A cap is welded to the top of the housing to produce prismatic and cylindrical batteries. Then, the cell is filled with electrolyte fluid through a small hole in the top cap.

Machine vision systems inspect EV battery tab- and top-cap weld seams for defects and uniformity, helping ensure the highest battery safety and performance levels.

Cell sheet stacking and winding

Misaligning the cathode, anode, or separator in cell assembly could jeopardize battery safety and complicate numerous downstream processes. If the separator material doesn't adequately divide the anode and cathode, the resulting connection could cause an electrical shortage or fire.

VisionPro and EtherInspect are vision analysis software solutions that work with Cognex Industrial Cameras (CICs) to measure the cathode, anode, and separator sheets. The software identifies reference points on the cell sheets, ensuring precise alignment. At the same time, CICs enable faster pick-and-place operations with expansive communication protocols. Facilities can quickly modify and redeploy these cell assembly solutions to address new challenges, scale operations, and achieve rapid product changeover.



Cognex machine vision systems seamlessly communicate with multiple protocols to increase EV battery cell sheet stacking and winding throughput while maintaining accuracy and precision.

Advanced, high-speed defect detection

The Trevista CI Dome illuminates components from all angles, revealing subtle defects and topographical information. The solution reduces inspection times using vision software and computational imaging to detect and classify flaws during high-speed operations.

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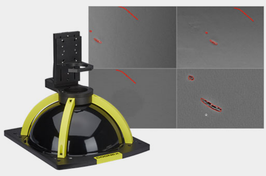
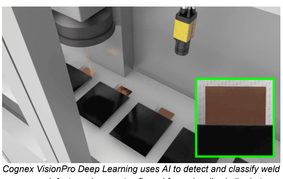




Cognex VisionPro Deep Learning uses AI to detect and classify weld seam defects and separates flawed from visually similar but acceptable weld seams.

Tab-Weld Seam Inspection

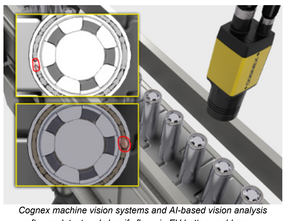
EV battery tab welding is a complex, tedious process; tabs are fragile and contain different materials. EV battery tab weld flaws are highly variable, appearing in various shapes, sizes, and forms. Separating defective from acceptable and cosmetically variable welds is inherently time-consuming and inhibits throughput.

VisionPro Deep Learning is artificial intelligence (AI)-based software compatible with 2D machine vision systems such as Cognex Industrial Cameras (CICs) that accurately separate acceptable from defective welds by reviewing thousands of images. The In-Sight 3D-L4000 uses a speckle-free blue laser, advanced vision tools, and a smart camera to inspect weld seams. These solutions improve battery throughput quality and reduce scrap rates by quickly differentiating defective EV battery weld seams from acceptable seams with cosmetic anomalies.

Top-Cap Weld Seam Inspection

Top-cap welds must be uniform and precise to ensure a secure seal after adding electrolyte fluid to the cell. Electrolyte leakage due to faulty welding can lower cell efficiency and cause the battery to short circuit.

VisionPro Deep Learning analyzes vast image sets to accurately detect and classify flaws while accounting for acceptable battery tab weld seams. At the same time, Cognex Industrial Cameras (CICs) capture images during in-line inspections. Classifying weld seam defects such as gaps and bubbles can uncover issues within the welding process, improving operational efficiency.



Cognex machine vision systems and AI-based vision analysis software detect and classify flaws in EV battery weld seams.

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