Component Cleanliness in Electric Vehicle (EV) Battery Production

Background

Since the early 90’s, Component Cleanliness in the automotive industry has been a highly critical driver to improve the performance and the reliability of advanced powertrain systems. Almost all engine and transmission plants have been obliged to upgrade their production processes to meet more and more severe cleanliness specifications. These changes have been driven by new Engineering standards in terms of operating pressures, dynamic clearances, surface finish, etc.

Problem

To avoid leaving any remaining traces of solvent in the EV casings after Cleanliness analyses, the carmaker specified the usage of DI-water instead of a standard petroleum-based solvent for the extraction procedure.

Another major concern from EV Battery manufacturer is environment hazard when a standard petroleum-based solvent used in the QC laboratory room. Inner surface of EV casings required a cleaning process prior to assembly of Anode, Cathode, and Electrolyte. Rinsing the Inner surface of EV casings required the use of DI-water.

Similarly, outer surface of EV casing assembly also required cleaning prior to assembling Cells into Modules. This stage required air and DI-water for wall flushing.

It is important to know that an EV casing assembly is fully charged with electricity, so any residual water could cause electric short-circuit problems.

Specific equipment to assess component cleanliness of parts and components before their assembly into powertrain systems has typically been deployed on the shop floor to control the multi-stage production process.

While the technical shift to Electrical Vehicles has significantly impacted powertrain technology, Component Cleanliness remains an important parameter monitored in the EV battery industry as it not only directly impacts the performance of the battery cells themselves, especially their capacitance and thermostability performance, but can also potentially cause an explosion.

An Asian EV battery manufacturer was asked by a major carmaker to clean the battery casing before the final assembly of the cells. Component Cleanliness analyses had to be performed per ISO 16232 and VDA 19 procedures – see below.

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Pall Solution

The Pall Cleanliness Cabinet (PCC) developed for this DI-water based extraction procedure required significant modifications from our standard unit in the design of the fluid circuits: the pressure rinsing line and wall-washing line were redesigned to address the different physical/chemical properties of the rinsing fluid (lubricity, density, viscosity, interfacial tension, etc.) The design modifications were validated to make sure that the overall capabilities of the PCC unit remained optimal to extract contaminants from the EV battery cell cases.

Based on this Pall developed a new series of PCC units* compatible with DI-water.

Conclusion

With the PCC unit developed to meet the carmaker’s extraction procedure the EV battery manufacturer was able control the production of its casings in terms of component cleanliness. As the casings of the battery cells met the cleanliness specifications, there was no obstacle to complete the final assembly of the battery cells. The carmaker validated the control process in place with the highest level of confidence.

This control is now fully integrated into its standard Quality Assurance standard work as any other production criteria.

Four DI-water PCC units are now deployed in different manufacturing plants to ensure that the battery cells meet the technical specifications in terms of performance and reliability wherever they are produced in the world.