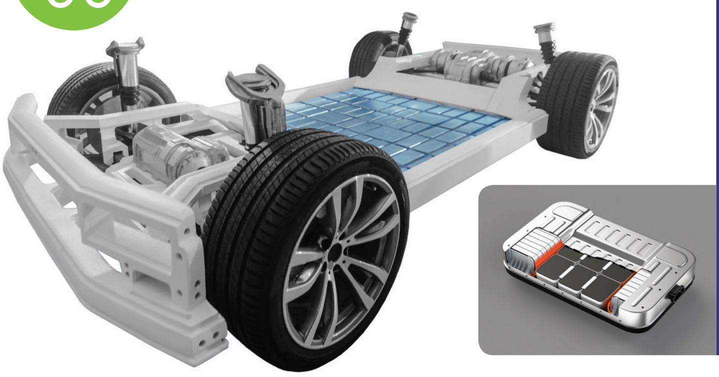
Liquid Electrolytes in High Energy Density EV Battery Production

CASE STUDY

PIABEVBAT7EN



Background

Since its introduction in the early 1990s, the technology rechargeable lithium-ion battery technology has greatly evolved, driven by increasing EV market demands for Li-ion batteries with higher energy, power density, and safety.

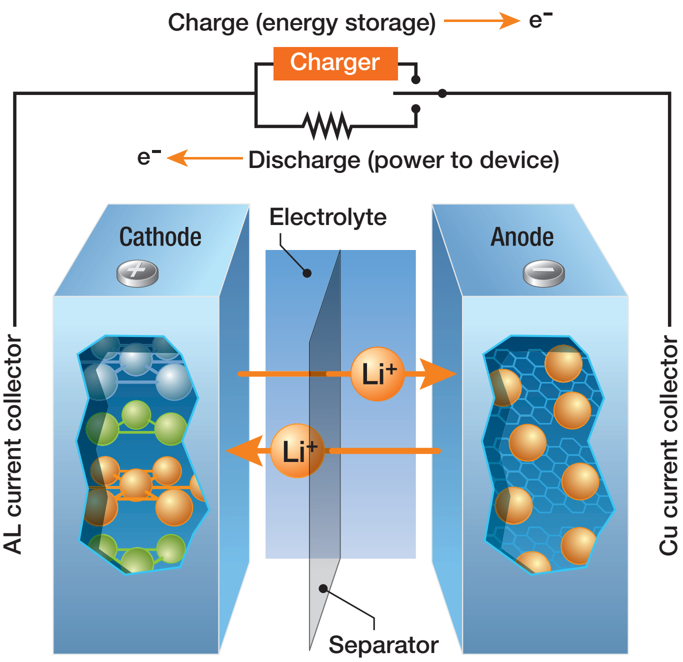
Due to almost unmatched volumetric energy density, Li-based batteries have dominated the portable electronic industry for the past 20 years. This is expected to continue in the future, and now Li-based batteries are also powering plug-in hybrid electric vehicles and zero-emission vehicles.

There is impressive progress in the exploration of electrode materials for lithium-based batteries because the electrodes are the limiting factors in terms of overall capacity inside a battery.

However, more and more interest has been focused on the electrolytes, which determine the current (power) density, the time stability, and the reliability of a battery.

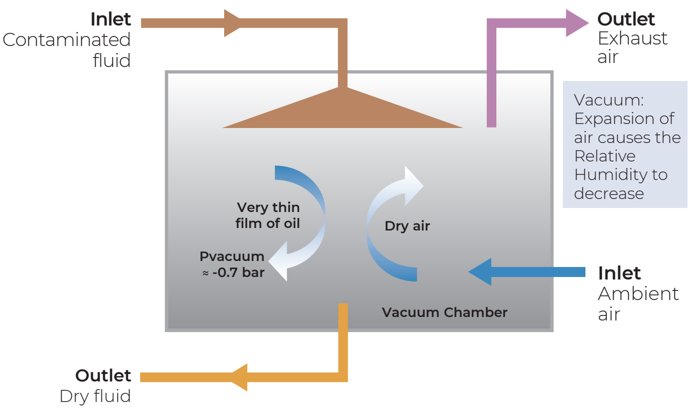
Electrolytes can be viewed as the inert component of the battery, and as such, they must demonstrate stability against both the cathode and anode surface.

While different types of electrolytes are used today (solid vs liquid, aqueous vs non aqueous, etc.), there is still a significant need for additional developments in this area to improve the performance of lithium-ion battery technology.



Lithium-ion battery charge/discharge diagram

How does the Pall Purifier work?



Problem

An innovative EV battery manufacturer contacted Pall to validate the cleaning and filling process of its latest generation of high energy density Li-based power systems.

These advanced batteries with larger energy densities usually exhibit thermal issues, reducing performance at higher operating conditions and potentially causing a fire or explosion. To avoid such catastrophic scenarios, a dielectric oil is used as electrolyte and coolant.

The challenge here is the extreme sensitivity of the dielectric oil to solid, gaseous and liquid contamination.

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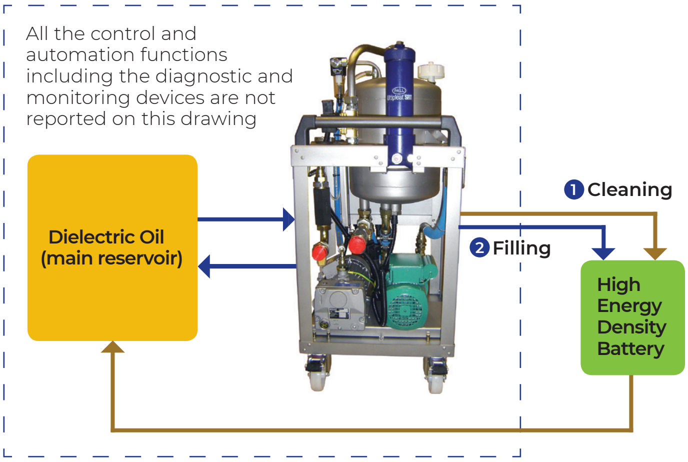
Pall Solution

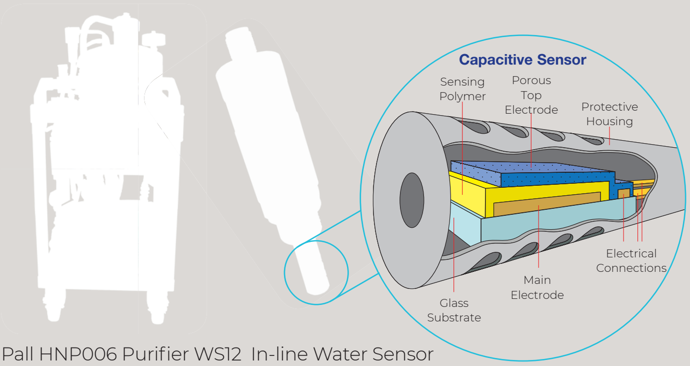
The main technical challenge was to not only develop the specific cleaning and filling equipment, but to also validate the overall cleaning and filling process to ensure a high cleanliness level of the dielectric oil before sealing the modular battery systems.

The vacuum dehydration technology was at the core of the equipment design that Pall developed for this cleaning and filling application: The Pall HNP006 purifier was fully integrated into the equipment in order to remove up to 90% of dissolved water and gases while cleaning-up the fluid. A Pall Water Sensor was also installed on-line to measure the water content of the dielectric oil all along the cleaning and filling process.

The purifier is fitted with a $\beta_{3\mu m(c)}$>2,000 antistatic filter medium to ensure a fast and efficient cleaning of the battery (1) before its final filling (2)



Cleaning & Filling Equipment



Pall HNP006 Purifier WS12 In-line Water Sensor

Conclusion

With the Pall Purifier and Water Sensor solutions installed on the liquid electrolyte cleaning and filling equipment, the EV battery manufacturer was able to maximize the quality of its production.

The cleanliness level achieved on the electrolyte at the point of use enabled the EV battery producer to avoid premature ageing or functional damage of the high energy density batteries due to solid, liquid or gaseous contamination.

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