MARPOSS

LEAK TEST

IN BATTERY CELLS PRODUCTION

Process control and quality check are always crucial operations in the manufacturing of secondary batteries, but they are even more important when it comes to cells for automotive use.
The use of batteries in EVs requires strict adherence to stringent quality standards for safety and reliability. Defects that might be considered, inconvenient' in other applications become completely unacceptable in the automotive environment.
Equally critical to battery performance and safety are the subsequent cell assembly stages.
Irrespective of the specific cell chemistry used, most rechargeable batteries are extremely sensitive to moisture and other forms of contamination.

LEAK TEST OF BATTERY CELL COMPONENTS

The first operation where leak testing is needed is in the manufacturing of the cell housing and cover.
The production of the housing components for rigid cells, such as prismatic and cylindrical, is carried out according to different processes and operations that, if not carried out correctly, can generate defects that will compromise the perfect sealing of the cell, once assembled.
If the housing is produced by sheet metal stamping (deep drawing), the process itself can create cracks and fissures at the most stressed points of the housing. If it is made by cutting, bending and welding, the critical points are the weld seams themselves.
To avoid a high reject rate, it is essential to check that the housing components are free from potential leak points before proceeding to the next stage of cell assembly.
Acceptable leakage levels for Li-ion cells are normally related to the maximum amount of moisture and other contaminants that are allowed inside the cell during its lifetime. For this reason, leak tests on cell components must identify particularly small leaks (in the range 10^{-5} - 10^{-7} mbar l/sec), which can only be detected with the use of helium as tracer gases in a vacuum chamber.

LEAK TEST OF ASSEMBLED BATTERY CELLS

The second part of the process requiring leak testing is when the cell is fully assembled before electrolyte filling.
The active components of the cell, anodes, separators and cathodes, have already been inserted into the housing at this stage, and the lid has been assembled, either by crimping or soldering, depending on the cell type. The cell is almost completely sealed at this stage, with only one hole left open for filling with liquid electrolyte.
It is essential to check that the lid is properly sealed before proceeding. After the electrolyte filling and the subsequent sealing of the filling hole, the battery cell enters the long and delicate stages of formation & ageing, with the associated charge and discharge cycles. Leaking cells during these operations represent not only an unjustified cost but also a risk to the safety of the system.
The cell is still open at this stage, and it's possible to blow a tracer gas inside and carry out a test in vacuum chamber. Helium is typically used for this purpose, as it is an inert gas that does not interact with the active elements of the cell.
Marposs can offer a wide range of leak testing applications based of helium in vacuum chamber technology, from semi-automatic benches for laboratory and sample testing to fully automatic machines dedicated to 100% testing in mass production.

HELIUM RECOVERY SYSTEM

All the vacuum chamber applications can be integrated with the helium recovery system to reduce the operating costs. Marposs offers HeSAVER: the standard & modular solutions for trace gas recovery, making your investment fully sustainable.

END OF LINE LEAK TESTING

After filling with electrolyte, the final sealing of the filling hole must be checked for product validation at the end of the line. Depending on the process, the test can be performed before or after formation, or after the aging and end-of line testing operations.
At these stages, the cell no longer has any openings through which an external tracer gas can be injected and it is therefore necessary to use a different type of test, which performs the direct tracing of the electrolyte vapours in a vacuum chamber.
The technique can be applied to any type of cell, prismatic, cylindrical or pouch, and for different electrolyte compositions. For the pouch type, due to their soft housing, it is sufficient to limit the expansion of the cell in the vacuum chamber to test the perfect sealing along the entire edge of the welding seam.
Electrolyte tracing is perfectly compatible with automatic line integration for 100% control of mass production. To ensure compliance with the line rate, the test can be carried out in batches, by simultaneously inserting several cells inside the vacuum chamber.
For off-line re-check of scrap batches, Marposs offers the Leak B-Tracer, an easy-to-use semi-automatic station designed to test the tightness of different types of battery cells (cylindrical - prismatic - button - pouch). This equipment is the perfect solution also for testing in R&D laboratories, check of pre-series production and small volume pilot lines.

LEAK TEST IN BATTERY PRODUCTION

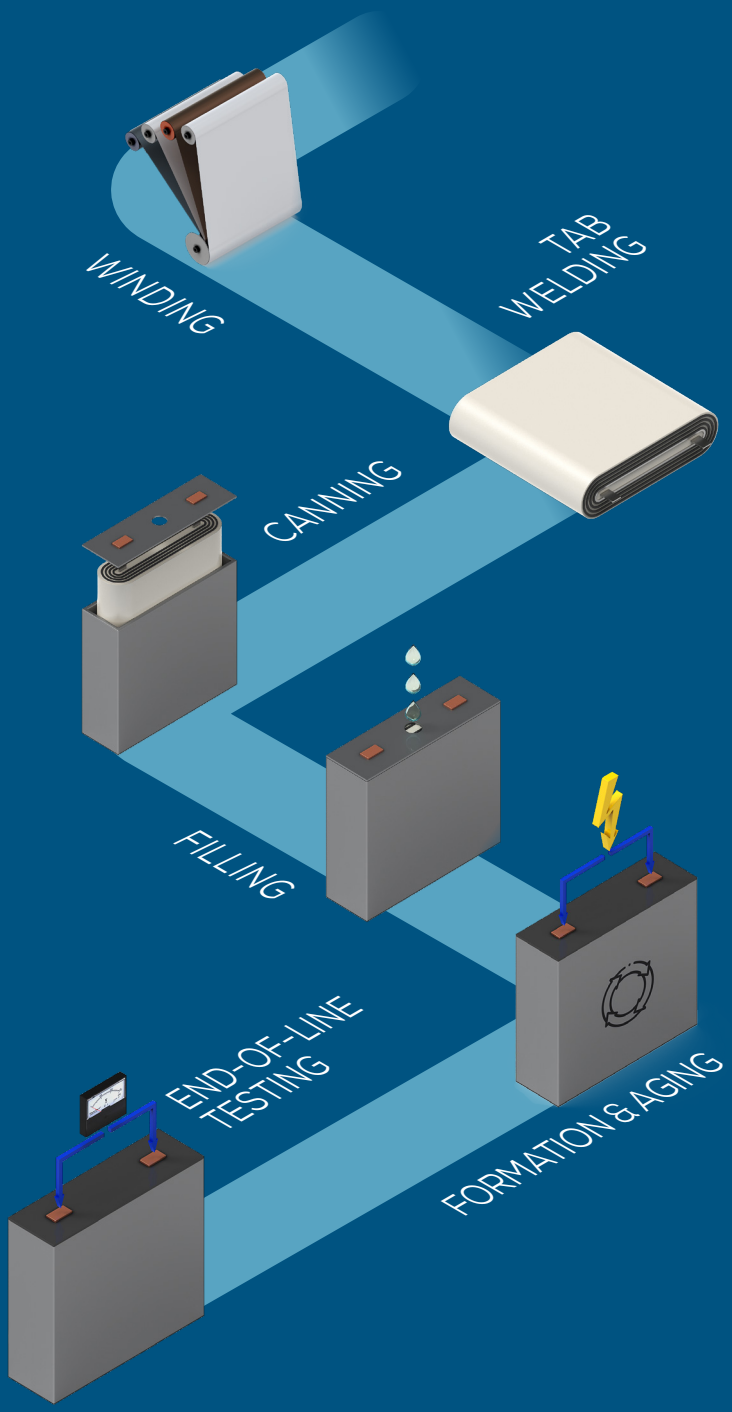
The proposal now covers all stages of the process, including conventional helium tests in vacuum chamber, for the cell housing, for the cell covers, the test of the complete cell before electrolyte filling and leak test of the cells after electrolyte filling. MARPOSS can provide a wide range of products and customized applications dedicated to leak testing of Li-ion battery cells with different shape: prismatic, cylindrical and pouch. The quantity, as well as the type of cells to be tested, can be easily defined and modified to accommodate new requirements by manual retooling of the sealing fixtures.
In case of test after the electrolyte filling the system can easily work with any type of electrolyte and, by using the AMU scanning procedure, our system can easily identify the correct AMU value without knowing the recipe of the solvent.
Leak test applications can be also integrated in production lines with high-speed level production, by multiple stations or by testing more cells in parallel.

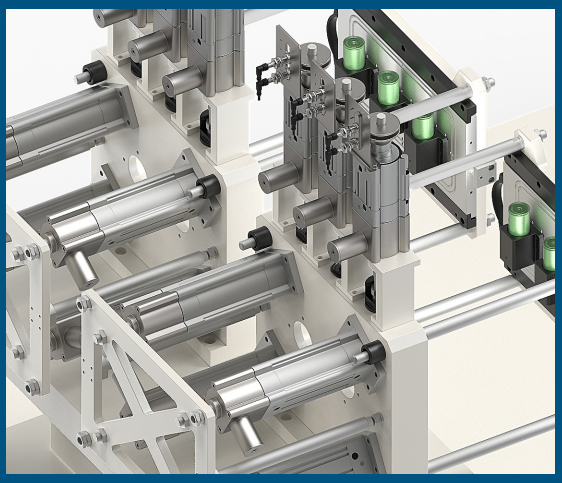
HELIUM RECOVERY SYSTEM: HeSAVER

A high efficiency helium recovery system connected to the leak test machines, either integrated or as a stand-alone unit, provides a fully integrated process, giving better system reliability with the shortest payback period ever.

- Recovers up to 95% of helium or He/N_2 mixtures
- Wide range of capacities (up to 1000 Nl/m) and operating
- Pressures (up to 350 bar)
- Very short payback period

Leak testing is a fundamental operation in the entire battery cell manufacturing process, especially for the new generations of lithium-ion secondary batteries. The perfect sealing of the case is one of the most important features, not only to prevent the dangerous leakage of electrolyte (which can produce toxic substances when in contact with the atmosphere), but also and above all to guarantee the quality and long-term reliability of the cells.
Checking the tightness of the battery cells before and after electrolyte filling is an essential operation in the lithium-ion cell production chain, fundamental to guarantee the quality and safety standards typical of the automotive market.





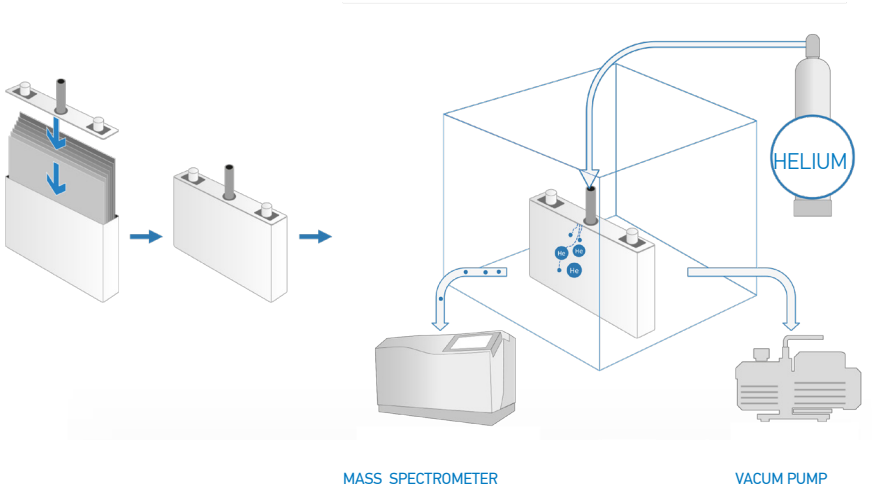
LEAK TESTING OPEN CELLS

- Helium tracing

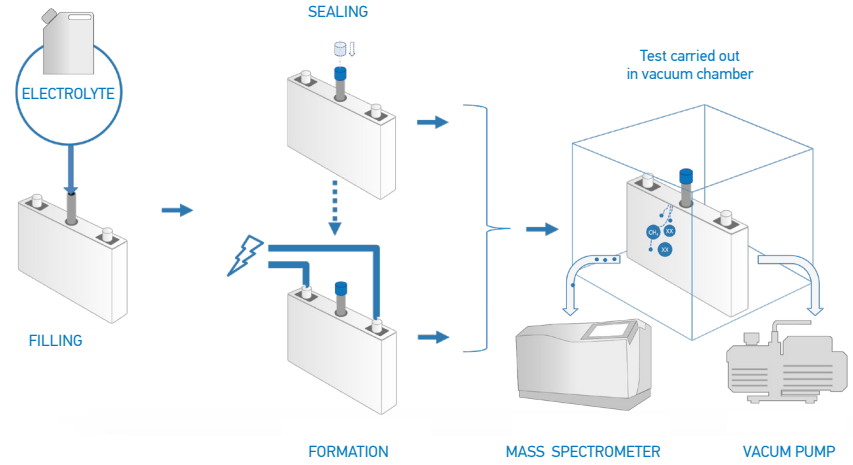
LEAK TESTING SEALED CELLS

- Electrolyte tracing

HOW WE TEST?



The Helium Leak Test in a Vacuum Chamber is a highly sensitive technique used to detect and quantify leaks in sealed components or systems. The component under test is introduced in a testing chamber and connected through a hole to the tracer gas (helium) circuit. The testing chamber and the tested component are separately emptied by the vacuum pumps, before opening the supply of tracer gas which is blown into the component.
In case of sealing defect, the tracer gas leaks out from the component towards the testing chamber, where it is collected and driven to a mass spectrometer that measure its amount and quantify the leakage.



The electrolyte tracing technique has been developed by Marposs expressly to allow the cell to be tested in the final stage of the process.
By loading the cells in vacuum chamber, in event of leak, it's possible to vaporize and extract the solvents, so to detect and quantify the leak through an appropriate mass spectrometer version.

The use of a dedicated calibration procedure, performed on master leaks expressly designed to carry out the test on the specific electrolyte configuration, allows not only to detect the presence of leaks but also to measure their extent, to compare them with the acceptability threshold.

CLICK or SCAN

DISCOVER MORE!
ELECTROLYTE TRACING TECHNIQUE

MARPOSS

For a full list of address locations, please consult the Marposs official website

Some models of the product line, or parts of them, may be subject to export restrictions if exported outside the European Union or may be subject to restrictive measures adopted by the competent national, supranational or international authorities.