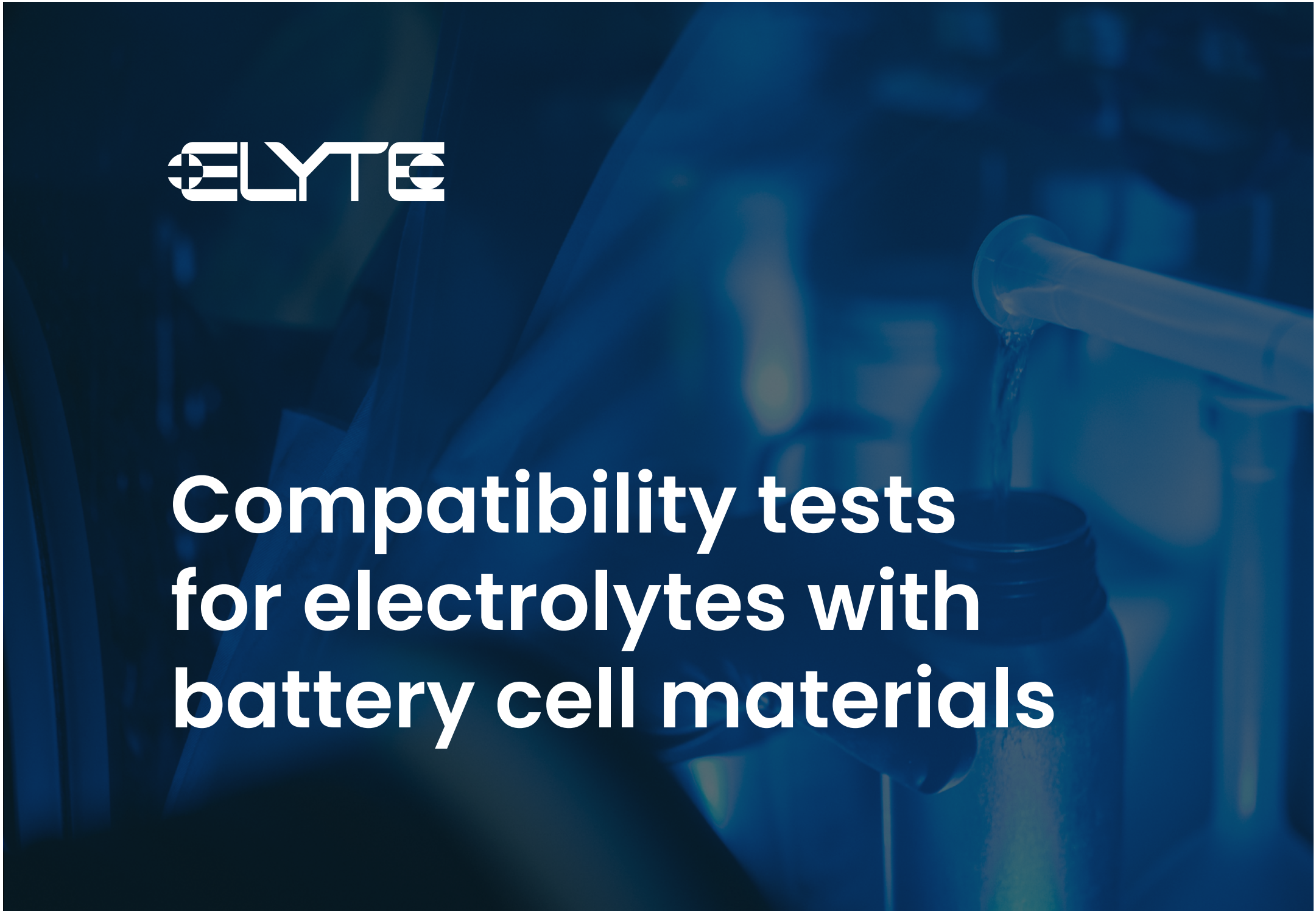
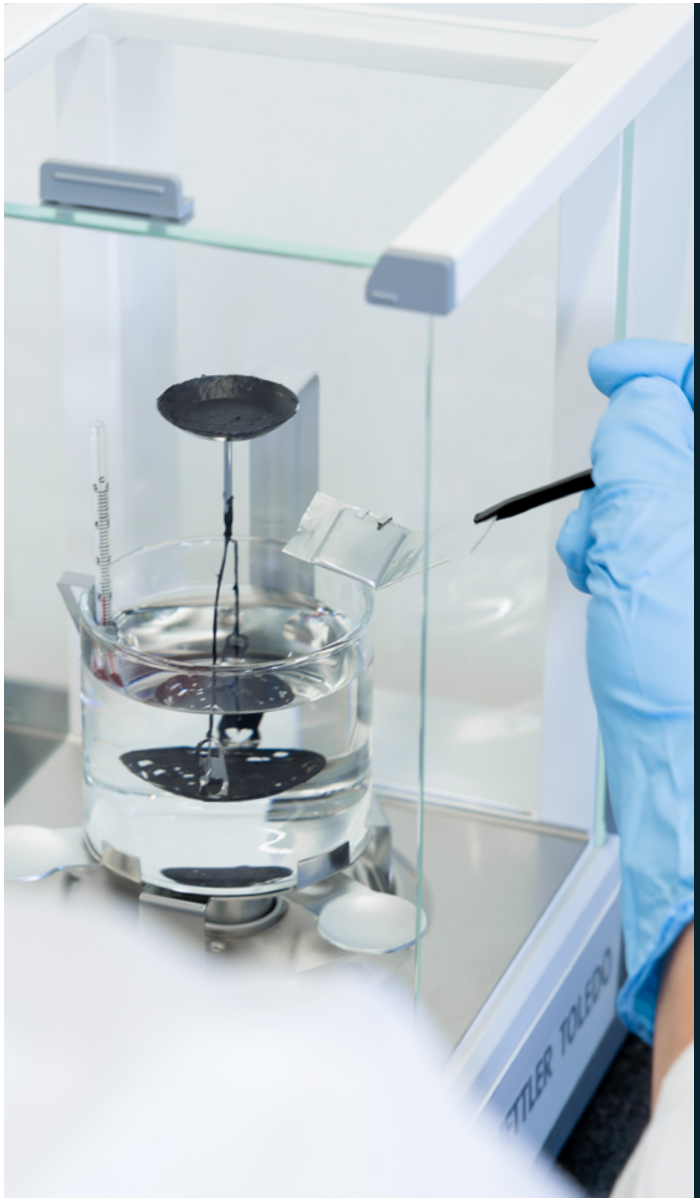


Compatibility tests for electrolytes with battery cell materials

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Who benefits from compatibility testing and what results are achieved?

E-Lyte offers tailored compatibility testing designed specifically for gasket and sealing material manufacturers. Since sealing materials in battery cells inevitably come into contact with the electrolyte solution, ensuring chemical compatibility is essential for safety, longevity, and performance.
To qualify a sealing material for use in battery cells, it must undergo thorough testing within a carefully designed, application-specific test scenario. That's why we begin every project with a collaborative workshop, working closely with our partners to define a targeted, results-driven testing strategy aligned with their materials and application goals.
Partner with E-Lyte to gain the insights you need before your materials go into production.

Significance of compatibility tests against liquid electrolytes

Sealing materials: Critical components in battery systems

In high-performance battery systems, such as those used in electric vehicles and other demanding applications, the compatibility of sealing materials against liquid electrolyte solutions is crucial. These seals ensure that the electrolyte remains securely within the cell while protecting against moisture and external contaminants.

Safety and longevity through material resistance

The safety, longevity, and efficiency of battery cells rely heavily on the integrity of these sealing materials. If seals are not chemically resistant, they can degrade or decompose over time. This can lead to electrolyte leakage and trigger chemical reactions with other cell components. Depending on the severity of the reaction, this may reduce performance, or in extreme cases, result in complete cell failure, potentially causing fire. In either case, the battery cannot operate reliably over its expected lifecycle.

Performance stability over time

Durability testing ensures consistent performance of the battery cell throughout its service life. Leakage of the liquid electrolyte affects the cell's functionality by lowering the concentration of the electrolyte solution. As a result, the cell may no longer reach its rated capacity during charging, reducing its ability to store electrical energy effectively.

Reducing environmental risk

Beyond performance concerns, leaked electrolyte can pose significant environmental hazards. Depending on the chemical composition, harmful substances may be released, leading to contamination and environmental damage. Resistance testing plays a key role in reducing these risks by preventing leakage before it occurs.

A key step in battery design and manufacturing

Resistance and durability testing of sealing materials is an essential part of modern battery design and production. It ensures safety, reliability, and environmental responsibility, especially in applications where battery failures can have serious consequences.

Our process to qualify materials for battery manufacturers



1 Set the right goals together

Successful collaboration starts with a shared understanding. No one knows the product better than its developer. Therefore, the first step is to fully understand the sealing material. Equally essential is a deep understanding of the electrolyte system it interacts with, as this complex chemical system can significantly influence material performance within the battery cell. In a focused workshop, both sides exchange insights into the sealing material, the electrolyte composition, and the chemical interactions during operation. This creates a solid foundation, aligns expectations, and ensures effective project planning. By critically evaluating the original objectives and applying our expertise, we define clear project goals and specific parameters for durability testing, ensuring that the material is fully qualified for use in battery systems.

2 Design of a custom-fit test study

Once a shared understanding is in place and clear project goals have been defined, the next step is the design of a custom-fit test study. Tailored to the specific properties of the sealing material and the electrolyte system, the study ensures well defined test conditions and meaningful results.

3 Benchmarking studies

To give full transparency and context, we also share insights from previously completed compatibility studies. These real-world examples help illustrate what can be expected from the process and final results.

Methods and procedures for compatibility tests

To test electrolyte compatibility with various materials, two complementary methods are used. The first involves storing material samples in electrolyte under controlled temperatures, allowing for detailed electrolyte analysis (method 1). However, it doesn't capture the effects of formation gases or vapors, and decomposition products may impact results. The second method uses prototype pouch cells to expose materials to realistic conditions, including gases and vapors (method 2). While this arrangement is more representative, this setup limits electrolyte analysis and may be influenced by physical changes like material swelling.



Method 1

Storage of material samples in electrolyte under temperature control for a defined period of time.

1. Material test

- Determination of reversible and irreversible swelling of material samples via Archimedes method
- Determination of weight changes of material samples



2. Electrolyte test

- Free acid content determination
- Colour determination acc. to ASTM D1209 (APHA)
- IC - Identification and quantification of the following components: LiPF6, LiFSI, LiTFSI, LiBF4, LiDFP. Trace analysis of anionic impurities: Chloride, Bromide, Sulphate
- GC-FID or GC-MS - Identification and quantification of the following components: DEC, DMC, EC, EMC, FEC, VC. Detection of volatile impurities
- ICP-OES - Identification and quantification of the following components: Al, B, Ba, Ca, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, P, Pb, Si, Zn. Additional elements on request
- HPLC-MS - Identification of organic molecules

3. Electrochemical evaluation of electrolyte after material contact in pouch cells

- 1st cycle differential capacity
- Coulombic efficiency at formation & conditioning cycles
- Absolute & relative discharge capacity
- Voltage hysteresis & efficiency and internal resistance development (HPPC)
- Quantification of gas formation during formation and cycling via Archimedes method

Method 2

Storage of material samples in prototype pouch cells under temperature control.



1. Material test

- Determination of reversible and irreversible swelling of material samples via Archimedes method before and after cycling
- Determination of weight changes of material samples

2. Electrochemical evaluation of sample material in pouch cells

- 1st cycle differential capacity
- Coulombic efficiency at formation & conditioning cycles
- Absolute & relative discharge capacity
- Voltage hysteresis & efficiency and internal resistance development (HPPC)
- Quantification of gas formation during formation and cycling via Archimedes method

Let's get started

Contact

sales@e-lyte.de

www.e-lyte.de

E-lyte Innovations GmbH
HQ, Production & Analytics

Werner-Heisenberg-Str. 1
67661 Kaiserslautern
Germany

E-lyte Innovations GmbH
R&D Center and Lab-Scale Production

Mendelstr. 11
48149 Münster
Germany

