



SafeLIB

**Safety Aspects of Lithium-Based
Traction Batteries**

Including the Qualification for
Second Life Applications

Towards guaranteed operational safety under all conditions for the use of LIBs in 1st and 2nd Life

Lithium-ion batteries (LIBs) are regarded as the key technology for electric energy storage and are widely used as traction batteries for vehicles. Their further/extended use in stationary, semi-stationary or other mobile applications ("2nd Life") is becoming increasingly important for reasons of sustainability and economic efficiency, be it in electrical energy storage systems or in industrial trucks.

In addition to many advantages, however, LIBs pose a considerable hazard potential (e.g., fire) regardless of the area of application. To ensure the operational safety of LIBs over their entire life cycle, there is currently a lack of sufficiently detailed understanding and knowledge. This includes the safety-relevant assessment and qualification, but also the improved early design of automotive LIBs for their reliable use ("1st Life"), reuse (especially after an accident) as well as other further use ("2nd Life").

The Key Questions

SafeLIB and its competent partners from science and industry aim to answer the following open research questions:

Q1 How can detailed knowledge about the (crash) behavior of one specific cell be used to conclude about other cells ("transferability of key properties, parameters and safety indicators"), enabling improved safety and overall design at an early development stage suitable for both 1st and 2nd Life?

Q2 How do specific electrical and electrochemical ageing mechanisms influence the mechanical and safety relevant behavior of LIB cells and modules in crash load cases? / Are LIB cells and LIB modules still safe to use in a vehicle after crash?

Q3 How can LIB modules from vehicles be technically qualified regarding safety for "2nd Life" applications (e.g., stationary energy storage or industrial trucks)? / Under which requirements and framework conditions (e.g., legal, business) can and may a manufacturer use LIBs from vehicles for its products?

The Goals

To this end, SafeLIB has set itself the following goals (G1-G3)



G1

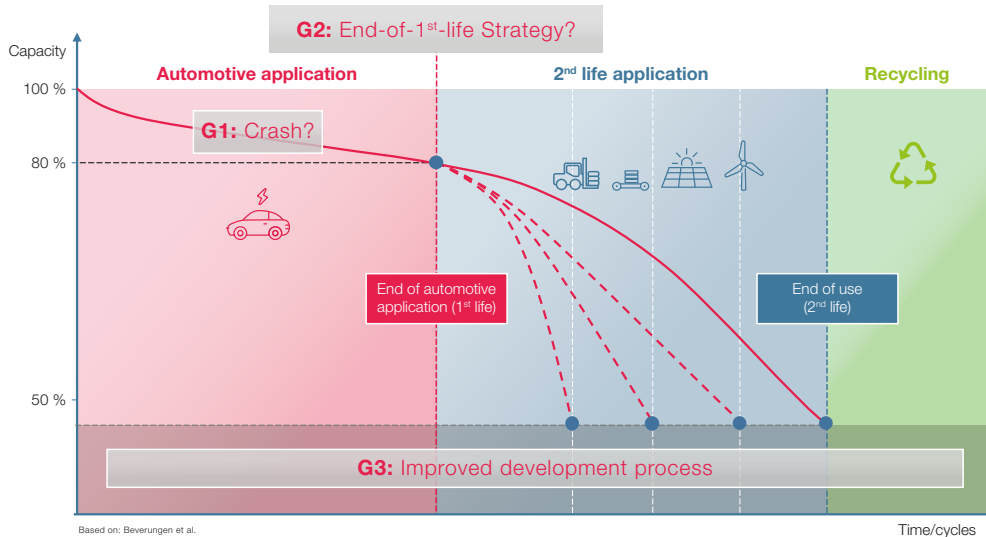
Assessment of the safety status of automotive LIBs in a crash, considering the product history ("First Life")

G2

Qualification of (automotive) LIBs for "Second Life"

G3

Improved battery design in the development process for the entire product life ("First and Second Life")



The SafeLIB Research Projects

P1: TRANSFER

Transferability of relevant properties between different LIB-cells and LIB-modules

- Making numerical models of Li-ion cells more time efficient and accurate to allow accurate failure mode prediction and localization – even at an early stage of the vehicle development process
- Improving the test boundary conditions for the investigation of thermal runaway of cells and the subsequent thermal propagation to adjacent cells to ultimately improve containment methods and thus safety for vehicle occupants and the environment in the event of cell failure

P2: INFINITY

Influence of ageing mechanisms on the mechanical and safety behavior of LIB cells

- Providing methods for assessing the state of safety of LIBs in the event of a road accident, considering the product history, to provide the best possible protection for all persons involved in an accident but also for the environment

P3: SEQUEL

Safety qualification criteria for increasing sustainability

- Creating a methodology for the evaluation and qualification of used automotive LIBs for 2nd life applications (mobile, semi-stationary and stationary) to directly increase their useful life (taking into account technical, economic/business, and legal aspects)



Contact

Vehicle Safety Institute – VSI Graz University of Technology

Inffeldgasse 13/VI

8010 Graz, Austria

Website: www.vsi.tugraz.at

Christian Ellersdorfer (Overall Coordinator)

Phone: +43 (0) 316 873 30318

E-Mail: christian.ellersdorfer@tugraz.at

Florian Feist (Lead P1)

Phone: +43 (0) 316 873 30312

E-Mail: florian.feist@tugraz.at

Gregor Gstrein (Lead P2)

Phone: +43 (0) 316 873 30314

E-Mail: Gregor.gstrein@tugraz.at

Jörg Moser (Lead P3)

Phone: +43 (0) 316 873 30322

E-Mail: joerg.moser@tugraz.at

www.tugraz.at/projekte/safelib



scientific partners



Institute of Chemistry
and Technology of Materials



Vehicle Safety Institute



industrial partners




Mercedes-Benz



Wacker Neuson
Group

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