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Best Practice Battery Design by OST

Enhanced Durability, Cold Start Property and Fast Charging Opportunity

End users request for battery systems that last long, can be used with full performance even under extreme environmental conditions and can withstand the awaited fast charging. To warranty this an adequate thermo management system is essential. Nowadays, such systems are electrically and thermally simulated directly after design to predict their behavior in advance.
A bottleneck is still the thermal characteristic of the battery cell and the derivation of a corresponding model, i.e. the determination of a digital battery cell twin. To answer this at OST a novel unique test equipment was build up, where the thermal behavior of Li-ion cells can be characterized [1]. Including this into a ROM battery model the design and further improvement of a battery system including the thermal management can be realized fast and agile by simulation.

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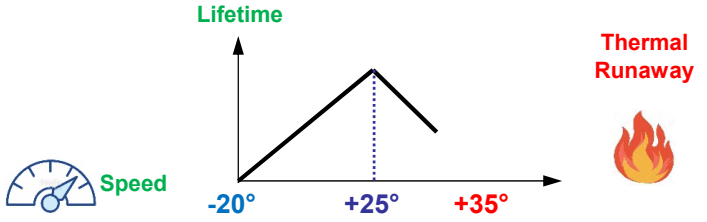
Requirements by End Users

Aging, full load conditions under extreme ambient temperatures and fast charging possibilities are among others a question of thermal conditioning:

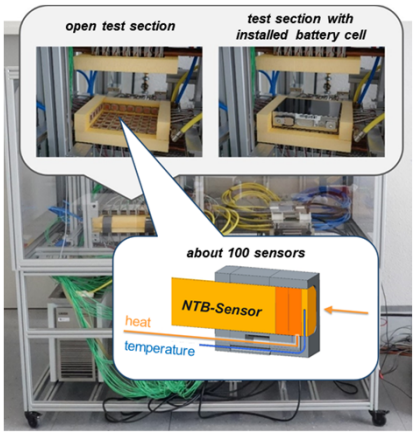
- ***min. aging is guarantied around 25 °C***
- ***at very low temperatures full load cannot be demanded due to Li plating***
- ***at very high temperatures full load cannot be demanded due to the risk of a thermal runaway***
- ***fast charging is causing rapid increase of internal temperature of a battery cell.***



Unfortunately Battery Cells are often a Black Box for Battery Designers:

Knowledge of the transient thermal and electrical cell behavior enables to build up a digital twin of the cell and whole battery system.

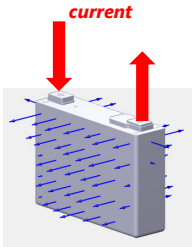
CTR – Cell Test Rig at OST



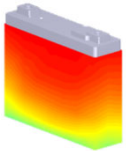
Unique Selling Point of OST

- ***How much heat from where ?***

(experimental evaluated)

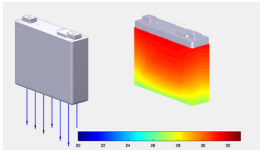


- ***Digital Twin of Battery Cell***



(derived by experimental data)

- ***Experimental validation of pursued cooling concepts***



NEW:

⇒ fast / agile adaption of the model to battery cell and cell chemistry

⇒ efficient practice-oriented approach (speed-up 10^2 to 10^3)

References

[1] Rouven Christen, Gerhard Rizzo, Alfred Gadola and Max Stöck: "Test Method for Thermal Characterization of Li-Ion Cells and Verification of Cooling Concepts", Batteries, Vol. 3(1), Art. 3, 2017.

[2] T. Waldmann, M. Wilka, M. Kasper, M. Fleischhammer und M. Wohlfahrt-Mehrens: „Temperature dependent ageing mechanisms in Lithium-ion batteries - A Post-Mortem study", Journal of Power Sources, Bd. 262,P. 129-135, 2014.

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