Thermal investigation of inhomogenities in aged batteries using an isoperibolic calorimeter

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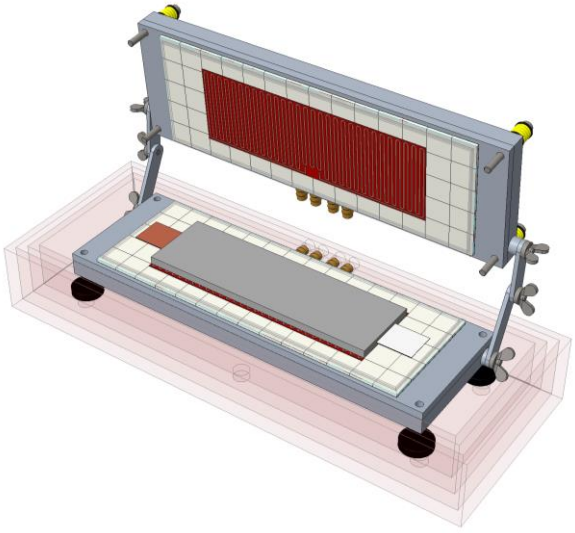
The energy dissipation and the corresponding heat release within a lithium-ion battery cell is an important indicator regarding the overall state of health (SoH). In this context, inhomogenities resulting from the layered internal structure and the complex production chain of the cell play a crucial role as they lead to additional stress. While in new pristine cells these inhomogenities are typically small, they increase with aging [1] evolving to distinct non-uniform heat release distribution so called “hotspots”.

In this work, an isoperibolic calorimeter (see figure) as an extension of [2] is built to measure the heat release of large format pouch cells. It uses spatially distributed thermoelectric generators (TEGs) based on the Seebeck effect to accurately determine not only the total heat release of the cell but also the local heat flow across the outer surface of the pouch cell.
Based on this experimental data, the thermal uniformity of the cell can be used as an additional quantity for aging characterisation. This allows insights of the underlying degradation modes extending the information derived from the most commonly used electrochemical methods like electrochemical-impedance-spectroscopy (EIS) and differential-voltage-analysis (DVA).



References:
[1] Baumhöfer, T.; Brühl, M.; Rothgang, S.; Sauer, D.U. Production Caused Variation in Capacity Aging Trend and Correlation to Initial Cell Performance. J. Power Sources 2014, 247, 332–338.
[2] Steeb, M.; Riedel S.; Sarge, S. M.; Tegethoff, W.; Köhler, J.: Thermal investigation of battery heat production and aging using an isoperibolic calorimeter. Die 24. Kalorimetrietage, Braunschweig, 26.-27. Mai 2021. pp. 114-115