Enhanced self-discharge tests for lithium-ion cells via current pulse measurements

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Lifetime of lithium-ion cells is an important issue for application in electric vehicles (EV). Since time-to-market is a decisive factor, accelerated aging tests at elevated temperatures for calendar life predictions are performed [1].
However, even those accelerated aging tests take six [2] up to twelve [3] months. We present a new test method, based on current pulse measurements, which reduces the measurement time for the determination of the temperature dependence of self-discharge to two days. Thereby, the temperature dependence of self-discharge R_{self} becomes accessible by measurement of only one lithium-ion cell, as measurements now can be performed sequentially. Figure 1 shows, that the temperature dependence of self-discharge can be described by Arrhenius behavior.

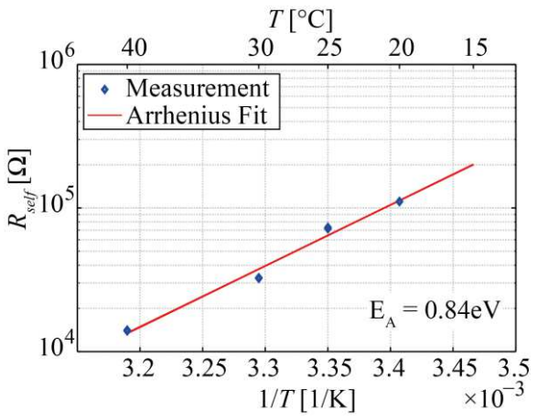

Figure 1: R_{self} determined by current pulse measurements exhibits Arrhenius behavior in the investigated temperature range.

This self-discharge constitutes of a (i) reversible and (ii) irreversible capacity loss [4]. Since this new method yields only the total self-discharge, standard-type storage experiments had to be performed for separating reversible and irreversible capacity loss.
Measurements, performed on commercial pouch cells with a blend cathode of LCO/NCA, are presented and compared to standard-type storage experiments for validation.

References:

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