Metadata for the dataset

Time-series cyclic aging data on 48 commercial NMC/graphite Sanyo/Panasonic UR18650E cylindrical cells.

1. Overview

In the experiment 48 cells of the same type were aged with the same profile under equal conditions. Prior to aging the initial performance was determined by a comprehensive begin-of-life (BOL) test. Aging reference parameter tests (RPT) were conducted in regular intervals to determine the current cell performance. Due to measurement equipment limitations the tests were started with batches of four cells every two to three days and thus slightly shifted in time.

2. Tested battery cells

The cells used in this investigation are Sanyo/Pana-sonic UR18650E cylindrical cells which are commercially available and produced in large quantities in an established fabrication process. This type uses a carbon anode and NMC as a cathode material. These cells were graded into group C from the manufacturer and are drawn from the same production lot. Due to this factory selection the cells only have a mean capacity of approximately 1.85 Ah compared to the A-grade nominal capacity of 2.05 Ah.

3. Testing procedures

The first part of the begin-of-life test is a measurement of pulse resistances without prior conditioning of the cell. All cells are delivered at nearly the same state of charge, which is set by the manufacturer after formation to minimize aging during storage. An optimal procedure for cell selection would work at this SoC to save the time for conditioning the cell. Thus only temperature equalization to 25°C is performed before the pulse resistance test at the delivery SoC. Next the capacity for different current rates is being determined. The cut-off voltage and maximum charge voltage are chosen to be moderate (3 V and 4.1 V) to minimize the stress from BOL and RPT testing. The charging is conducted with constant current of 2 A and the maximum charge voltage is being held until the current is lower than 40 mA. The pulse resistances followed by an impedance spectrum are measured at three different temperatures and three different voltage levels. To set the voltage level the cell is first charged and then discharged using a constant current of 2 A until the desired voltage

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is being reached. Then this voltage is held until the current is lower than 40 mA. This conditioning is always performed at 25°C, afterward the measurement temperature is set. The three voltage levels correspond to approximately 70%, 50% and 30% state of charge.

Cycling of the cells is conducted at a constant ambient temperature of 25°C. One cycle consists of 30 min discharging to 3.5 V and 30 min charging to 3.9 V, both current limited to a maximum of 4 A. The charge turnover is about 1 Ah and corresponds to cycles between approximately 20% and 80% state of charge. Because of the voltage limits the charge turnover varies with the state of health of the cell, but the depth of discharge in relation to the aged capacity is being kept nearly constant (only influenced by the resistance increase). This cycling methodology is motivated by real world applications where the operating regime is limited by the voltage levels and also helps to reduce the influence of the test equipment variations.

The RPT only includes the capacity tests and pulse resistance tests at 25°C but at all three voltage levels. No impedance measurements are included. In this work only the 2 A discharge capacity is being used as the performance measure.

4. Data description

The detailed description of the data structure, data variables and the processed version of this raw data can be found in the following gitlab project:

https://git.rwth-aachen.de/isea/battery-degradation-trajectory-prediction

5. License