

30Q Lithium-Ion Cell Cycling With Strain Monitoring

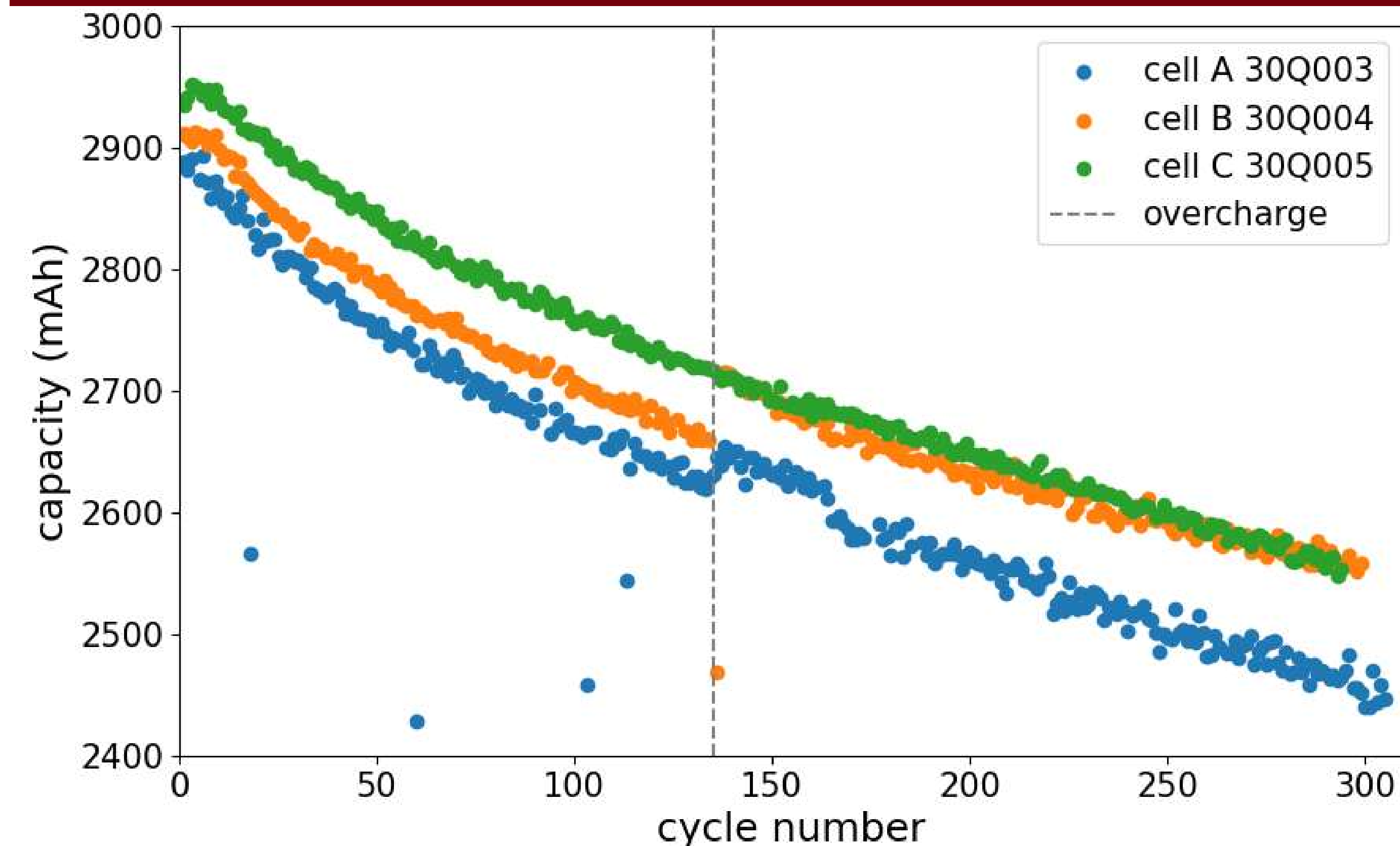
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Objective

- The objective of this study is to analyze the effects of 1C cycling on Samsung 30Q 18650 cells with a focus of evaluating hoop strain recordings. To allow the development of tools which rely on strain monitoring to quickly and effectively control battery operation.
- Cycling was performed using CCCV charge at 3 A with a 0.15 A cutoff, 3 A CC discharge, receiving a one-hour rest between each charge or discharge.

Cycling Data – Cell Capacity Degradation

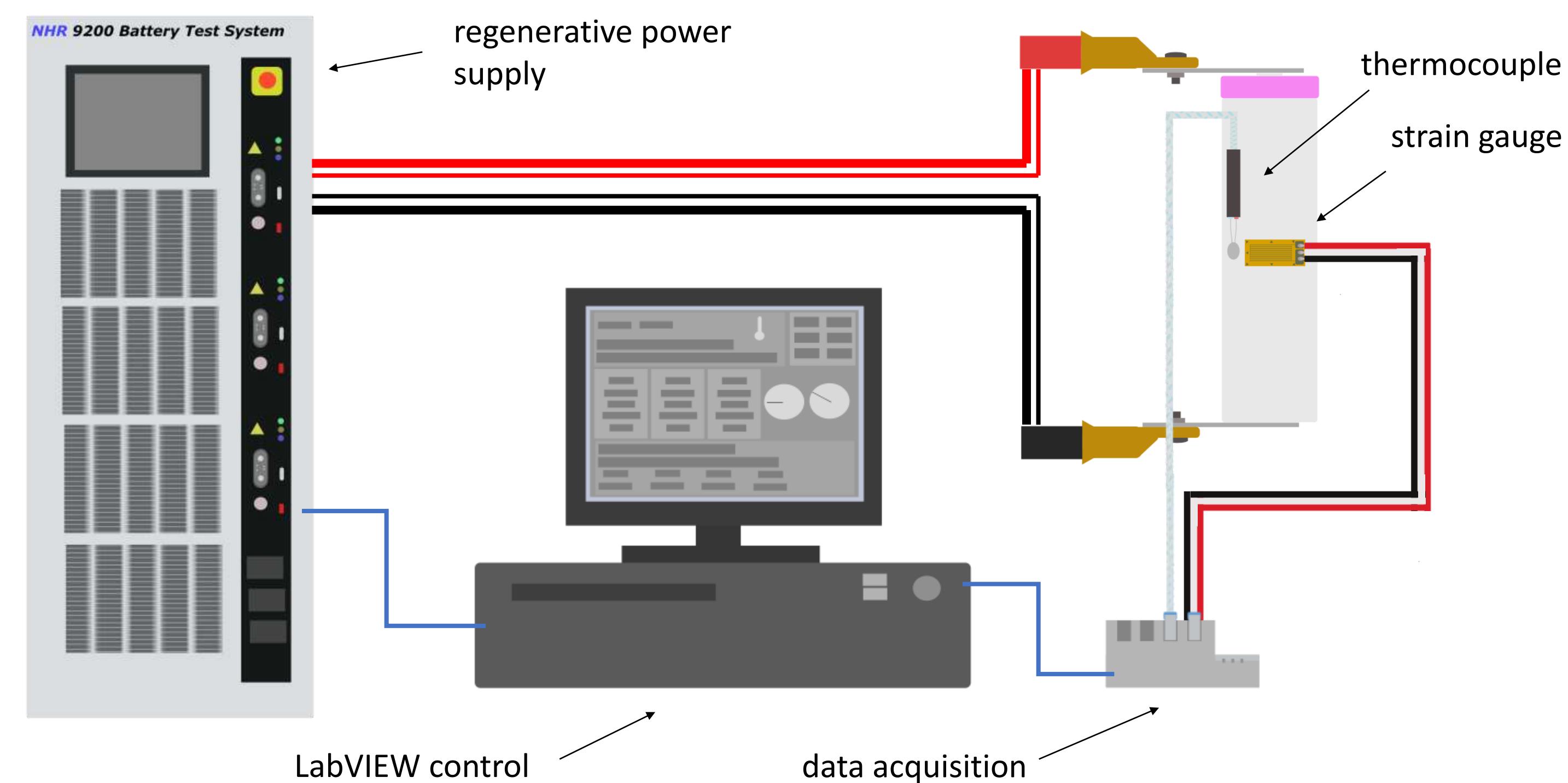


- Several issues arose during long term testing, of which some would result in overcharging or undercharging of single cells.
- Future modifications to hardware and software will prevent erroneous data and protect cells from damage caused by software control issues.

Samsung 30Q 18650 Specifications

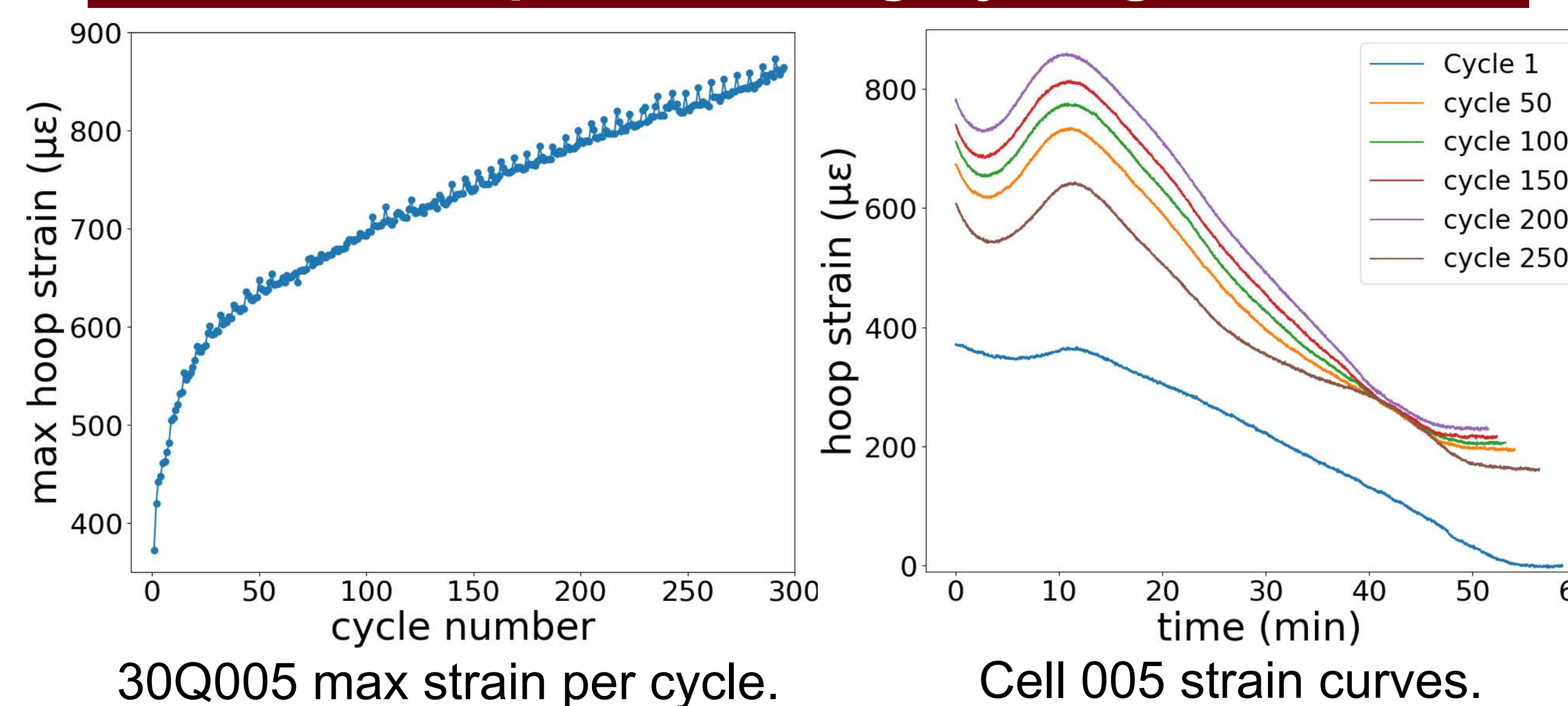
- 3000 mAh Capacity
- 2.5 V to 4.2 V Operating range
- 3.7 V Nominal voltage
- Nickel Cobalt Aluminum (NCA) Chemistry

Testing Setup



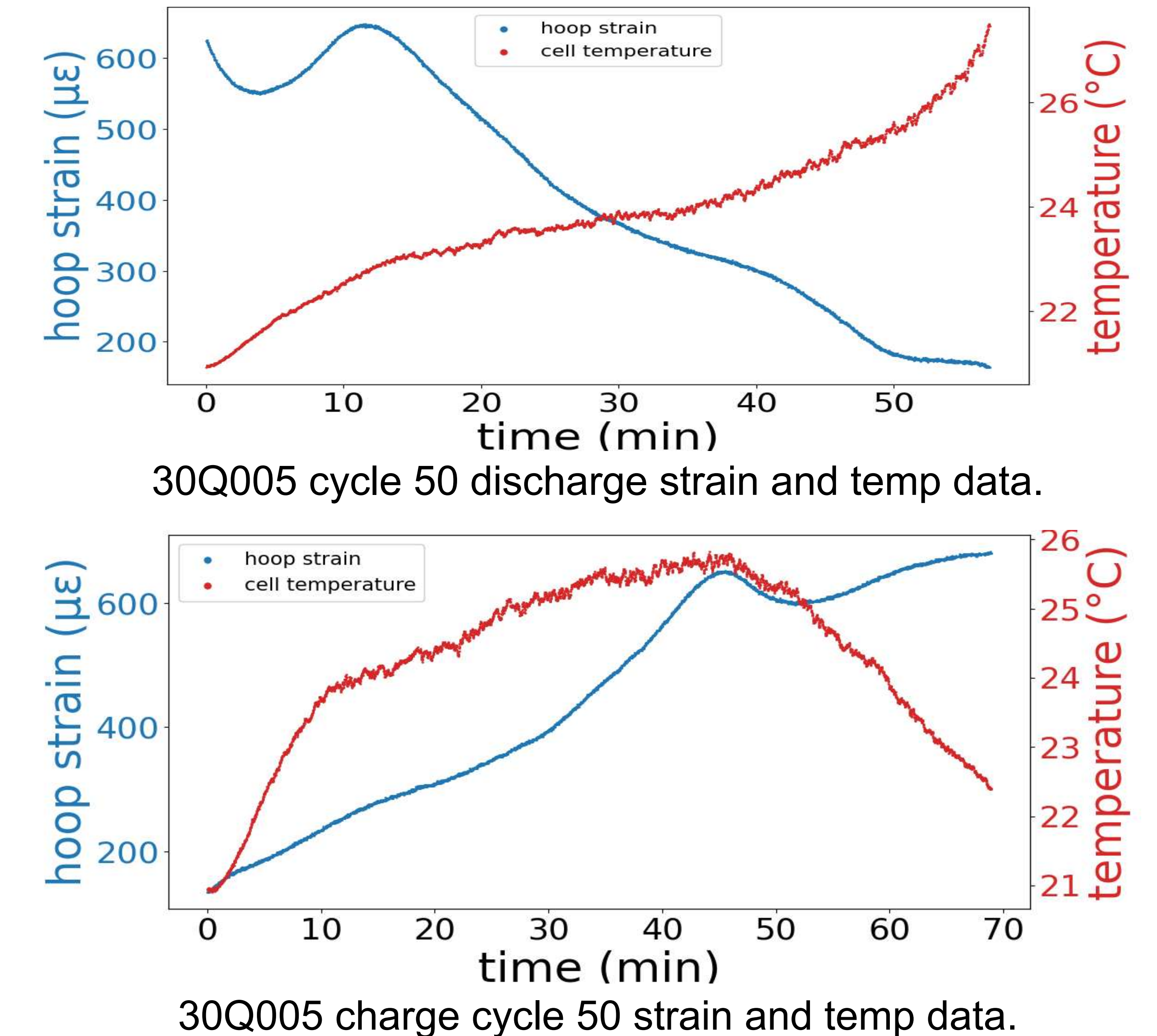
- Testing is controlled through LabVIEW with strain and temperature data being monitored through an Ni cDAQ.
- Cell voltage and current is monitored and controlled through the NHR battery test module operating as a DC power supply.

Strain Development During Cycling



- Analysis of strain recordings throughout the cycling process reveals several unique trends.
- As the battery ages, its charged strain level increases, which can be seen in both graphs. Additionally with age, the size of the change in strain steadily increases.
- As these cells approach their end-of-life, we hope to see a strain response.

Single Cycle Strain Analysis



- From the collected data it is clear these cells grow when they are charged and shrink when discharged.
- This data makes it clear that there is clear correlation between a cell's SOC and its strain level. And that strain recordings are not due to temperature changes within the cell alone.

Results & Future Work

- While more testing must be performed to construct a solid understanding, initial results have proven there is a significant effect on battery strain during a battery's lifecycle.
- Future work will focus on developing a more refined knowledge of strain. And incorporating strain into battery management systems for health monitoring and fast charging control.