ACCU BOOST TRUST PROVEN

Technical report on Li-Ion elements testing results

About our company.

BATTERY RENOVATION is a company that specializes in professionally testing and refurbishing rechargeable batteries for electric bicycles, scooters, and other devices based on Li-Ion cells.
Additionally, we develop and manufacture specialized, high-precision equipment for diagnosing Li-Ion elements and batteries, as well as assembling new Li-Ion battery packs for various purposes.
We also sell tested Li-Ion cells with a "battery element passport" issued based on test results.

What sets us apart? It's our responsible approach, high expertise, the use of innovative scientific methods, and the availability of unique specialized equipment that allows us to quickly and accurately analyze the parameters of battery packs and Li-Ion cells, ensuring a high standard of diagnostic quality and refurbishment work.

Every rechargeable battery and individual Li-Ion cell we install in a battery pack or sell undergoes rigorous testing, with detailed test results presented in both tabular and graphical formats.

Thanks to our thorough and responsible approach, all our customers not only have the right but also the opportunity to know precisely what they are acquiring. They can not only refurbish their rechargeable batteries or purchase new Li-Ion cells but also acquire a completely accurate and well-documented amount of Watt*Hours of energy.

1. Introduction:

Before installation into the battery pack, all Li-Ion elements undergo thorough testing and are individually matched according to their characteristics determined during the test process. Each element undergoing testing is assigned a unique number, which is displayed on the report page.

In this report, the test results of each element installed in the battery pack are compiled in a final table with a detailed graphical representation of the discharge process during testing.

2. Li-Ion Element Testing Methodology:

During the test, charged Li-Ion elements are discharged from 4.2 volts to 2.6 volts. The entire voltage reduction scale is divided into segments with a 0.01-volt increment. After each segment is completed (meaning, when the element's voltage decreases by 0.01 volts during discharge), voltage, discharge current, and segment passage time are automatically measured with high accuracy.

Based on the measured data, other indicators and parameters are calculated. The capacity of the element is equivalent to the energy released by the element during the entire discharge period.

3. Key characteristics of measurement equipment:

Voltage measurement resolution of Li-Ion element (volts)	0,00125
Current measurement resolution of Li-Ion element (amps)	0,0001
Time measurement resolution (seconds)	0,0001
Total relative measurement equipment error (not exceeding) (%)	0,25

4. Terminology used in the final test results table for each Li-Ion element:

Element number: A unique 10-digit number assigned to each element during testing. The first 6 digits encode the testing date - year, month, and day.

Voltage before discharge (Volt): The voltage of a fully charged element just before the start of discharge.

Start discharge voltage (Volt). The voltage of the element is measured 3 seconds after the start of discharge.

Start discharge current (Amp). The discharge current of the element is measured 3 seconds after the start of discharge.

High measure voltage (Volt). The voltage of the element at the beginning of discharge, from which the calculation of the energy (capacity) of the Li-Ion element is started.

Low measure voltage (Volt). The voltage of the element at the end of discharge, at which the calculation of the energy (capacity) of the Li-Ion element is stopped.

Finish discharge current (Amp). The discharge current of the element is measured 2 seconds before the voltage decreases to the Low measure voltage (before the capacity calculation ends).

Discharge time (Second). The total time of element discharge from the *High measure voltage* to the *Low measure voltage*, during which measurements are taken, and the capacity of the Li-Ion element is calculated.

Full capacity (Watt * h). The energy delivered by the element during discharge from *High measure voltage* to *Low measure voltage*, is equivalent to its capacity. This parameter provides the most accurate representation of the real capacity of the Li-Ion element compared to *Capacity at an average discharge voltage of X.XXX Volt (mA*h)*. It is calculated throughout the discharge period by summing the energy delivered in each segment when the voltage drops during Li-Ion element discharge by 0.01 volts.

Capacity at an average discharge voltage of X.XXX Volt (mA*h). The capacity of the Li-Ion element is expressed in mAmper * hour. This parameter, by itself, does not precisely reflect the real capacity of the element, because real capacity also depends on changing voltage during discharge. Therefore, the average (effective) value of this voltage *average discharge voltage* is also indicated. It is calculated throughout the discharge period by summing the results of multiplying the discharge current (milliAmpere) by the duration (second) of each segment when the voltage drops during Li-Ion element discharge by 0.01 volts.

Average discharge power (Watt). The averaged value is equivalent to the average power of Li-Ion element discharge.

Calculated impedance (mOhm). The calculated (total, actual, effective) internal electrical resistance of the element is measured during short constant current discharge.

Internal resistance (measured) (mOhm). The internal electrical resistance of a fully charged element is measured by passing an alternating current through the element at a frequency of 1 kHz with an amplitude of 5 volts.

5. The terminology used in the graphic representation of the testing process for each Li-Ion element:

Voltage (Volt). The voltage on the Li-Ion element is recorded when passing through the current segment with a 0.01-volt increment.

Discharge time (Second). The total time elapsed from the beginning of discharge to the moment when parameters are recorded in this segment.

Current (Amper). The discharge current of the Li-Ion element is registered when passing through the current segment.

Segment duration (Secund). The time it takes to pass through the segment (when the element's voltage decreases by 0.01 volts during discharge).

Segment capacity (mWatt * h). The energy released by the Li-Ion element when the voltage drops by 0.01 volts during the passage of the current segment.

Capacity (Watt * h). The energy released by the Li-Ion element from the beginning of discharge, including the current segment's *Segment capacity*.

Discharge power (Watt). The power of the Li-Ion element's discharge during the passage of the current segment.

Capacity gain (mWatt * h / Sec). The average increase in released energy per second during the passage of the current segment (reflects the discharge power of the Li-Ion element).

Load resistance (effective) (Ohm). The calculated (effective) electrical resistance of the external load corresponding to the current segment during discharge.

6.1 Technical report on Li-Ion element testing results

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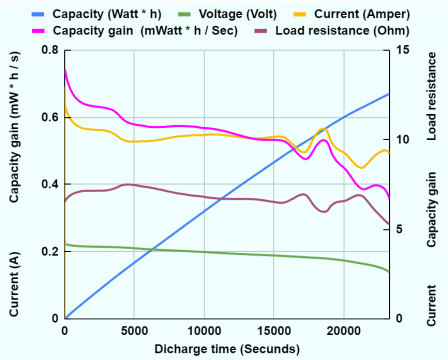
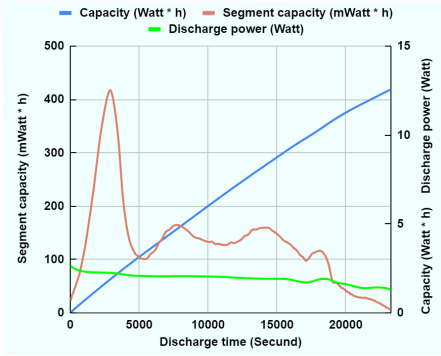
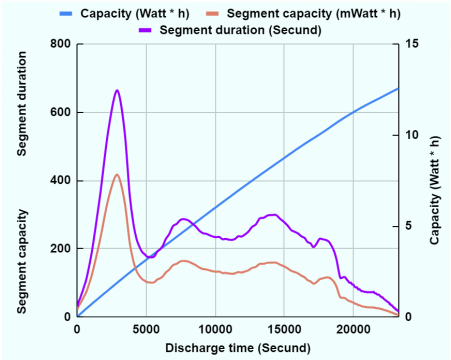
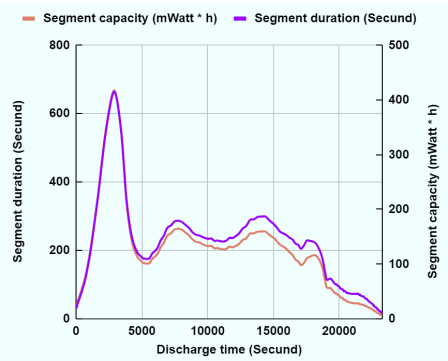
Element Number

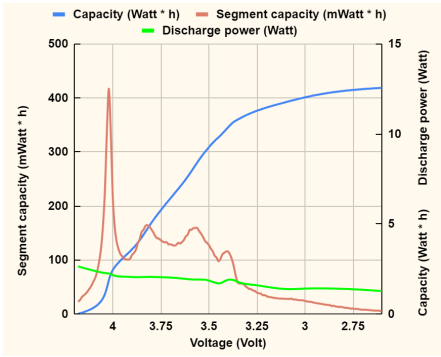
Voltage before discharge (Volt)	4.25
Start discharge voltage (Volt)	4.216
Start discharge current (Amp)	0.658
High measure voltage (Volt)	4.19
Low measure voltage (Volt)	2.6
Finish discharge current (Amp)	0.492
Discharge time (Second)	23280
Full capacity (Watt * h)	**12.567**
Average discharge power (Watt)	1.94
Calculated impedance (mOhm)	**51.7**
Internal resistance (measured) (mOhm)	**26.3**
Capacity at an average discharge voltage of 3.644 Volt (mA*h)	**3449**

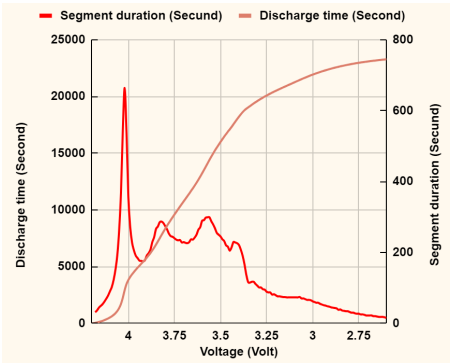


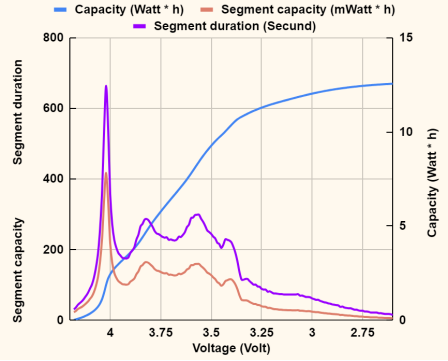


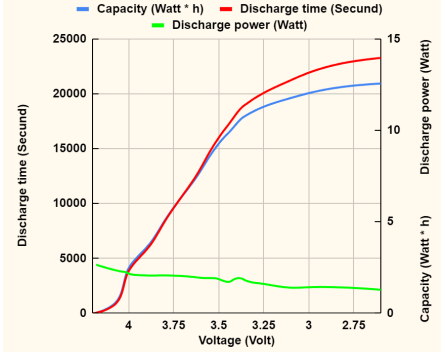


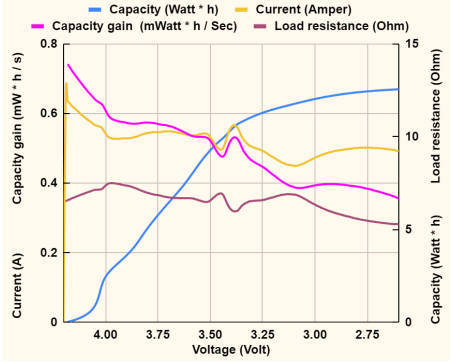










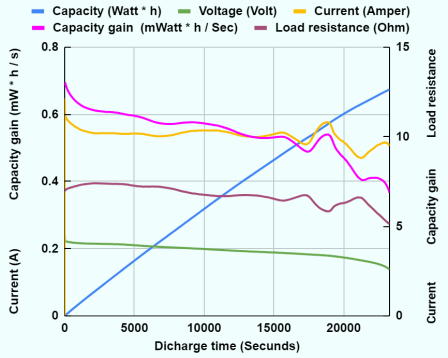


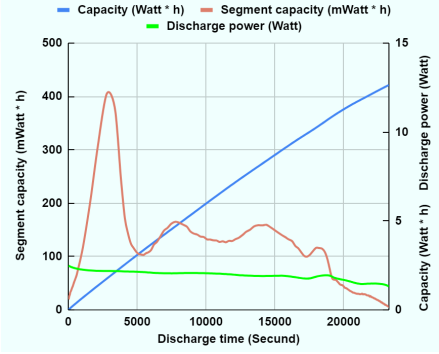
6.2 Technical report on Li-Ion element testing results

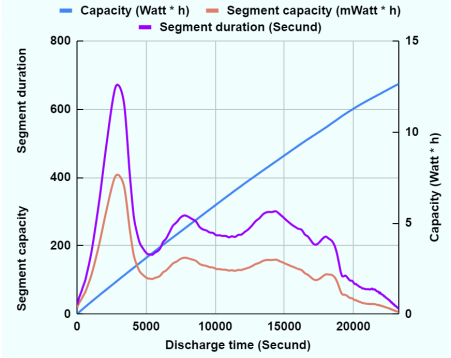
23 08 17 00 02

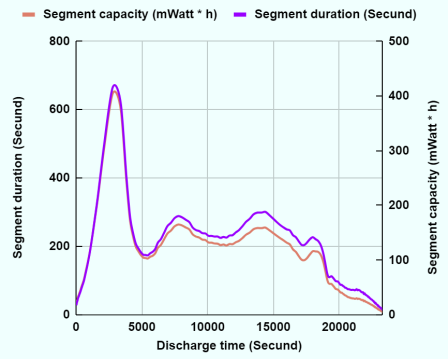
Element Number

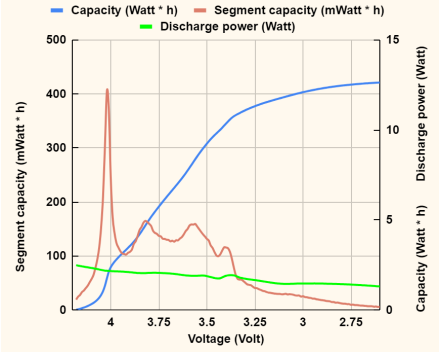
Voltage before discharge (Volt)	4.25
Start discharge voltage (Volt)	4.21
Start discharge current (Amp)	0.601
High measure voltage (Volt)	4.19
Low measure voltage (Volt)	2.6
Finish discharge current (Amp)	0.506
Discharge time (Second)	23294
Full capacity (Watt * h)	**12.644**
Average discharge power (Watt)	1.95
Calculated impedance (mOhm)	**66.6**
Internal resistance (measured) (mOhm)	**25.8**
Capacity at an average discharge voltage of 3.639 Volt (mA*h)	**3475**

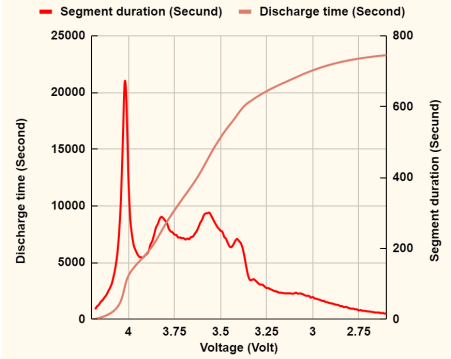


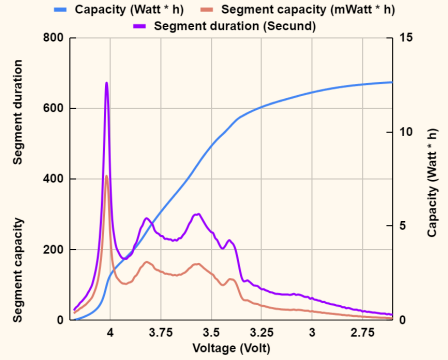


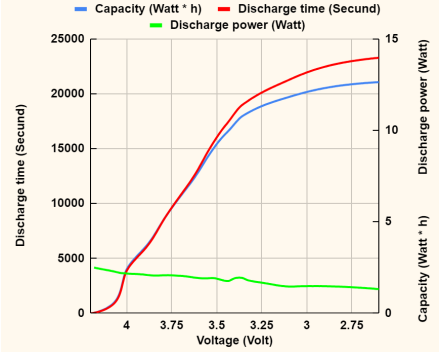


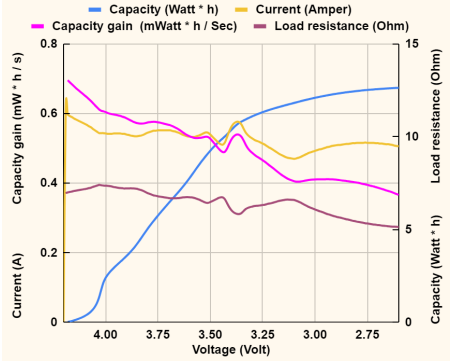










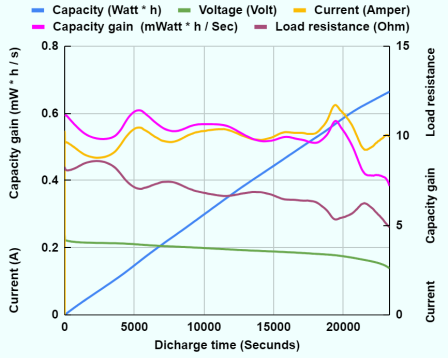


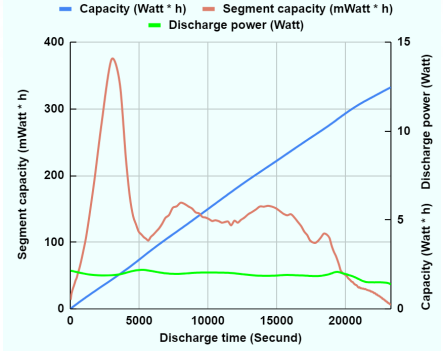
6.3 Technical report on Li-Ion element testing results

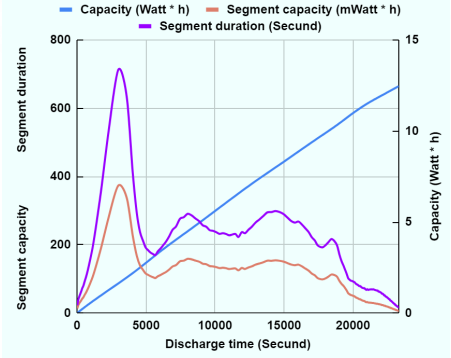
23 08 17 00 03

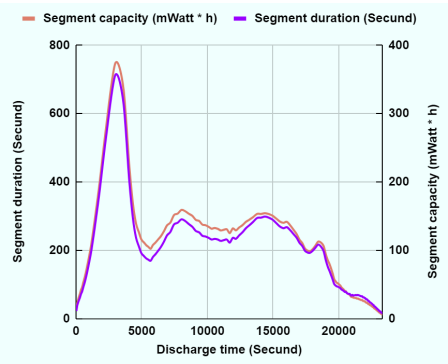
Element Number

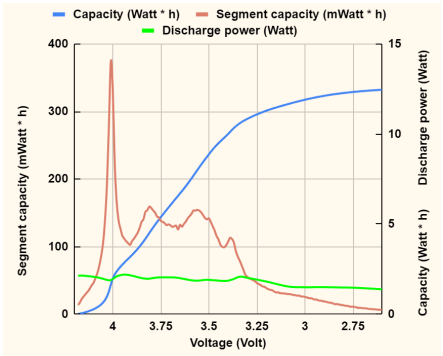
Voltage before discharge (Volt)	4.249
Start discharge voltage (Volt)	4.2
Start discharge current (Amp)	0.502
High measure voltage (Volt)	4.19
Low measure voltage (Volt)	2.6
Finish discharge current (Amp)	0.53
Discharge time (Second)	23321
Full capacity (Watt * h)	**12.462**
Average discharge power (Watt)	1.92
Calculated impedance (mOhm)	**97.6**
Internal resistance (measured) (mOhm)	**26.5**
Capacity at an average discharge voltage of 3.622 Volt (mA*h)	**3441**

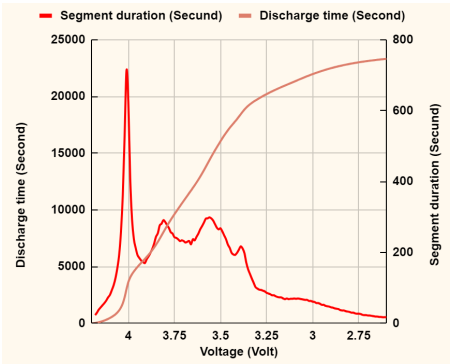


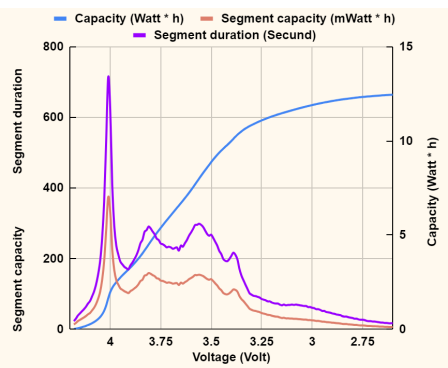


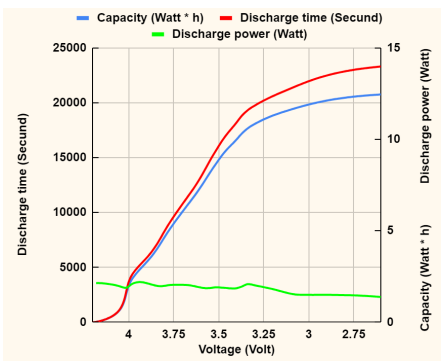


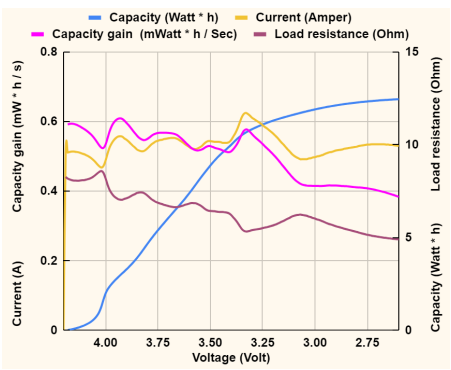










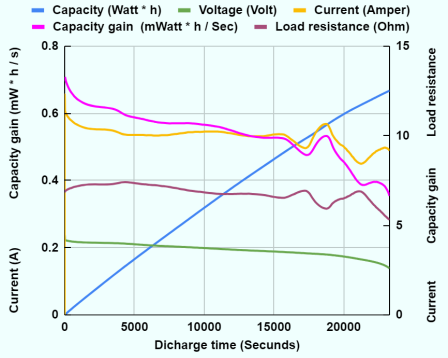


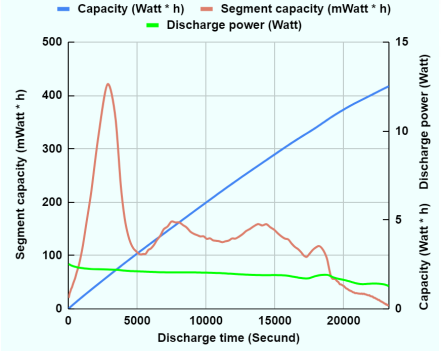
6.4 Technical report on Li-Ion element testing results

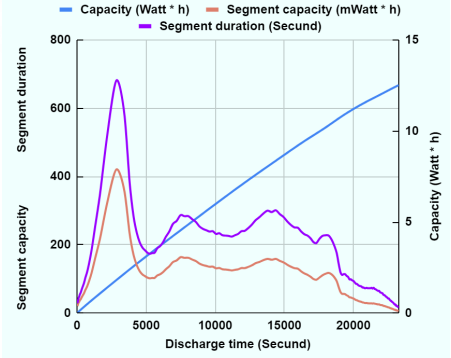
23 08 17 00 04

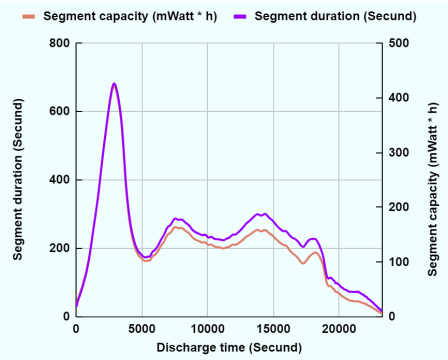
Element Number

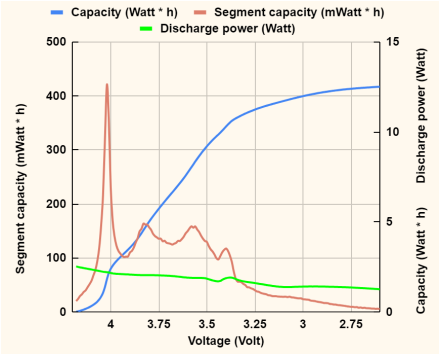
Voltage before discharge (Volt)	4.249
Start discharge voltage (Volt)	4.211
Start discharge current (Amp)	0.615
High measure voltage (Volt)	4.19
Low measure voltage (Volt)	2.6
Finish discharge current (Amp)	0.489
Discharge time (Second)	23290
Full capacity (Watt * h)	**12.52**
Average discharge power (Watt)	1.94
Calculated impedance (mOhm)	**61.8**
Internal resistance (measured) (mOhm)	**23.4**
Capacity at an average discharge voltage of 3.643 Volt (mA*h)	**3437**

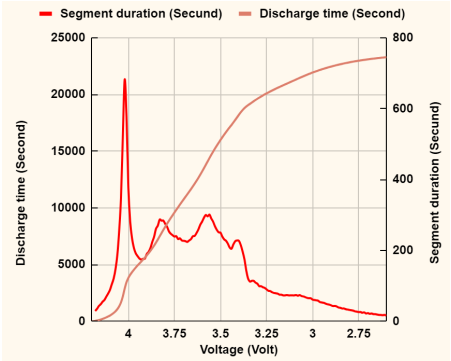


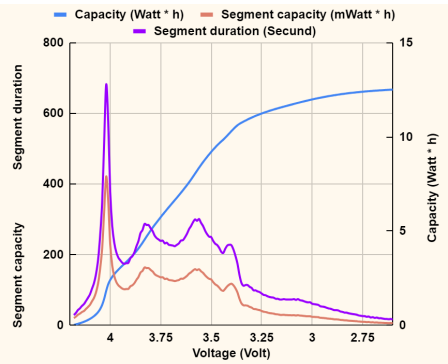


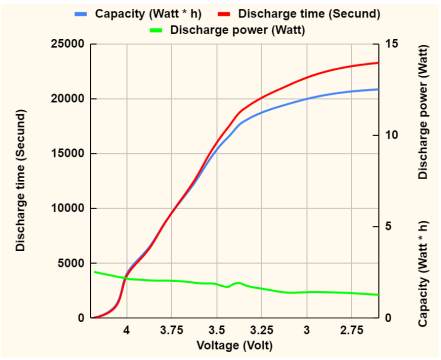


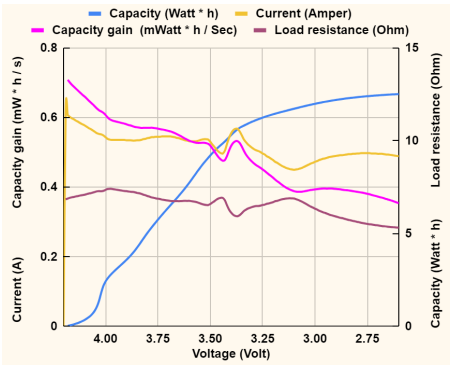










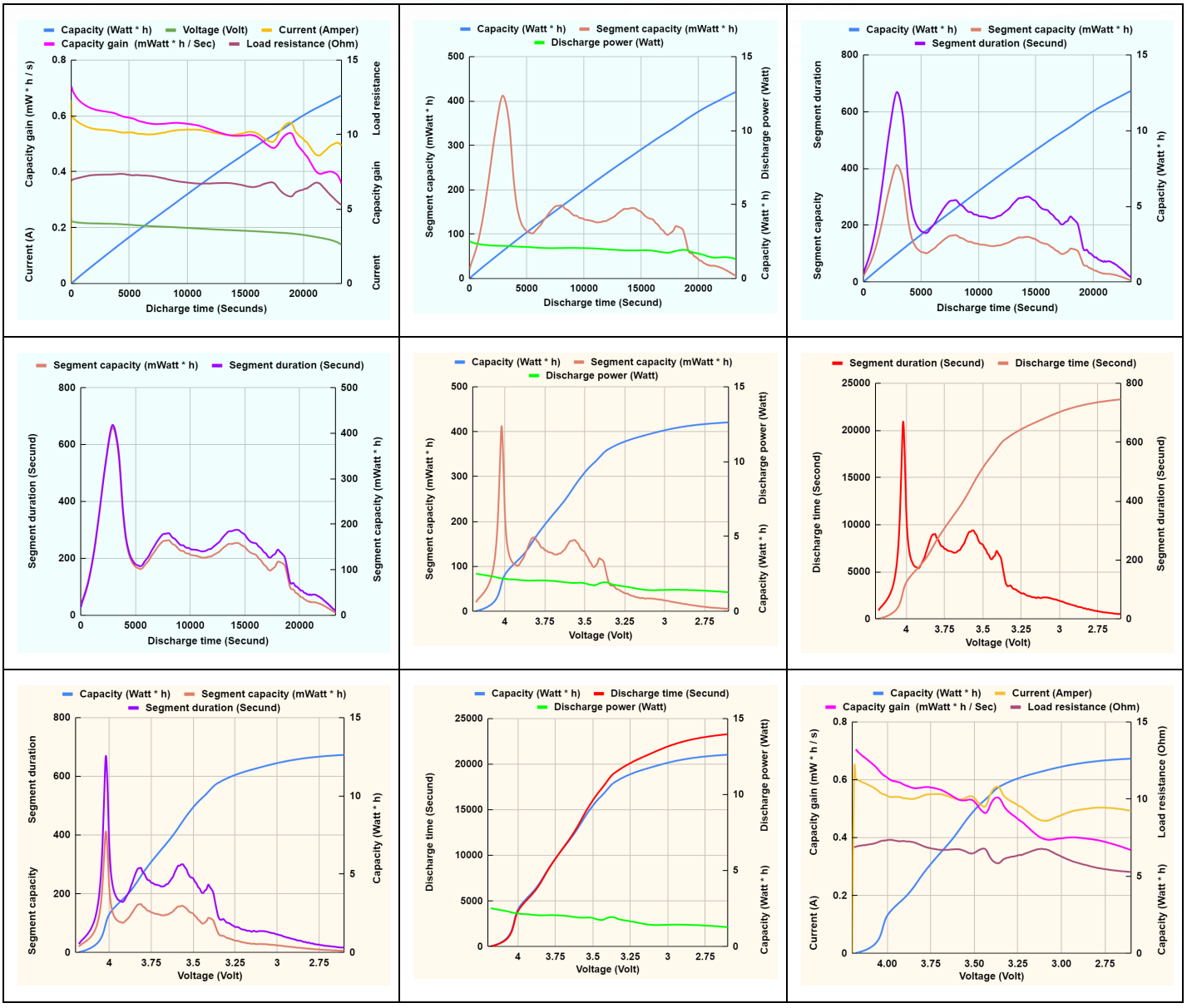


6.5 Technical report on Li-Ion element testing results

23 08 17 00 05

Element Number

Voltage before discharge (Volt)	4.25
Start discharge voltage (Volt)	4.213
Start discharge current (Amp)	0.617
High measure voltage (Volt)	4.19
Low measure voltage (Volt)	2.6
Finish discharge current (Amp)	0.492
Discharge time (Second)	23290
Full capacity (Watt * h)	**12.623**
Average discharge power (Watt)	1.95
Calculated impedance (mOhm)	**60.0**
Internal resistance (measured) (mOhm)	**26.1**
Capacity at an average discharge voltage of 3.642 Volt (mA*h)	**3466**

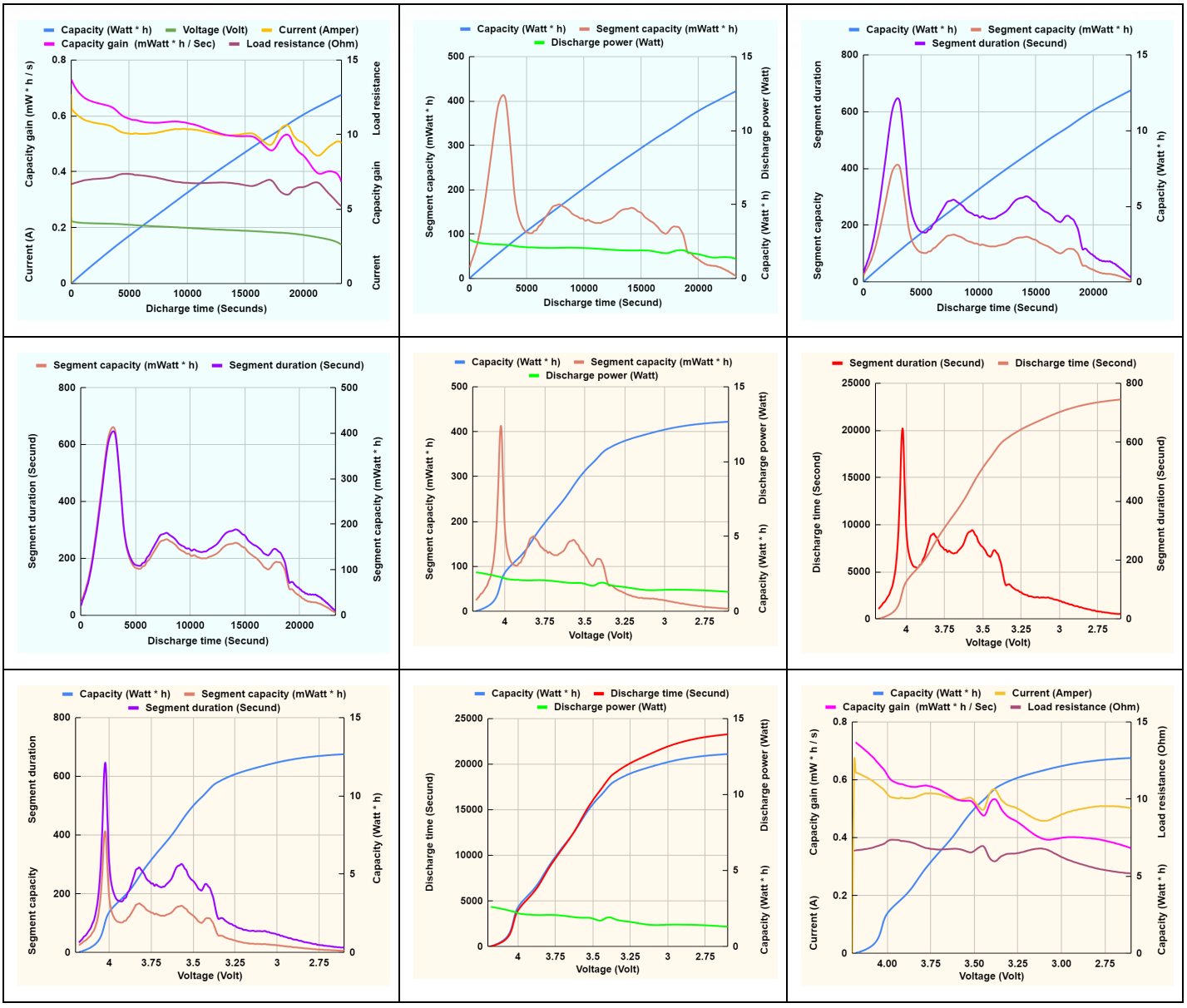


6.6 Technical report on Li-Ion element testing results

23 08 17 00 06

Element Number

Voltage before discharge (Volt)	4.25
Start discharge voltage (Volt)	4.218
Start discharge current (Amp)	0.642
High measure voltage (Volt)	4.19
Low measure voltage (Volt)	2.6
Finish discharge current (Amp)	0.502
Discharge time (Second)	23281
Full capacity (Watt * h)	**12.669**
Average discharge power (Watt)	1.96
Calculated impedance (mOhm)	**49.8**
Internal resistance (measured) (mOhm)	**24.8**
Capacity at an average discharge voltage of 3.648 Volt (mA*h)	**3473**

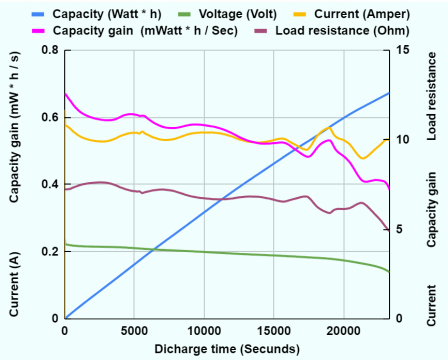


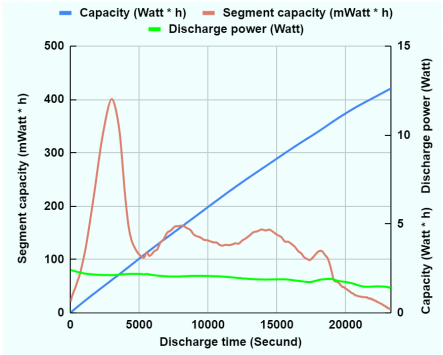
6.7 Technical report on Li-Ion element testing results

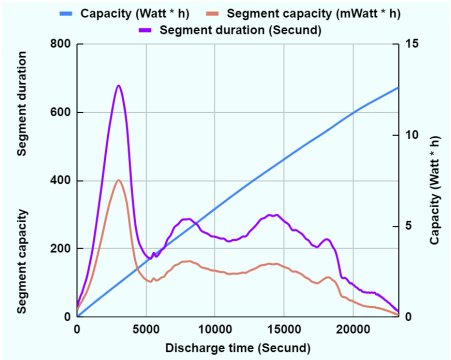
23 08 17 00 07

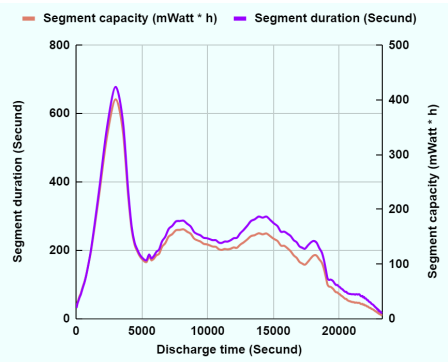
Element Number

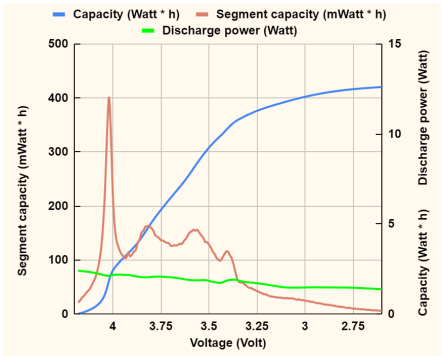
Voltage before discharge (Volt)	4.251
Start discharge voltage (Volt)	4.213
Start discharge current (Amp)	0.573
High measure voltage (Volt)	4.19
Low measure voltage (Volt)	2.6
Finish discharge current (Amp)	0.531
Discharge time (Second)	23299
Full capacity (Watt * h)	**12.613**
Average discharge power (Watt)	1.95
Calculated impedance (mOhm)	**66.3**
Internal resistance (measured) (mOhm)	**25.0**
Capacity at an average discharge voltage of 3.639 Volt (mA*h)	**3466**

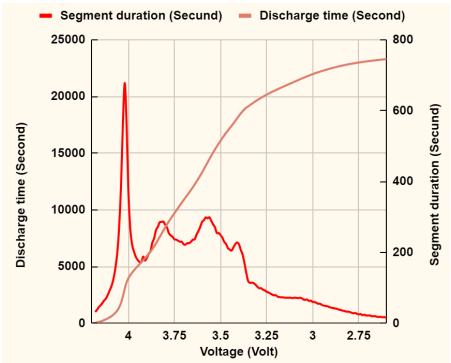


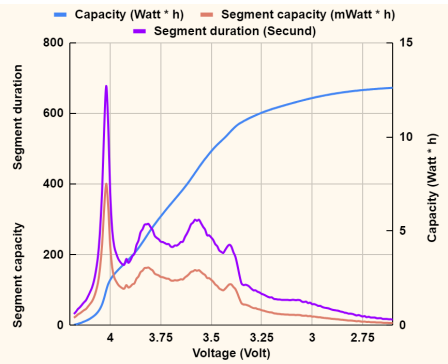


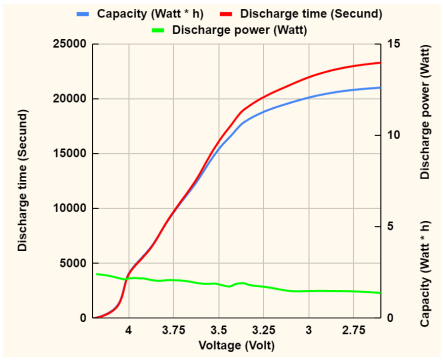


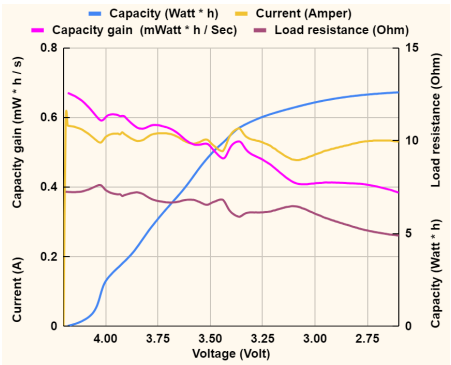










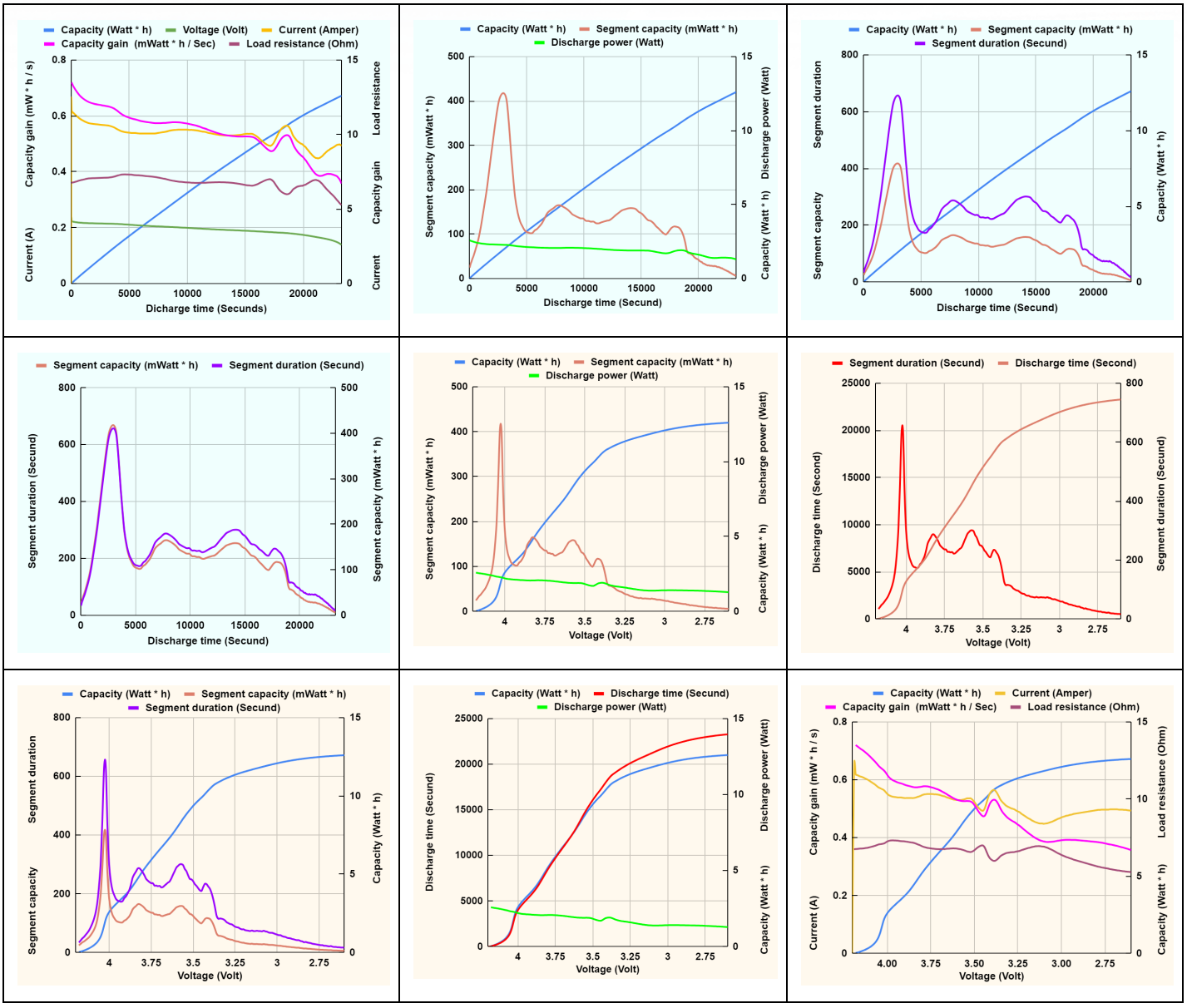


6.8 Technical report on Li-Ion element testing results

23 08 17 00 08

Element Number

Voltage before discharge (Volt)	4.251
Start discharge voltage (Volt)	4.218
Start discharge current (Amp)	0.623
High measure voltage (Volt)	4.19
Low measure voltage (Volt)	2.6
Finish discharge current (Amp)	0.494
Discharge time (Second)	23279
Full capacity (Watt * h)	**12.602**
Average discharge power (Watt)	1.95
Calculated impedance (mOhm)	**53.0**
Internal resistance (measured) (mOhm)	**24.7**
Capacity at an average discharge voltage of 3.65 Volt (mA*h)	**3452**

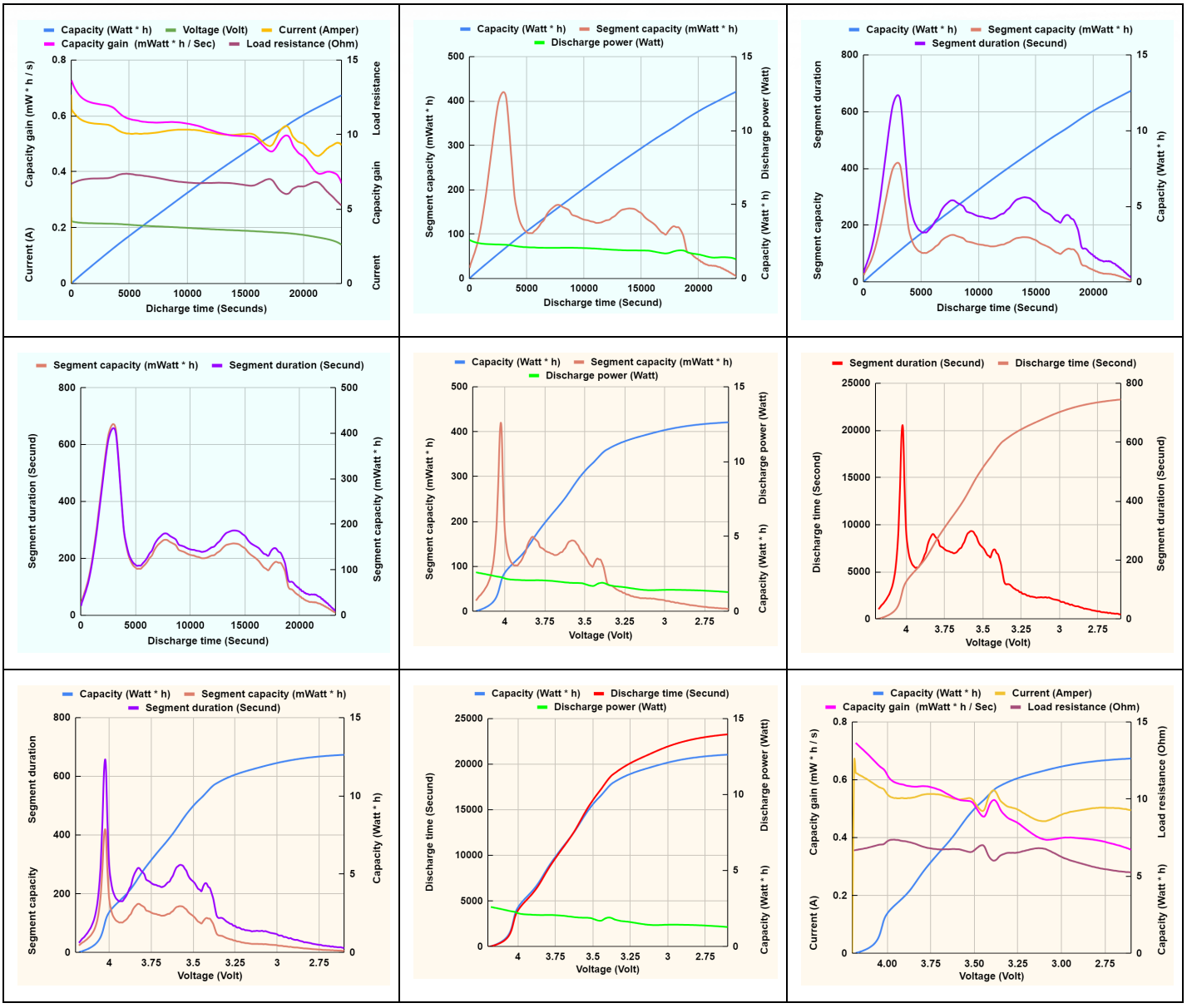


6.9 Technical report on Li-Ion element testing results

23 08 17 00 09

Element Number

Voltage before discharge (Volt)	4.25
Start discharge voltage (Volt)	4.218
Start discharge current (Amp)	0.639
High measure voltage (Volt)	4.19
Low measure voltage (Volt)	2.6
Finish discharge current (Amp)	0.495
Discharge time (Second)	23277
Full capacity (Watt * h)	**12.63**
Average discharge power (Watt)	1.95
Calculated impedance (mOhm)	**50.1**
Internal resistance (measured) (mOhm)	**24.2**
Capacity at an average discharge voltage of 3.648 Volt (mA*h)	**3462**



6.10 Technical report on Li-Ion element testing results

23 08 17 00 10

Element Number

Voltage before discharge (Volt)	4.251
Start discharge voltage (Volt)	4.216
Start discharge current (Amp)	0.61
High measure voltage (Volt)	4.19
Low measure voltage (Volt)	2.6
Finish discharge current (Amp)	0.498
Discharge time (Second)	23285
Full capacity (Watt * h)	**12.644**
Average discharge power (Watt)	1.95
Calculated impedance (mOhm)	**57.4**
Internal resistance (measured) (mOhm)	**24.8**
Capacity at an average discharge voltage of 3.646 Volt (mA*h)	**3468**