SGS Germany GmbH

Test Report No.: V47W0003

Order No.: V47W	**Pages:** 18	**Munich,** Dec 19, 2024

Client:	CT-Coating AG
Equipment Under Test:	Pouch Cell Proto AS-24/1124
Manufacturer:	CT-Coating AG
Task:	Performance test according to customer requirements Cyclization test
Test Specification(s):	The test specifications were defined by the customer
Result:	No pass/fail criteria set

The results relate only to the items tested as described in this test report.

approved by:	**Date**	**Signature**
Metzger Lab Manager eMobility	Dec 19, 2024	

This document was signed electronically.

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1 Summary

The performance tests were carried out according to customer specifications.

2 References

2.1 Specifications

The performance tests were carried out according to customer specifications.

2.2 Glossary of terms

DUT	device under test
EUT	equipment under test
N/A	not applicable
P/N	part number
CC	constant current
CV	constant voltage

3 General Information

3.1 Identification of client

CT-Coating AG
Kantering 36
D-53639 Königswinter

Mr. Hölzenbein

3.2 Test laboratory

SGS Germany GmbH
Traunreuter Str. 3
82538 Geretsried-Gelting

3.3 Time schedule

Delivery of EUT:	Nov 22, 2024
Start of test:	Nov 22, 2024
End of test:	Dec 04, 2024

3.4 Participants

Table 1-1: List of participants

Name	Function
C.B. (aus Datenschutz nur Kurzform)	Eyewitnessing (temporarily)
Matthias Oldemeier	Editor

4 Equipment under Test

All information about the test specimen was provided by the customer.
A total of one test item was tested.

Table 2-1: Overview of the examinees

manufacturer	CT-Coating AG
Type designation	pouch cell
S/N	Proto AS-24/1124

Figure 1: Pouch Cell

5 Test Equipment

5.1 Test laboratory

The tests were carried out in the Laboratory for Connectivity & Products / e Mobility of SGS Germany GmbH, Traunreuter Str. 3, 82538 Geretsried-Gelting.

5.2 Measuring equipment

Table 3-1: Measuring equipment used.

ID. No.	measuring equipment	manufacturer	Status	last Calibration	Next Cal.
B0115	eMob Chamber Temperature	Zundar Technology	ind		
B0839	Battery Test System	BaSyTec GmbH	ind		
S7046	Precision Balance MS1003TS/00	Mettler Toledo	cal	Dec 05, 2023	Dec 31, 2024

cal = Calibration, car = Calibration restricted use, chk = Check, chr = Check restricted use, cpu = Check prior to use, calchk = Calibration and check, ind = for indication only, cnn = Calibration not necessary, service = Wartung (Service), man = Maintenance, calservice = Calibration & Service, chkservice = Check & Service, calchkservice = Calibration & Check & Service, calinit = Initial Calibration only

6 Test Specifications and Results

The test results in the report refer exclusively to the test object described in section 4 and the test period in section 3.3.

6.1 Test specification

In a preliminary test with an identical setup, the capacity of the cell was determined through a charging and discharging cycle. After this procedure the performance test parameter were adjusted for the run. The parameters used for the test are listed below.
The test procedure was defined by the customer as follows:
The cell is cycled for one hundred full charge/discharge cycles with the parameters below. In addition the capacity, the gravimetric and the volumetric energy density should be determined.

Charge procedure: CC/CV
Discharge procedure: CC
Capacity: 24 Ah (based on prior .5C discharging cycle)
Nominal voltage: 3.55 V
Charge voltage: 4.15 V
Charge current: 24 A (1C)
Cut-off current: 1.5 A (C/16)
Discharge cut-off voltage: 2.7 V
Discharge current: 24 A (1C)
Max. temp. (stop condition): 45 °C
Break between charging & discharging: 5 min
Break between full cycles: 5 min
Amount of full cycles: 100
Data recording rate: 10 Hz
Climate chamber T_set: 25 °C

Capacity test:

The capacity test consists of one cycle with a charge/discharge current of 0.5C.

Performance test:

The performance test consists of one hundred cycles with a charge/discharge current of 1C.

6.2 Test execution

Test-set-up:

The test specimen is set up in a temperature chamber.

Figure 2: Test equipment

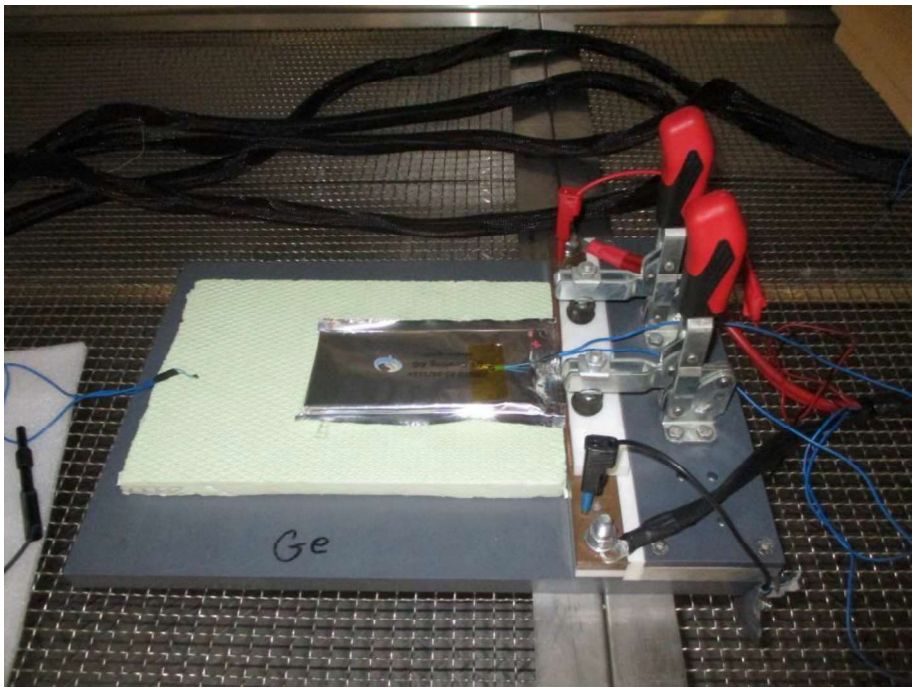

Figure 3: Test specimen in the temperature chamber

6.3 Test results

6.3.1 Volume and weight measurement

Dimensions:

length=16.3cm width=7.3cm height=1.009cm

Figure 4: Measurement of dimensions

Volume calculation: V=1.63dm * 0.73dm * 0.109dm = 0.1201l

Weight:

Figure 5: Weight measurement

Weight: Fg = 0.31262 kg

6.3.2 Capacity test

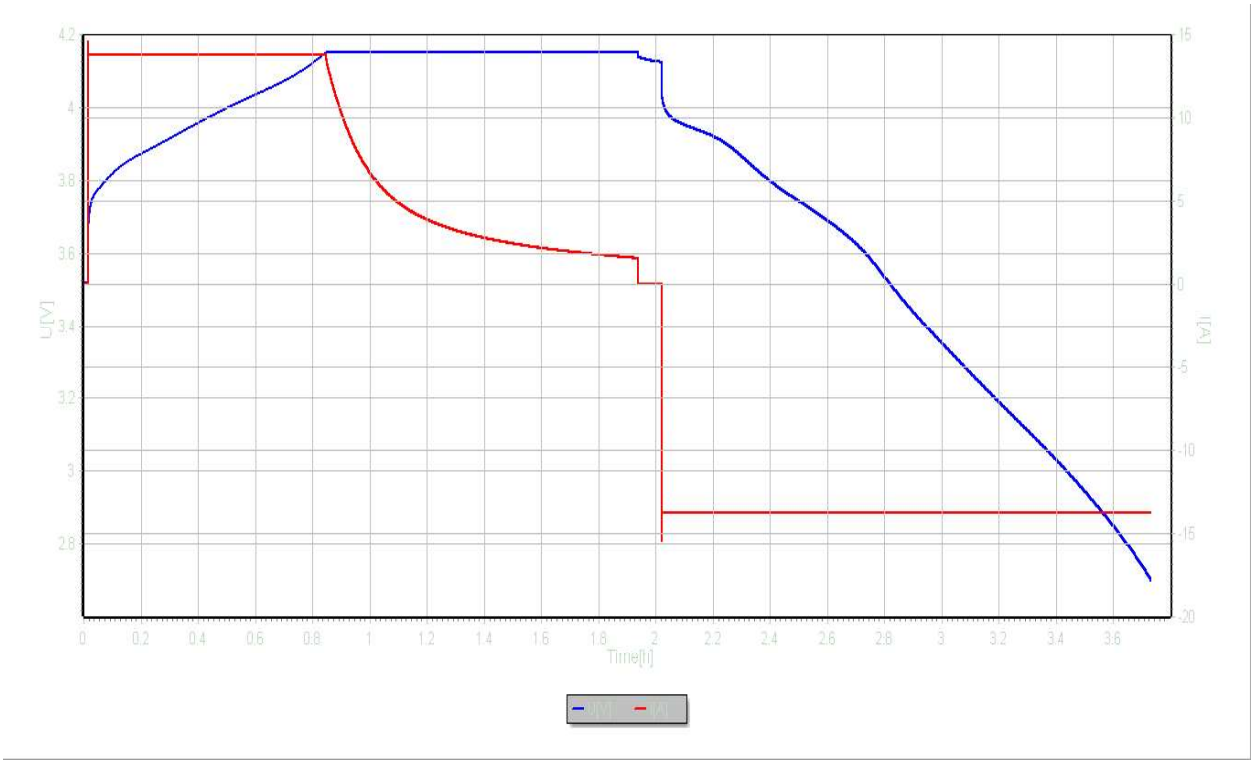

Figure 6: Voltage / Current Diagram

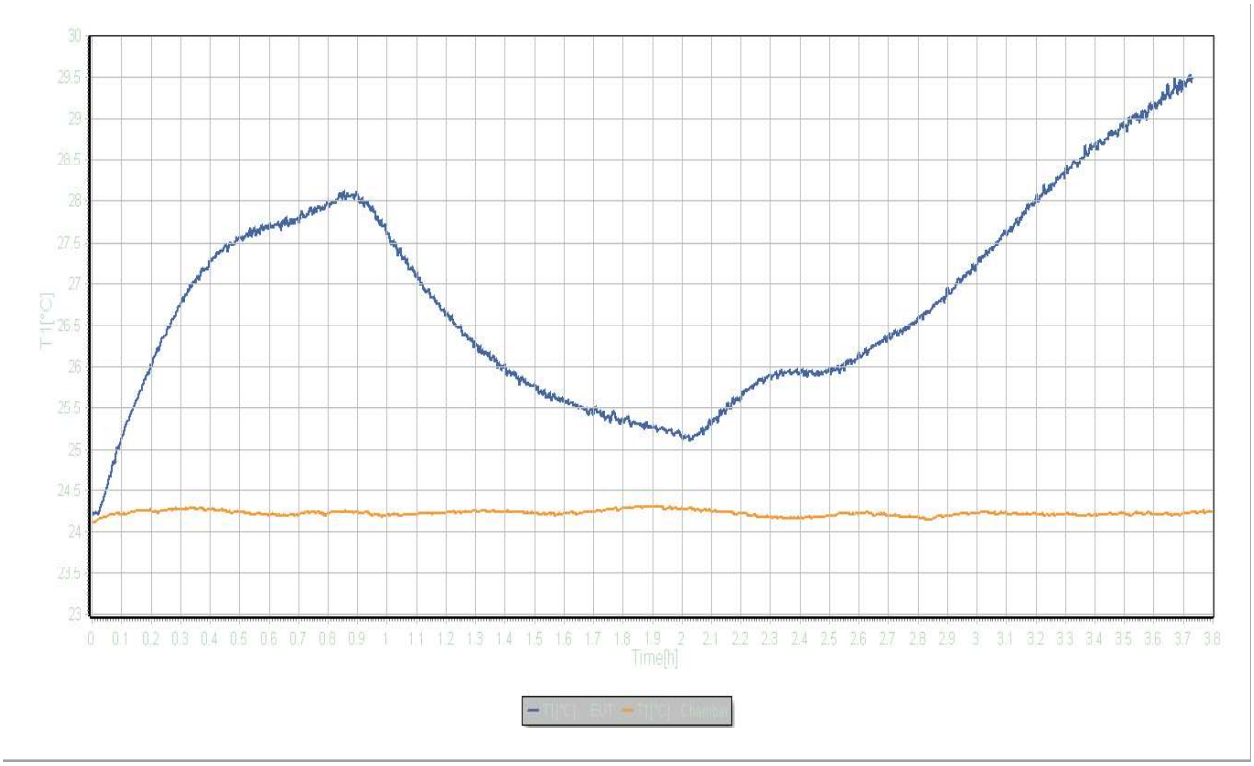

Figure 7: Temperature profile EUT / Chamber

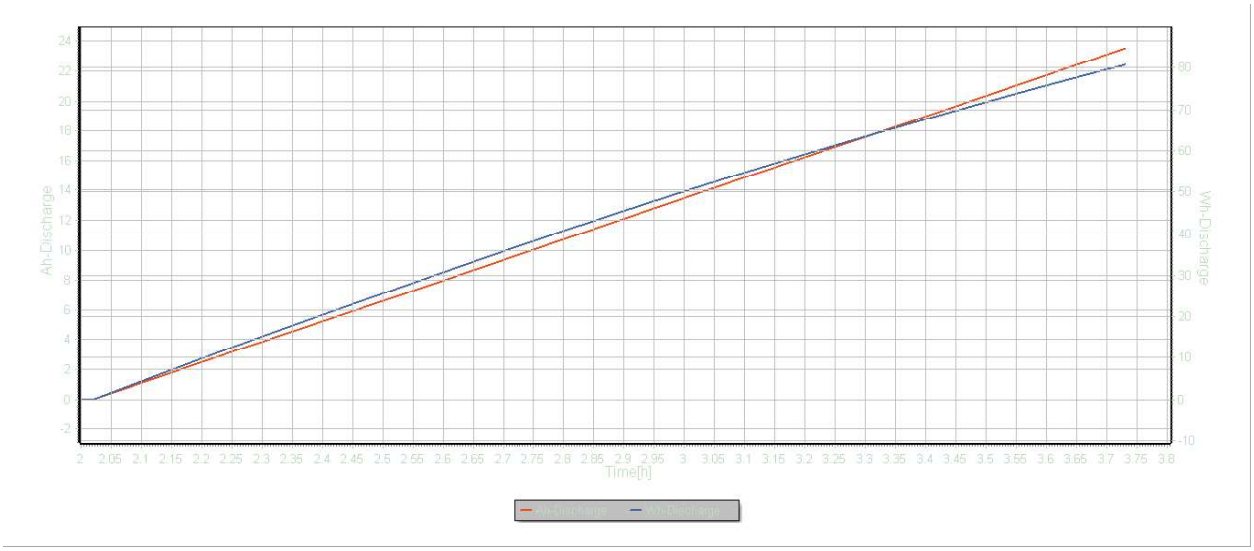

Figure 8: Capacity and energy of discharge cycle

Table 4-1: Results of the capacity test and charge/discharge times

Cycle	Discharge time t/min	Discharge capacity C/Ah	Discharge energy E/Wh
Zyklus 1	102.6	23.5142	80,6951

6.3.3 Performance test

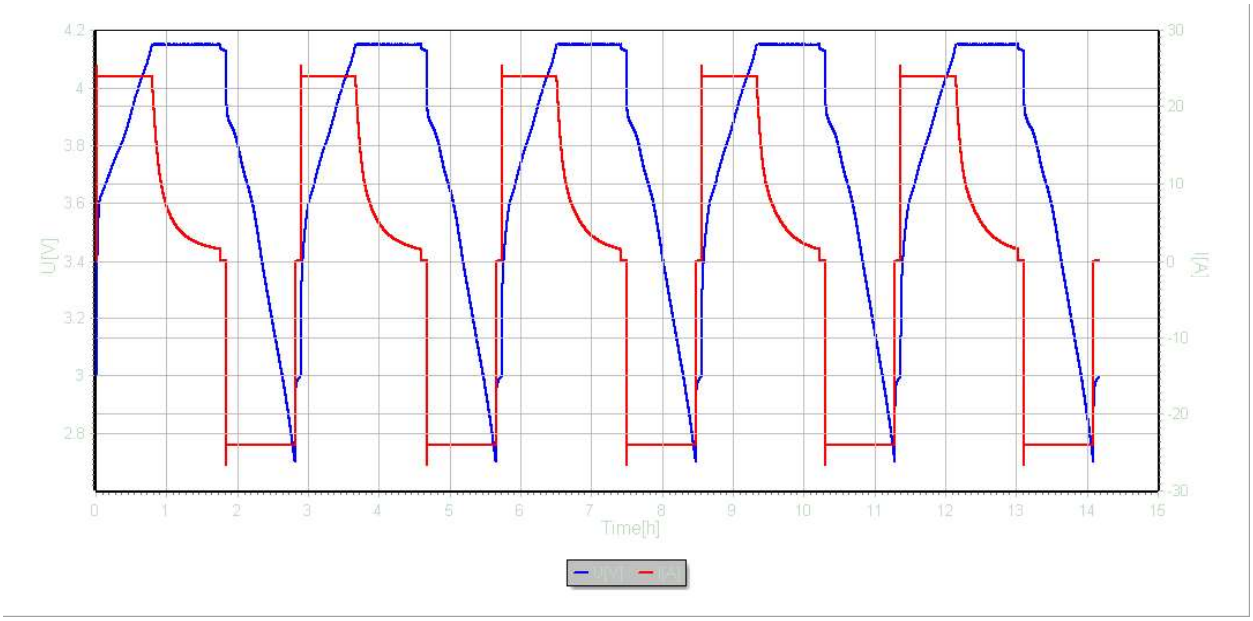

Figure 9: Voltage / Current Diagram of cycle 1-5

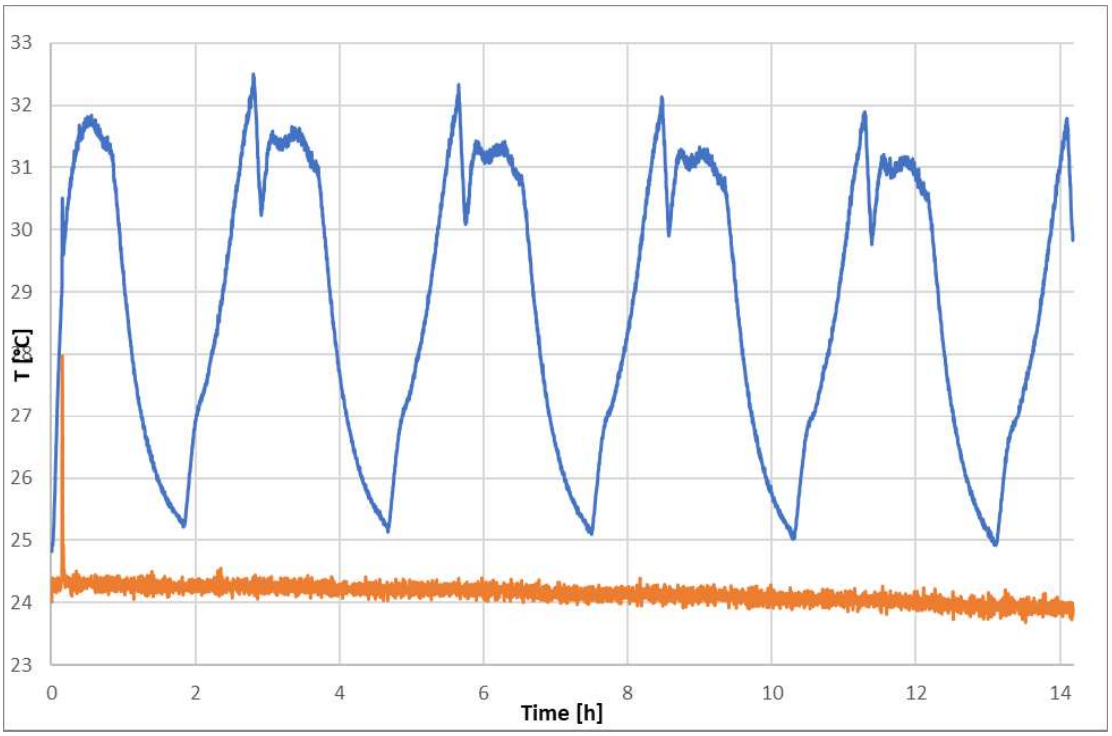

Figure 10: T-EUT / T-chamber of cycle 1-5

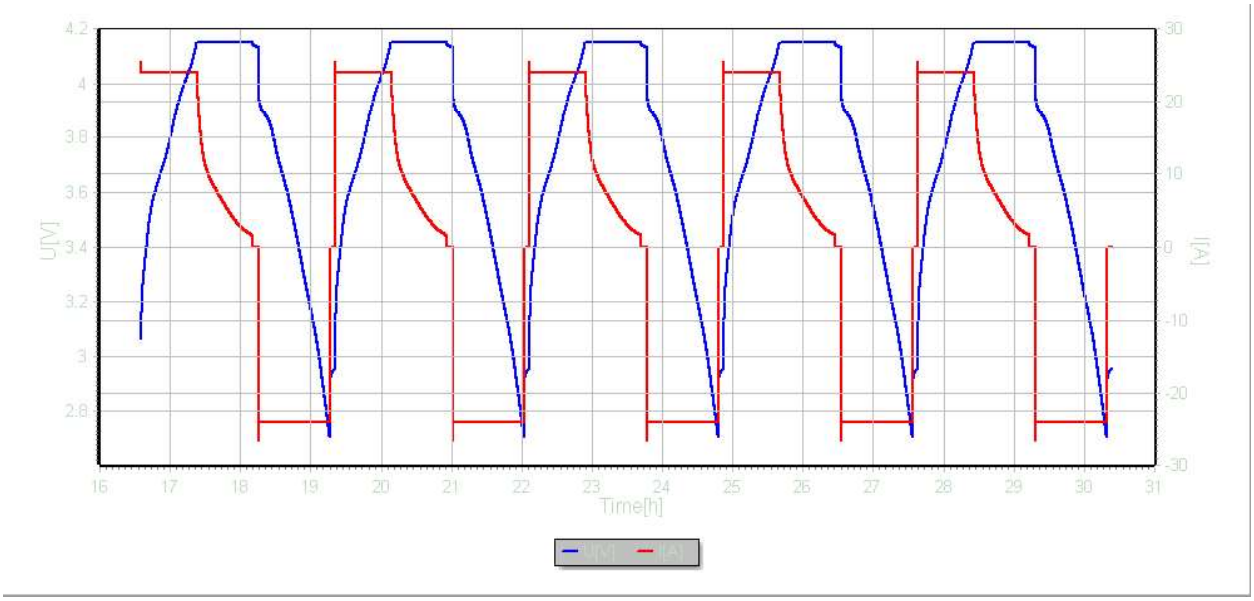

Figure 11: Voltage / Current Diagram of cycle 96-100

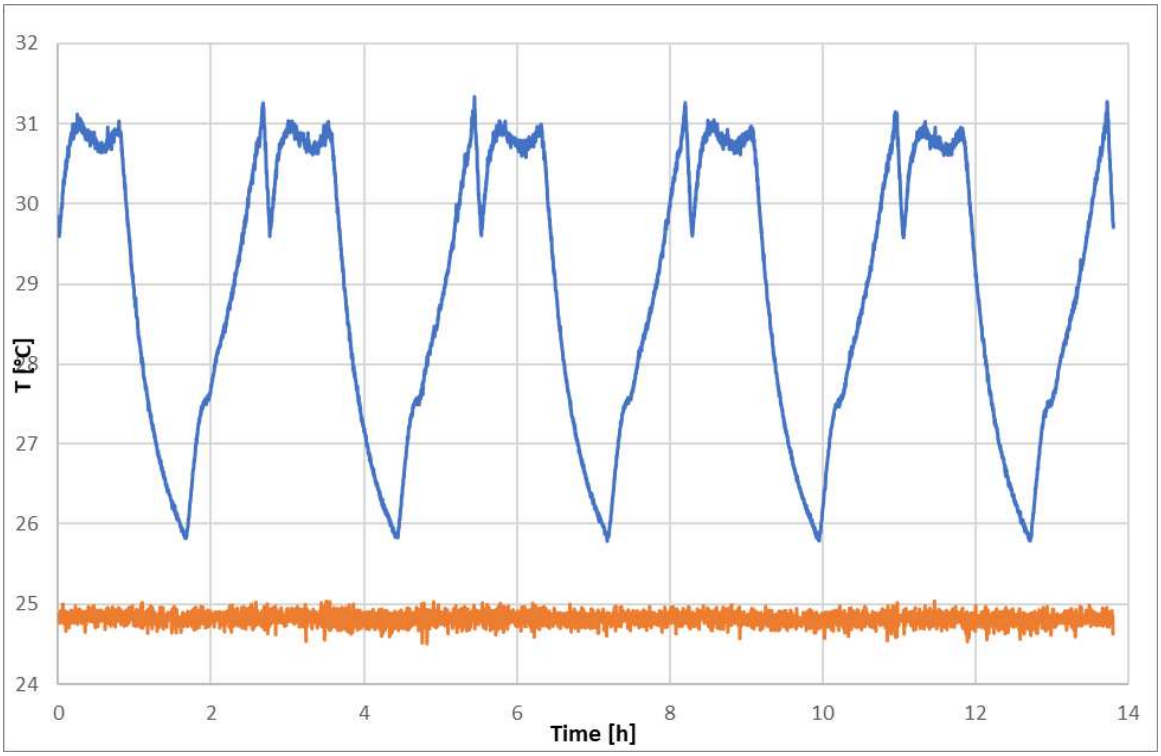

Figure 12: T-EUT / T-chamber of cycle 96-100

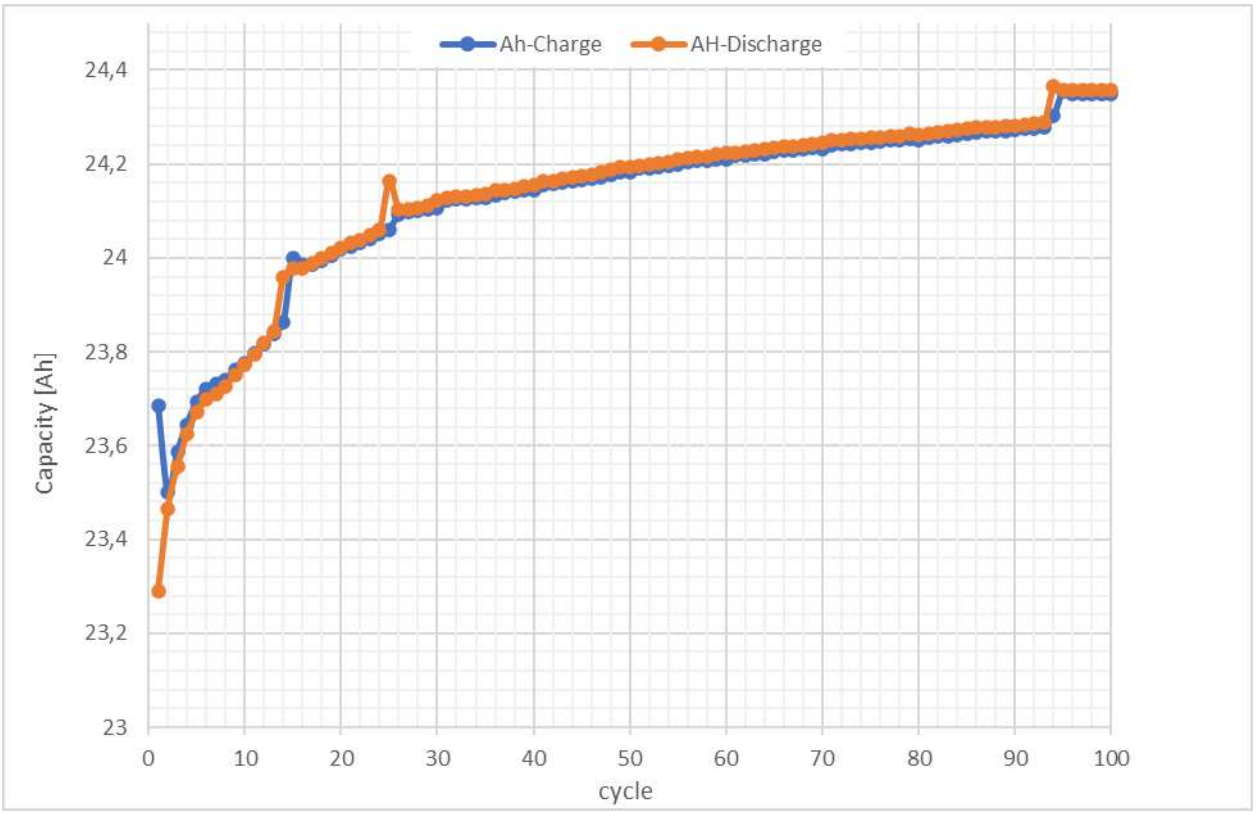

Figure 13: charge / discharge capacity over cycles

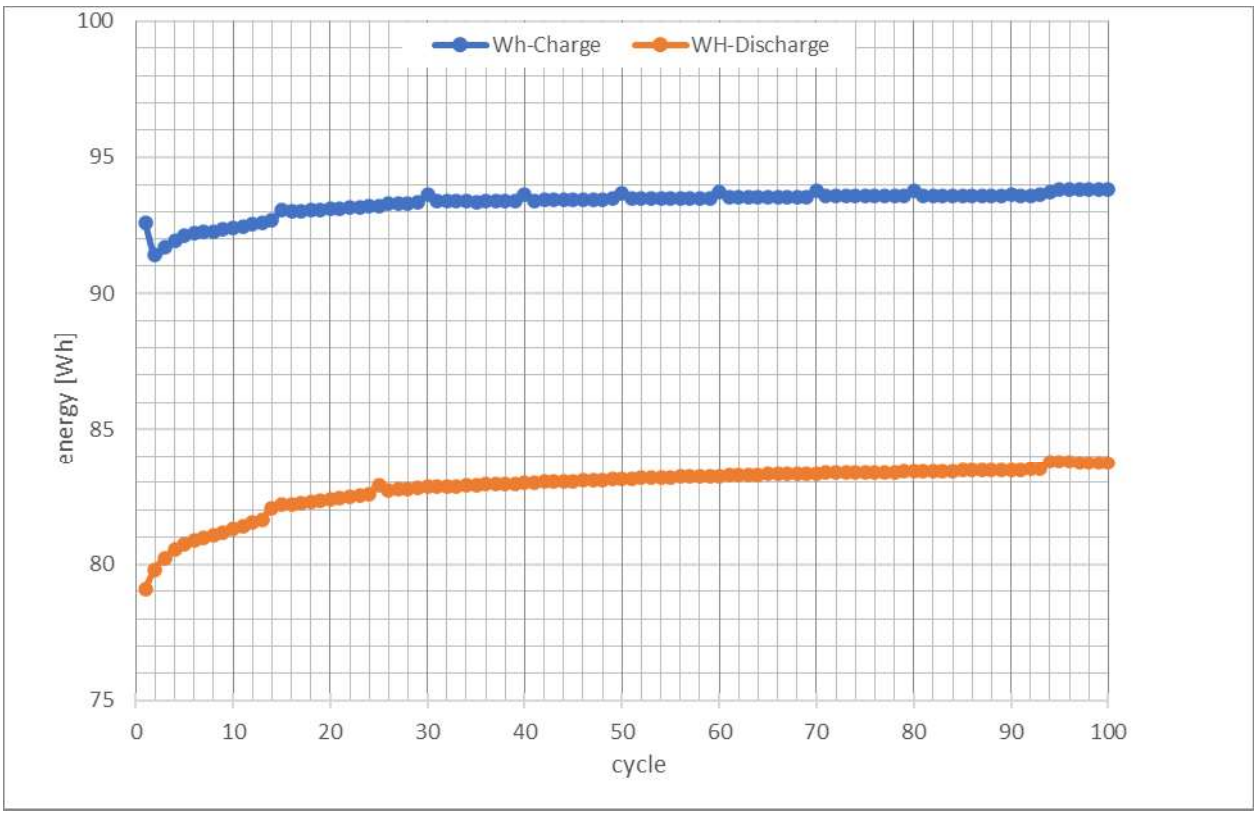

Figure 14: charge / discharge energy over cycles

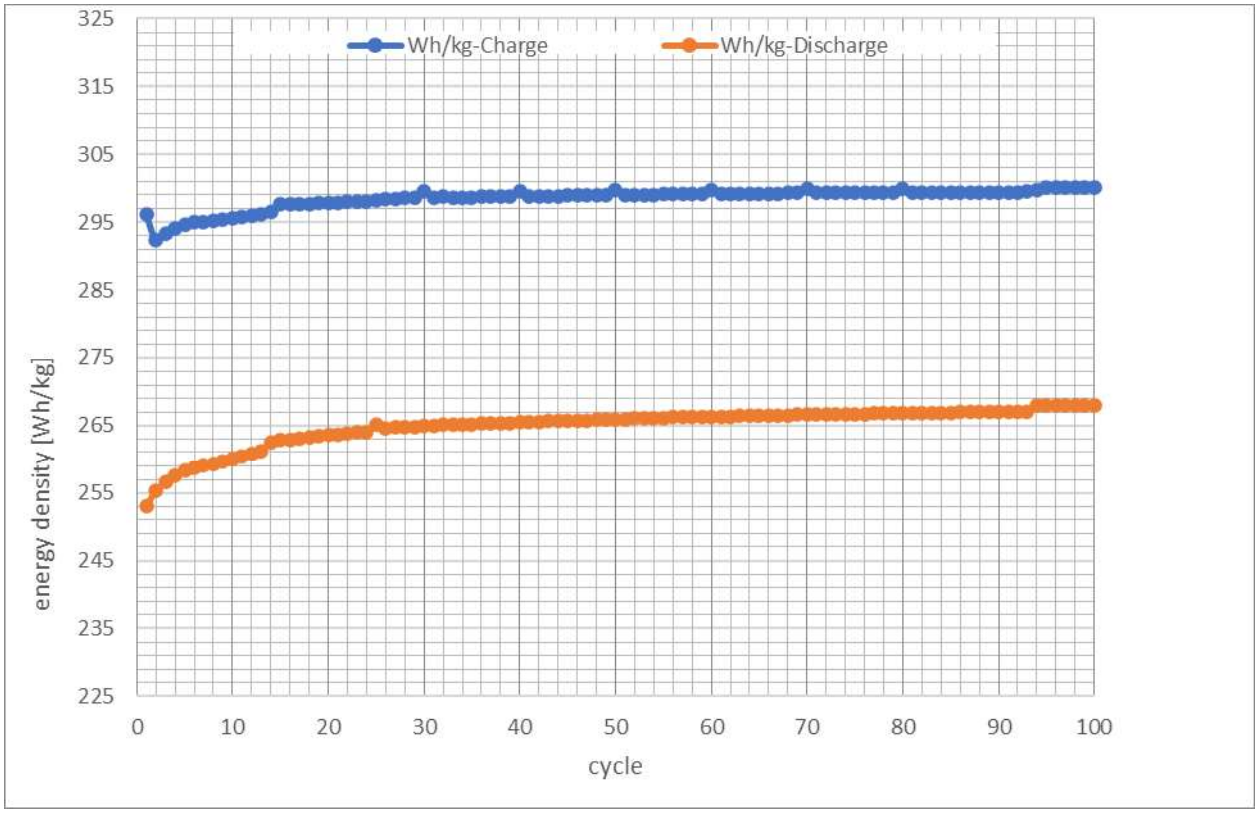

Figure 15: charge/discharge gravimetric energy density over cycles

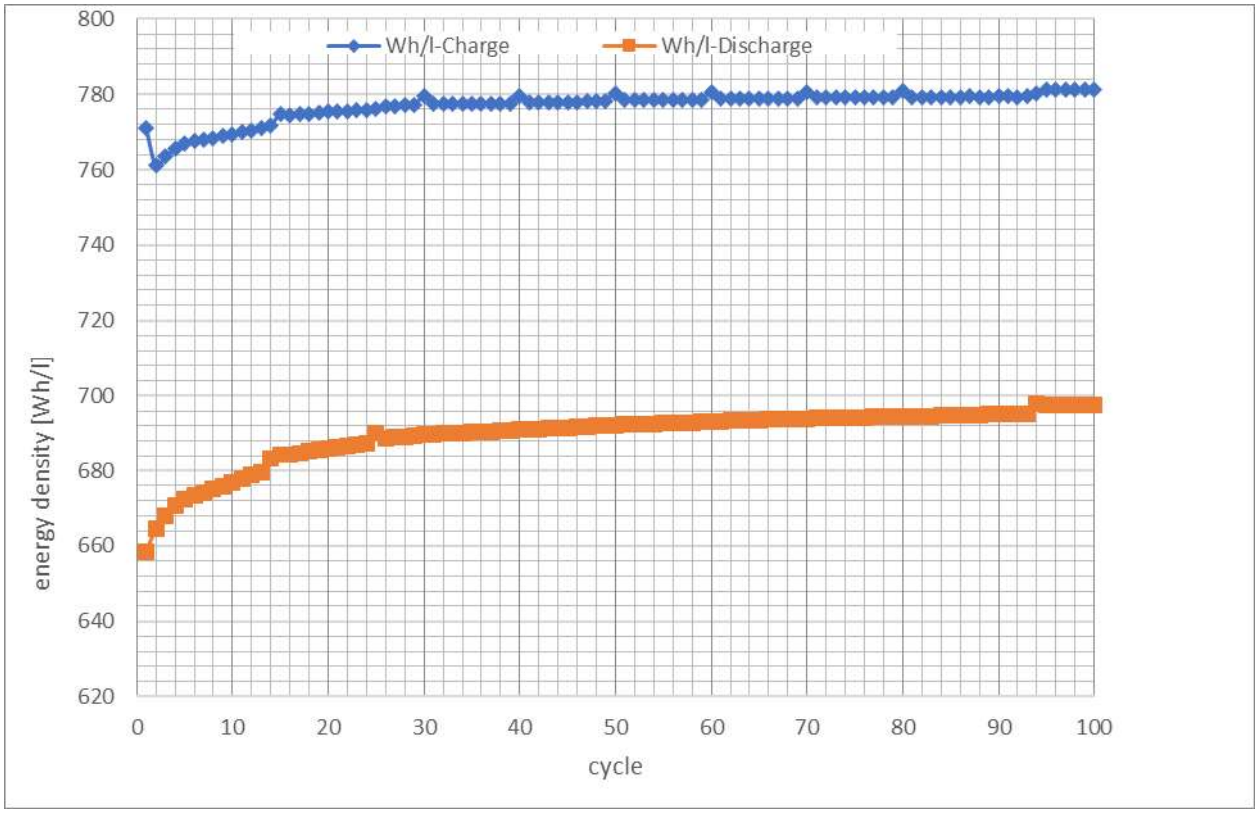

Figure 16: charge/discharge volumetric energy density over cycles

Table 4-2: Results of the capacity and energy test and charge/discharge times

Cycle	Charge time t/h	Charge capacity C/Ah	Charge energy E/Wh	Discharge time t/h	Discharge capacity C/Ah	Discharge energy E/Wh
Cycle 10	1.6280	23.7771	92.4119	0.9905	23.7725	81.2856
Cycle 50	1.5919	24.1825	93.7000	1.0081	24.1949	83.1342
Cycle 100	1.5801	24.3496	93.8177	1.0149	24.3582	83.7650

Average Charge Capacity for all 3 charge cycles: 24.1031Ah
Average Discharge Capacity for all 3 discharge cycles: 24.1085Ah
Resulting average Coulomb Efficiency for all 3 cycles: 100.02 %

Average Energy Throughput for all 3 charge cycles: 93.3099Wh
Average Energy Throughput for all 3 discharge cycles: 82.7283Wh
Resulting Average Energy Efficiency for all 3 cycles: 88.65 %

Charge/discharge volumetric/ gravimetric energy density:

Zyklus 100 Charging ρel = 781.1629Wh/l
Zyklus 100 Discharging ρel = 697.4606Wh/l

Zyklus 100 Charging ρel = 300.1205Wh/kg
Zyklus 100 Discharging ρel = 267.9623Wh/kg

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End of Test Report