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SGS Germany GmbH

Test Report No.: V1PF0004

Order No.: V1PF	**Pages:** 13	**Munich,** Apr 26, 2024

Client:	CT-Coating AG
Equipment Under Test:	Pouch Cell
	Proto AS-21/0424
Manufacturer:	CT-Coating AG
Task:	Performance 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	Apr 26, 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

N/A

2.2 Glossary of terms

DUT	device under test
EUT	equipment under test
N/A	not applicable
P/N	part number

3 General Information

3.1 Identification of client

CT-Coating AG
Kanterring 36
D-56639 Königswinter
Mr. Hölzenbein

3.2 Test laboratory

SGS Germany GmbH
Traunreuter Str. 3
82538 Geretsried-Gelting

3.3 Time schedule

Delivery of EUT:	Apr 16, 2024
Test period:	Apr 16, 2024
End of (latest) observation period:	Apr 16, 2024

3.4 Participants

Table 1-1: List of participants

Name	Function
Denisa Dosenovic	Eyewitnessing
Ernst Hölzenbein	Eyewitnessing
Christian Blum	Eyewitnessing
Robert Erdmann	Eyewitnessing
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-21/0424

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 cell parameters were determined through a complete charging and discharging cycle and adjusted again for the cycling 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 five full charge/discharge cycles with the parameters below. In addition, the charging and discharging time as well as the capacity, the gravimetric and the volumetric energy density should be determined.

Charge procedure:	CC/CV
Charge voltage:	4.3 V
Charge current:	11.5 A
Cut-off current:	190 mA
Discharge cut-off voltage:	3.0 V
Discharge current:	11.5 A
Max. temperature:	65 °C
Break between charging & discharging:	5 min.
Duration:	5 h

The data recording rate is 10 Hz.

6.2 Test execution

Test-set-up:

The test specimen is set up in a temperature chamber.

Figure 2: Test environment

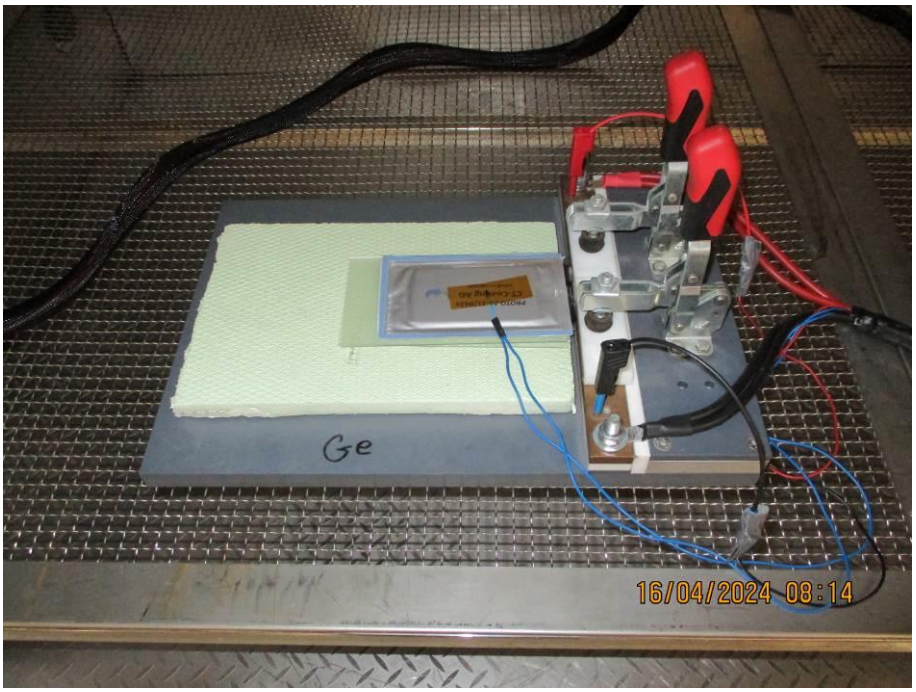

Figure 3: Test specimen in the temperature chamber

6.3 Test Results

Capacity test and charge/discharge times

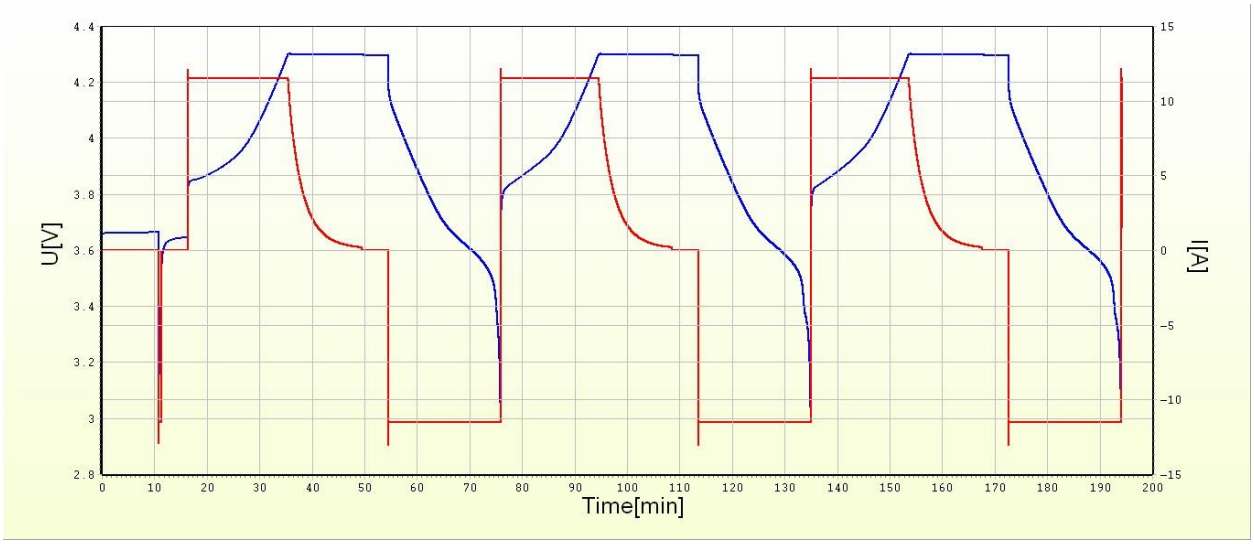

Figure 4: Voltage and Current Diagram cycle 1-3

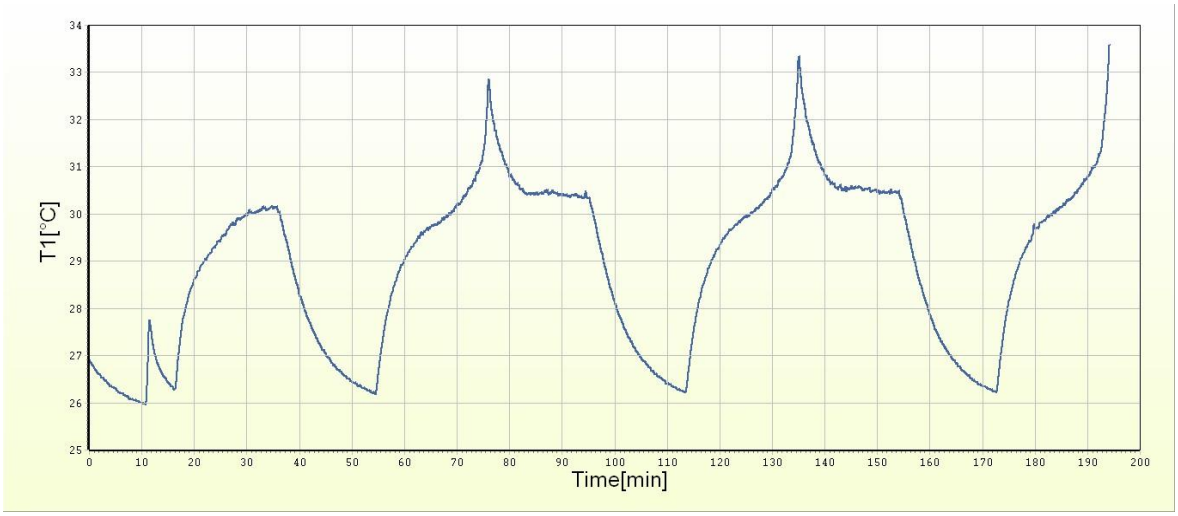

Figure 5: Temperature profile cycle 1-3

The measurement was stopped after the third cycle and a five-minute break was inserted in the test program between discharging and charging the test specimen. The last two cycles were then started.

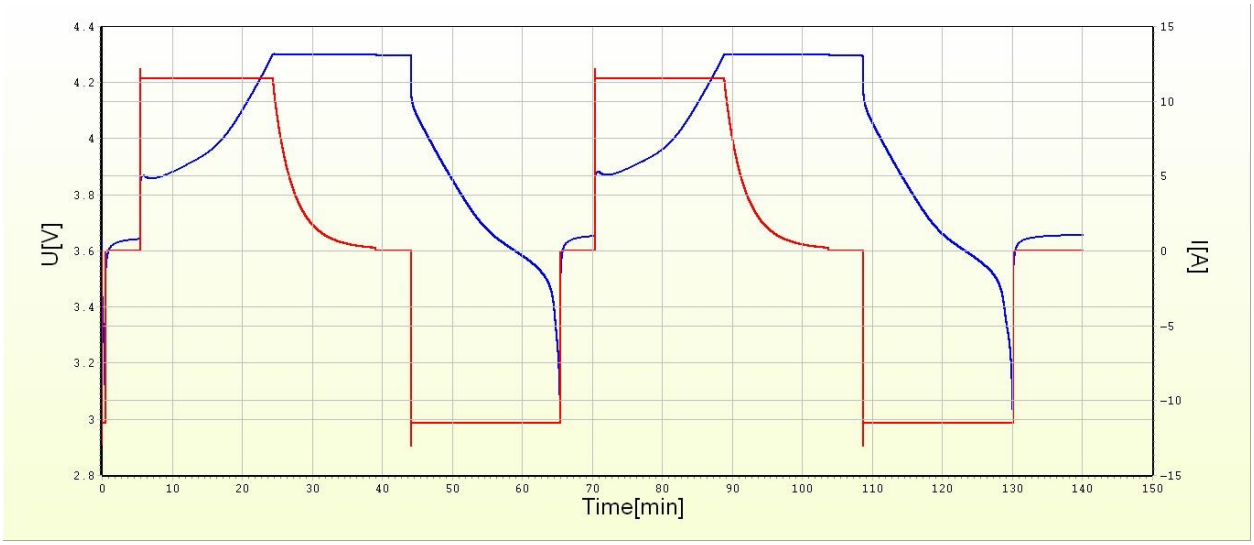

Figure 6: Voltage and Current Diagram cycle 4-5

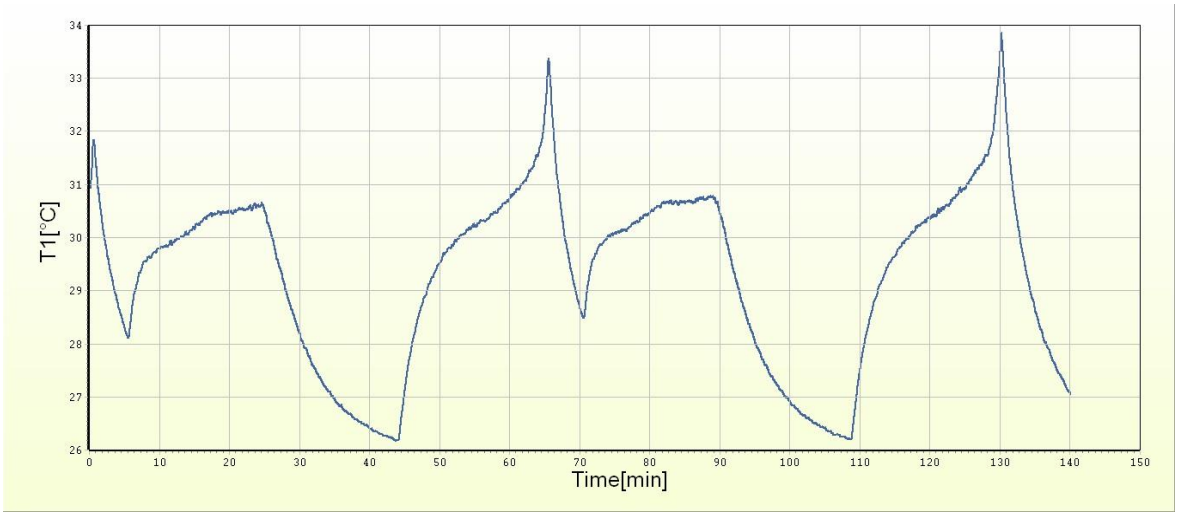

Figure 7: Temperature profile cycle 4-5

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

Cycle	Charge time t/min	Charge capacity C/mAh	Charge energy E/Wh	Discharge time t/min	Discharge capacity C/mAh	Discharge energy E/Wh
Zyklus 1	33.17	4184	16.11	21.40	4102	15.33
Zyklus 2	32.61	4107	16.54	21.43	4108	15.32
Zyklus 3	32.69	4112	16.57	21.41	4105	15.28
Zyklus 4	33.58	4184	16.24	21.36	4095	15.23
Zyklus 5	33.25	4098	16.57	21.37	4098	15.20

Average Charge Capacity for all 5 charge cycles: 4137 Ah
Average Discharge Capacity for all 5 discharge cycles: 4102 Ah
Resulting average Coulomb Efficiency for all 5 cycles: 99.15 %

Average Energy Throughput for all 5 charge cycles: 16.406 Wh
Average Energy Throughput for all 5 discharge cycles: 15.272 Wh
Resulting Average Energy Efficiency for all 5 cycles: 93.09 %

Gravimetric and volumetric energy density at charging and discharging

Figure 8: Volume measurement

Result for discharging: 105mm*60mm*4.2mm ≙ 0.0265 l with 15.272W/h follows pel=576.3 Wh/l
Result for charging: 105mm*60mm*4.2mm ≙ 0.0265 l with 16.406W/h follows pel=619.1 Wh/l

Figure 9: Mass measurement

Result for discharging: 0.05143 kg with 15.272 W/h follows pel=297 Wh/kg
Result for charging: 0.05143 kg with 16.406 W/h follows pel=319 Wh/kg

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End of Test Report