

Empa
Überlandstrasse 129
CH-8600 Dübendorf
T +41 58 765 11 11
F +41 58 765 11 22
www.empa.ch

Swaytronic GmbH
Mr. Benjamin Urech
Binzenholzstrasse 18
CH-5704 Egliswil

Test Report No 5214010881

Test assignment	Electrical Characterization Lithium-Polymer-Battery
Client:	Swaytronic GmbH
Test object:	Swaytronic Frozen-LiPo 11.1V 2200mAh 35C/70C
Client's ref:	Mr. Benjamin Urech
Order dated of:	5.10.2015
Test object received:	28.9.2015
Test performed:	2. – 5. November 2015
Number of pages:	6
Attachments:	-

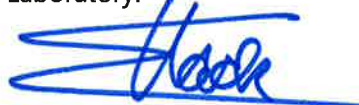
Empa, Swiss Federal Laboratories for Materials Science and Technology
Dübendorf, 9. November 2015

Expert:



Marcel Held

Head of Laboratory:

n.v. 

Dr. U. Sennhauser



Note: The test results are valid solely for the tested object. The use of the test report for advertizing purposes, any reference to it or the publication of excerpts require the approval of the Empa (see Information Sheet). Test reports and supporting documents are retained for 10 years. Information on the measurement uncertainty can be requested from the laboratory.

1. Test assignment

By order of Swaytronic GmbH an electrical characterization of a Lithium-Polymer battery pack is performed. Therefore the battery is fully charged at room temperature and then discharged with a current-time profile defined by the client. Discharging is performed after a 10 minute storage at ambient temperatures of 0°C, -10°C and -20°C. An additional test measures cell voltages during a storage period of two hours at an ambient temperature of -10°C with the battery charged to a defined level.

2. Specimen

Specimen is a battery pack of Swaytronic GmbH designated as *Swaytronic Frozen-Lipo 11.1V 2200mAh 35C/70C*, consisting of three cells connected in series..

The nominal capacity of the battery is specified as 2200 mAh.

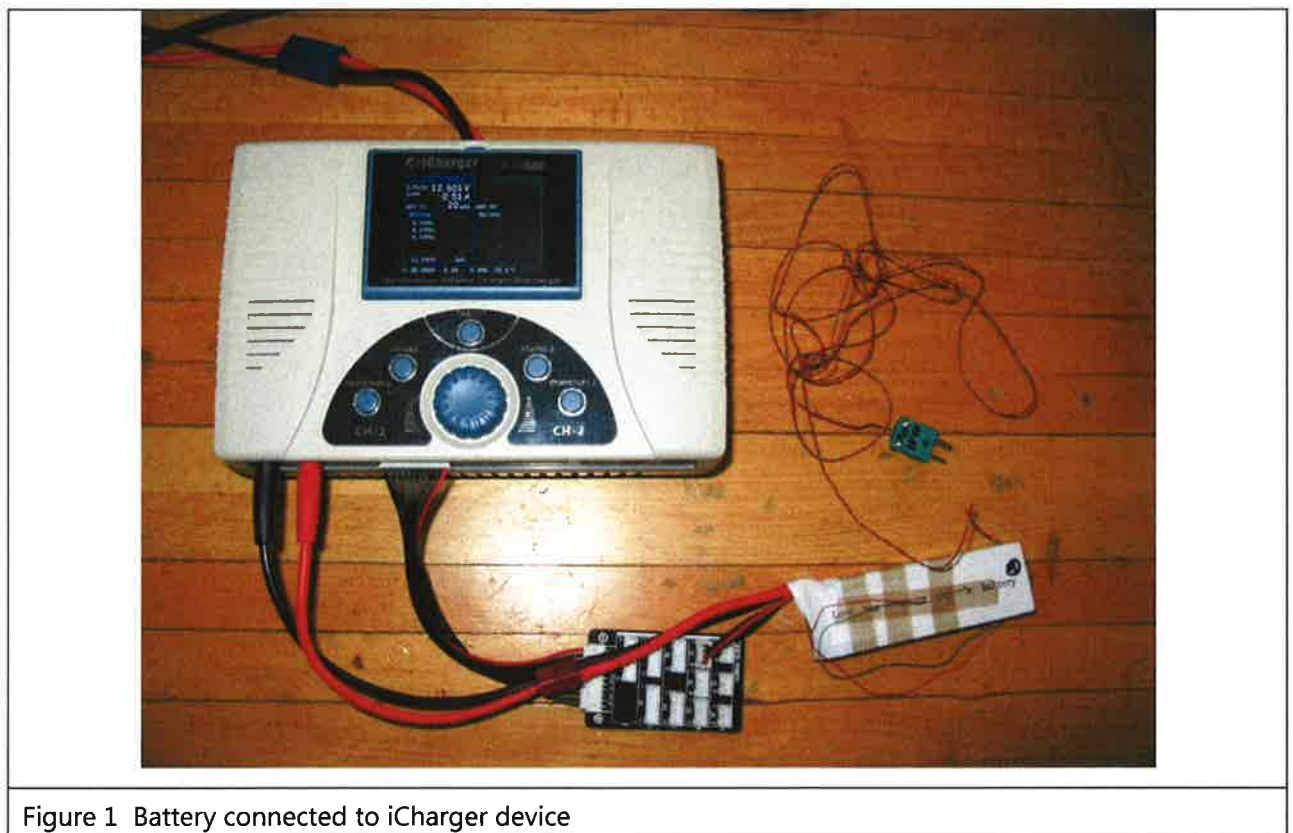


Figure 1 Battery connected to iCharger device

3. Measurement equipment

Battery tester Maccor, SOP 5081 and 5082

Battery charger *iCharger 4010 DUO*

4. Test conditions

The discharging profile is defined by the client and depicted in fig. 2.

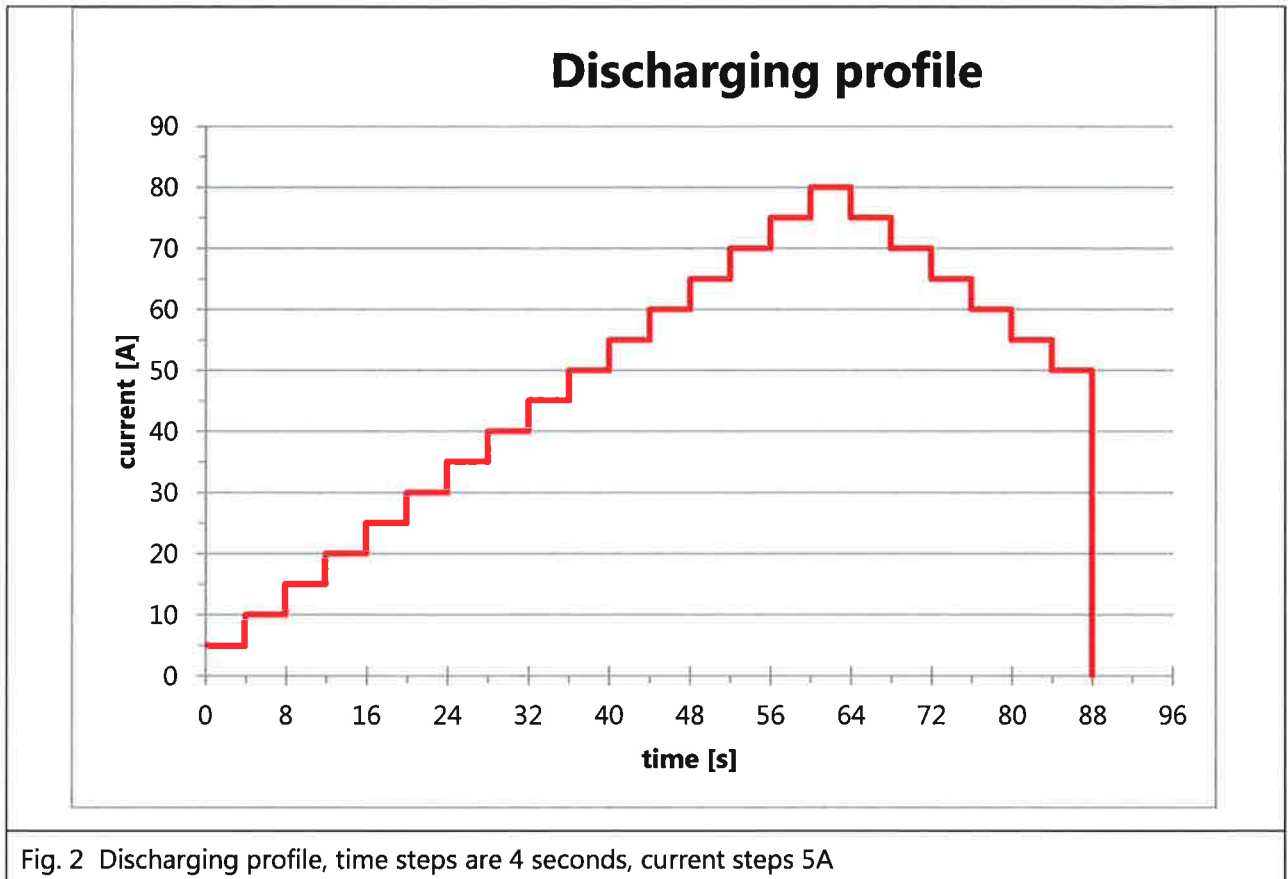


Fig. 2 Discharging profile, time steps are 4 seconds, current steps 5A

Measurement conditions

The battery was fully charged at room temperature ((iCharger LiPo Program *Charge*, LiPo Capacity 2200mAh, Cells 11.1V (3s), current 2.2A (1C), Mode *Balancing slow*).

Afterwards the specimen was placed in the temperature controlled battery test container. Ten minutes later the discharging test was started. During discharge the following parameters were measured: cell voltages, battery voltage, discharge current, temperature at surface of specimen as well as discharged capacity and energy.

For the measurement of cell voltages during a two hour storage at -10°C the battery was partly charged and balanced (iCharger LiPo Program *Storage*, LiPo Capacity 2200mAh, Cells 11.1V (3s), Mode *Storage Voltage 3.85 V/Cell*).

5. Results

It was possible to run the discharging profile at all three ambient temperatures 0°, -10°, -20°C, see figures 3, 4 and 5. The instantaneous power– calculated as current times battery voltage – reached about 700 Watts in all three measurements, see fig. 6 as example.

During storage at -10°C ambient temperature for two hours all cell voltages remained stable at 3.85 Volt, see figure 7.

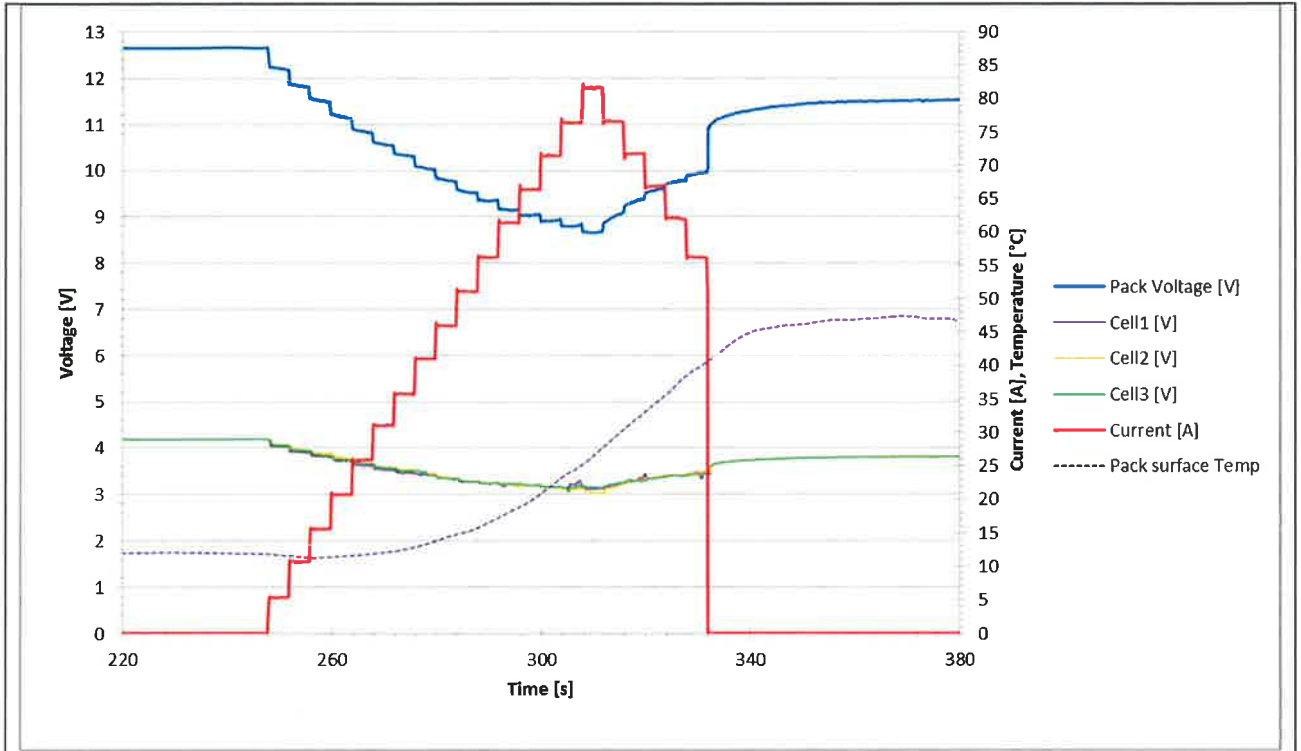


Fig. 3 Measurement at 0°C ambient temperature, discharged capacity, energy: 1.1455 Ah, 10.89 Wh

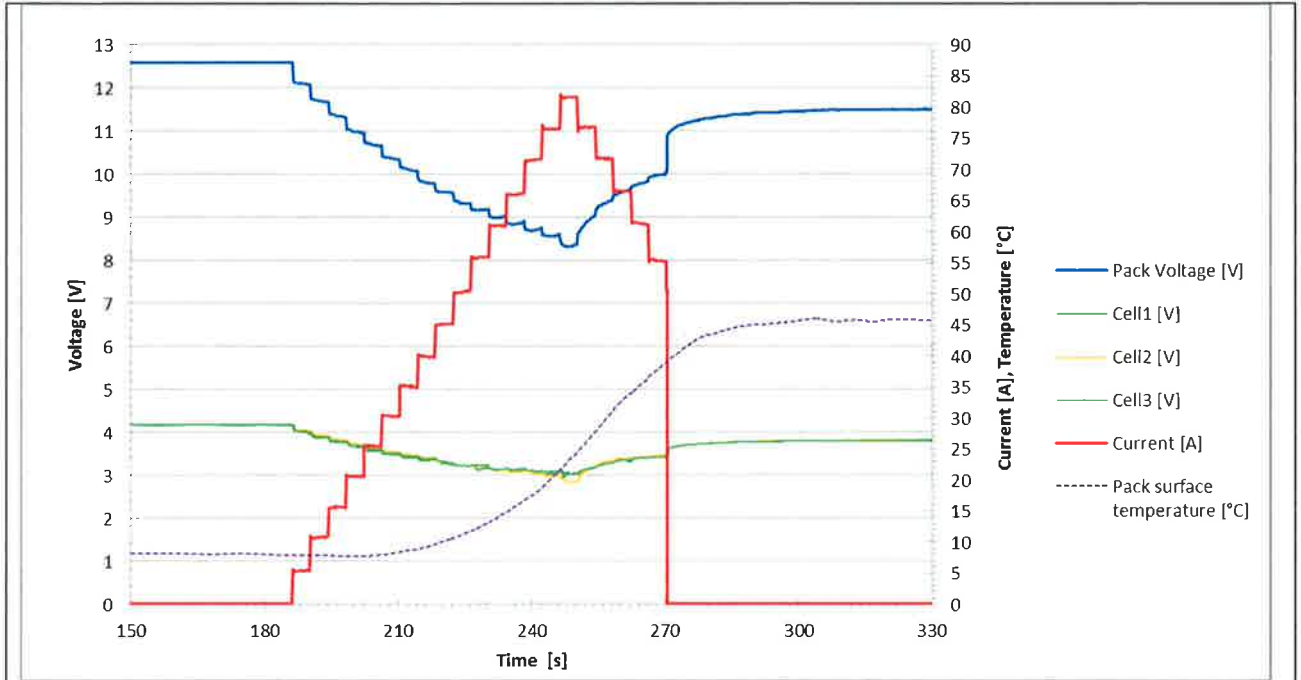


Fig. 4 Measurement at -10°C ambient temperature, discharged capacity, energy: 1.1391 Ah, 10.665 Wh

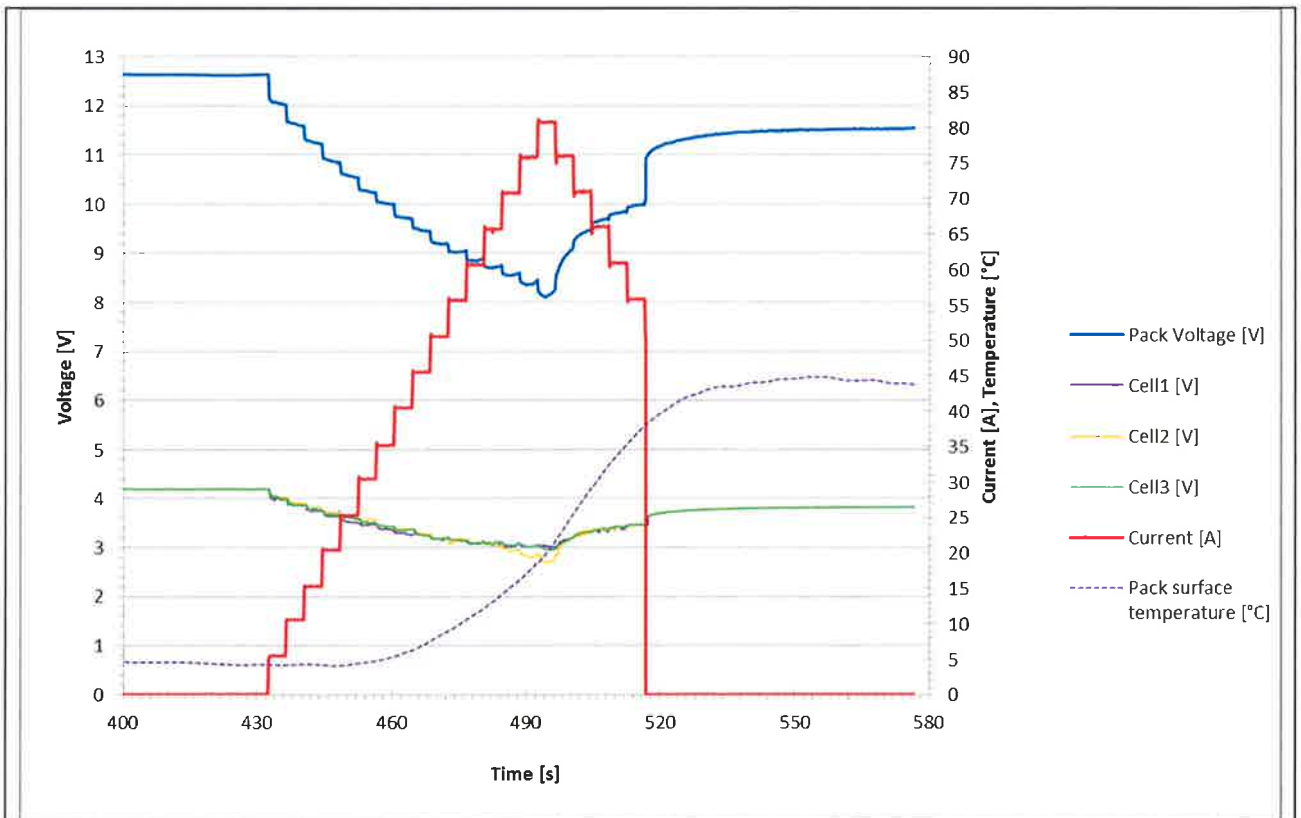


Fig. 5 Measurement at -20°C ambient temperature, discharged capacity, energy: 1.1328 Ah, 10.51 Wh

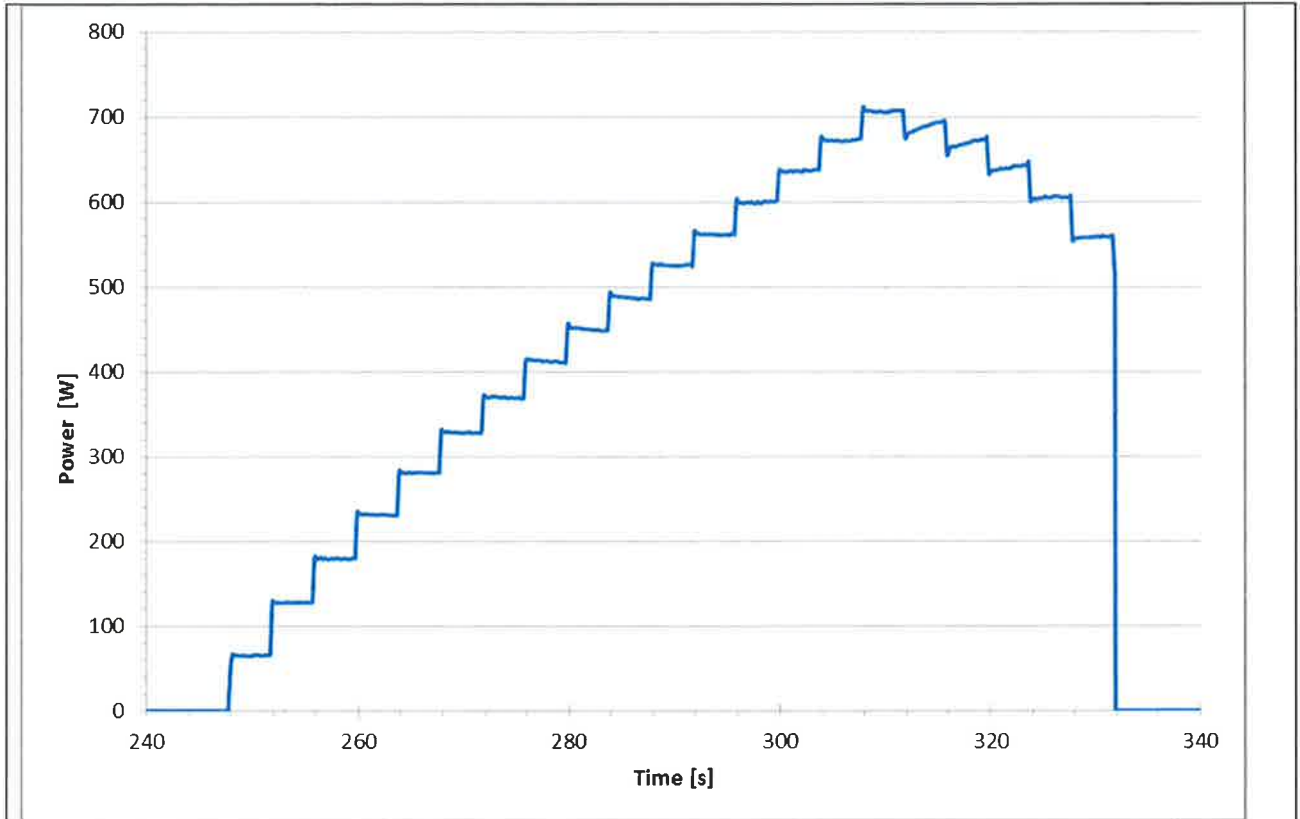


Fig. 6 Power at 0°C ambient temperature

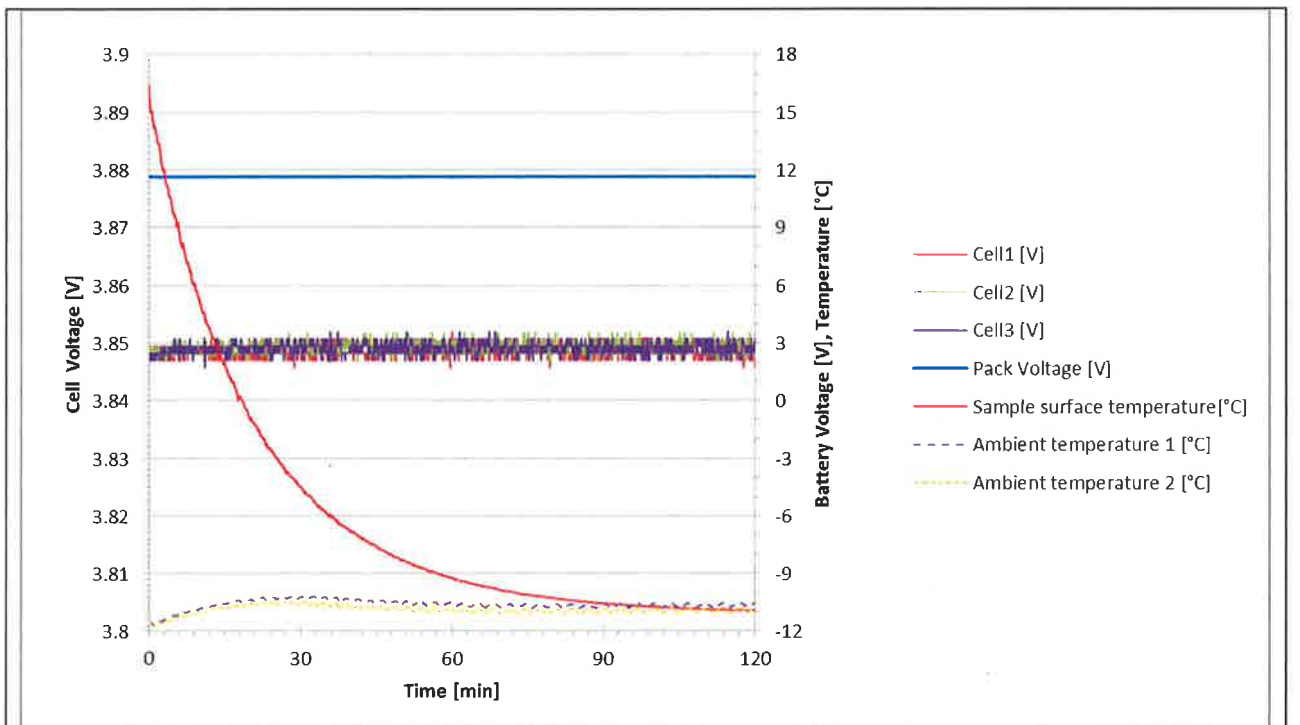


Fig. 7 Storage at -10°C, 2 hours, cell voltages remained stable at 3.85 Volts