

GWL Technology Report



High Current Charging and Discharging Report for Lithium (LiFeYPO₄) Cells

The purpose of the test is to verify the life-span of the LiFeYPO₄ cells in long time run. The following questions will be answered:

- 1) How will the cell behave after 10 000 and more cycles
- 2) How will the performance of the cell be when charging and discharging with high current (more than 1C)?
- 3) Will the cell overheat or have any other malfunction?
- 4) Will the cell age and lose its capacity?

The test is done with LFP090AH – Winston Battery LiFeYPO₄ model

The cycle definition:

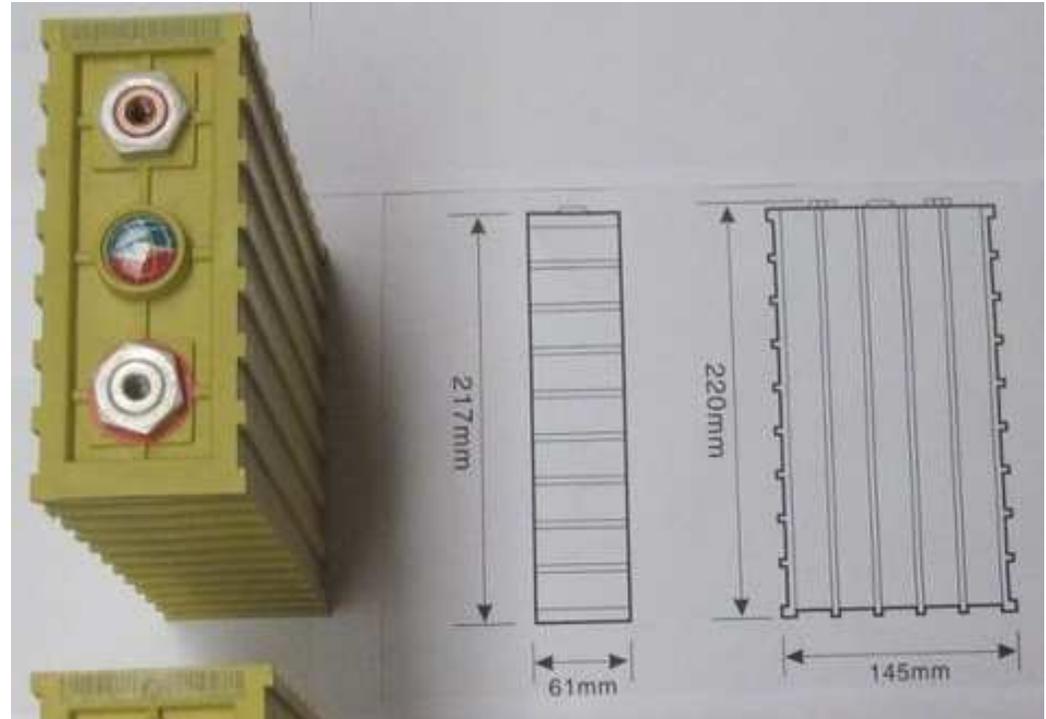
- A) Discharge the battery with 130A current (1.5C) for 250 seconds
- B) Relax for a short period (up to 250 seconds)
- C) Charge the battery with 130A current (1.C) until 4.0V and then reduce the current (up to 350 seconds)
- D) Relax for a short period (up to 100 seconds) and start discharge A) again

The timing of the cycle is 950 seconds (up 16 minutes per cycle)

To make the test of 10 000 cycles, the time for testing needed is 2670 hours (111 days). To make the test of 13 000 cycles, the time for testing needed is 3470 hours (144 days)

The test was performed by the **Czech Technical University in Prague, Faculty of Transportation Sciences, Department of Control and Telematics.**

The test report follows on next pages.



<http://www.ev-power.eu>

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Faculty of Transportation Sciences

Department of Control and Telematics

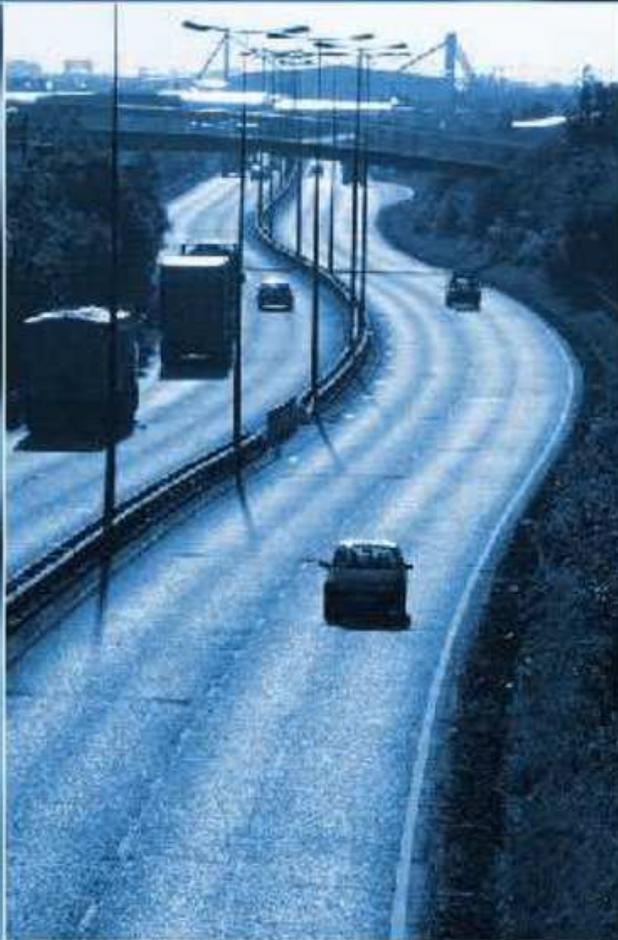
**WORKPLACE FOR LONGTIME
PERFORMANCE TESTING OF
ENERGY ACCUMULATORS FOR
ELECTRIC VEHICLES**

13.5.2011

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Martin Leso, leso@fd.cvut.cz

Assistant professor



Description of testing workplace

Photograph:



PS

Acc

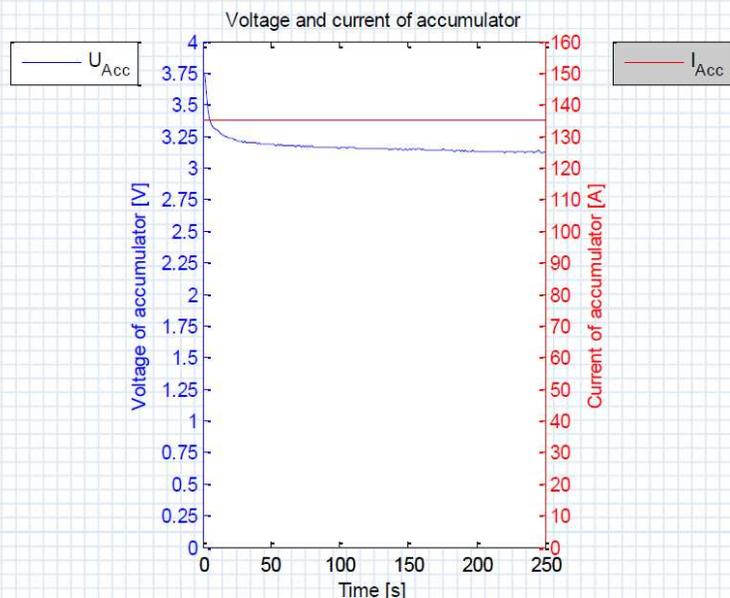
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The discharge characteristics after 13 000 cycles at 1.5 C (130A)

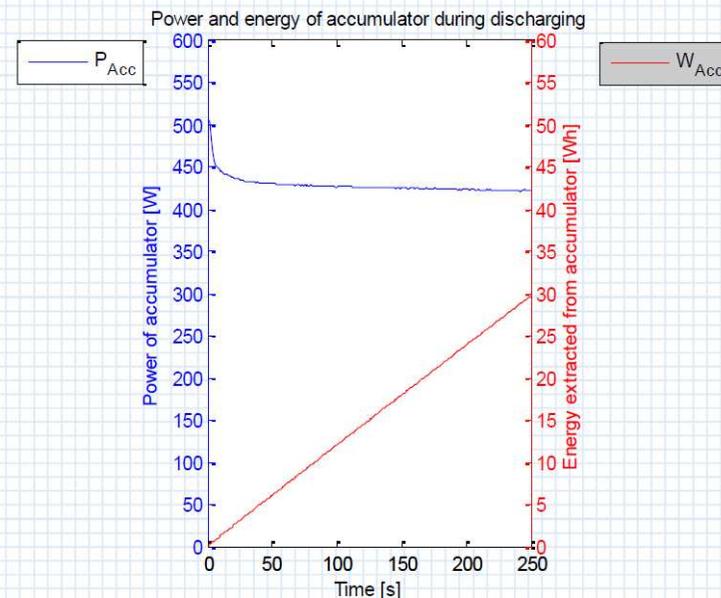
1) Discharging – voltage and current

Voltage and current during discharging of accumulator 90 Ah LiFeYPO₄ after 13000 cycles of 10% depth under 35 °C.



1) Discharging – power and energy

Power and energy during discharging of accumulator 90 Ah LiFeYPO₄ after 13000 cycles of 10% depth under 35 °C.



Conclusion of the discharge characteristics after 13 000 cycles:

There is no degradation in the performance of the cell. The cell performs the same way and no significant change of in the discharge characteristics has been measured.

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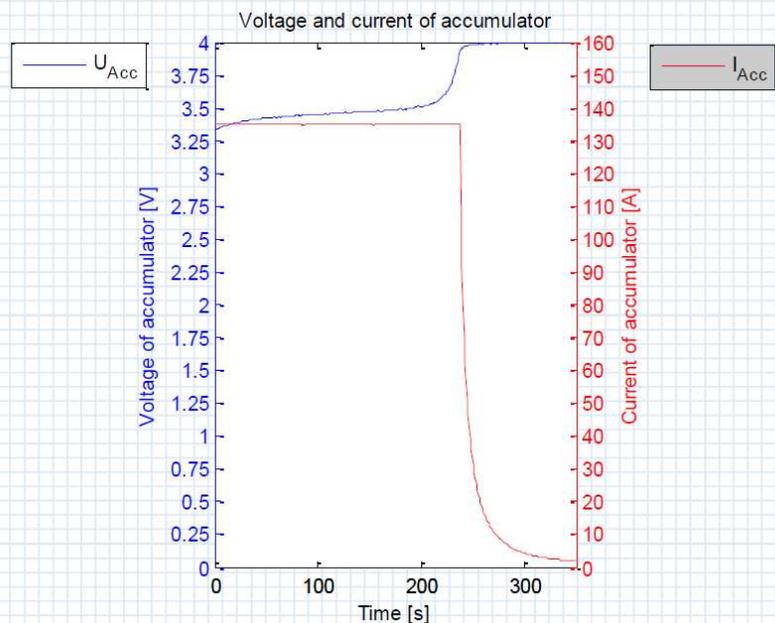
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The charge characteristics after 13 000 cycles at 1.5 C (130A)

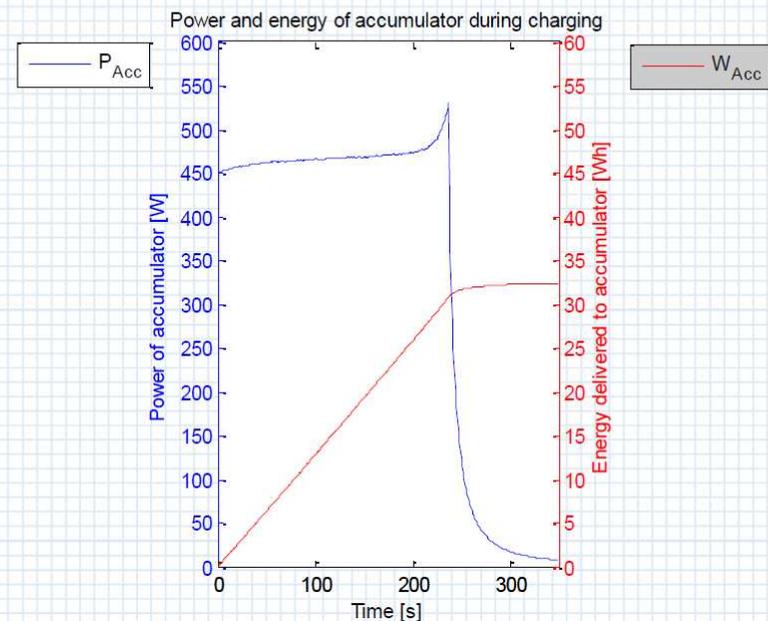
2) Charging – voltage and current

Voltage and current during charging of accumulator 90 Ah LiFeYPO_4 after 13000 cycles of 10% depth under 35 °C.



2) Charging – power and energy

Power and energy during charging of accumulator 90 Ah LiFeYPO_4 after 13000 cycles of 10% depth under 35 °C.



Conclusion of the charge characteristics after 13 000 cycles:

There is no degradation in the performance of the cell. The cell performs the same way and no significant change of in the charge characteristics has been measured.

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The energy accumulation results after 13000 cycles at 1.5 C charge and discharge

Results of testing

Summary of example results - accumulator 90 Ah
LiFeYPO₄ after 13000 cycles of 10% depth under 35 °C.

I [xC]	W _{Out} [Wh]	W _{In} [Wh]	η [%]
1,5	29,6	32,4	91,4

Czech Technical University in Prague – Faculty of Transportation Sciences
Department of Control and Telematics



The effectiveness of the energy storage after 13 000 cycles is still 91.4%

The answers to the test questions

1) How will the cell behave after 10 000 and more cycles

The cell behaves in the same ways after 13000 cycles. No abnormalities or a change of the cycle performance has been measured.

2) How will the performance of the cell be after so many cycles of charging and discharging with high current (more than 1C)?

Despite the high charging and discharging rate, the performance of the cell did not show any abnormalities.

3) Will the battery overheat or have any other malfunction?

The cell does not overheat and we did not record any increase of temperature.

The cell keeps the same temperature during the test.

4) Will the battery age and lose its capacity?

There is no measurable degradation of the cell and the cell did not lose either the capacity or the ability to accumulate and to release energy.

The test results exceeded our expectations. The cell performance is extremely satisfying.

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