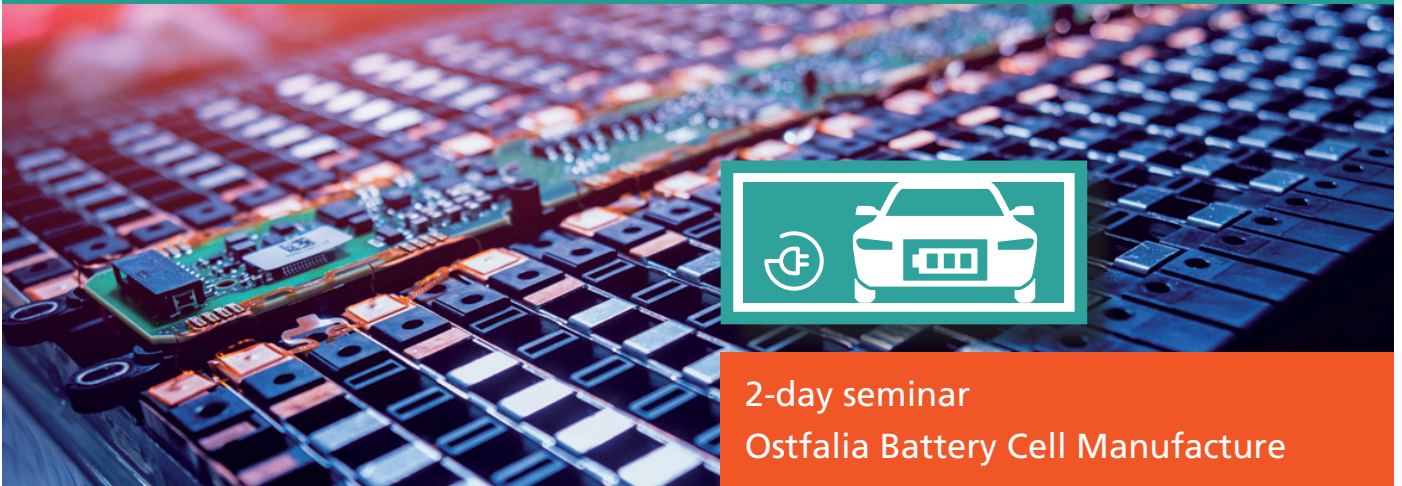


QUALIFICATION

BATTERY CELL PRODUCTION



2-day seminar

Ostfalia Battery Cell Manufacture

The production of lithium-ion battery cells

is covered in this seminar. For this purpose, theory and practice are combined. The focus is on the construction and commissioning of a battery cell. The concept of the "Ostfalia Battery Cell Manufacture" is unique worldwide and allows deep insights into cell production and cell operation from basic design to post-mortem analysis. Each participant will build their own individual cell and executes all manufacturing and analysis steps independently.

Target groups

- Technical staff in battery production
- Engineers/ technicians from the automotive industry
- Production employees

Groups will be divided homogeneously to achieve optimal results. 4 participants per group.

Advantages of the Ostfalia Battery Cell Manufacture

- Academic environment with comprehensive expertise
- The seminar contents may be arranged flexibly
- Know-how beyond cell production: Abuse tests, simulation and measurement of complete cells, modules to automotive measurements
- State-of-the-art laboratory equipment: e.g. nano-XCT, laser scanner microscope, light microscope, SEM with EDX, Raman spectroscopy, laboratory for rheology, particle analysis, impedance spectroscopy, 3-electrode measurements, optically accessible cells
- Longterm cooperation with Volkswagen in the qualification field
- Event in the new laboratory building in the middle of Wolfsburg

Program schedule 2-day seminar

Seminar day 1

Refreshing the basics of lithium-ion batteries

- Interactive lecture

Structure of laboratory cells

- Lab work

Seminar day 2

Construction in the glove box, commissioning of the laboratory cells

- Lab work

Disassemble and analyze the laboratory cells

- Lab work and Analysis

Hands-on seminar

in theory and practice

Day 1 8.00 -12.00 o'clock

13.00 -17.00 o'clock

Day 2 8.00 -12.00 o'clock

13.00 -17.00 o'clock

Registration

www.tww.de

Costs 2-day seminar:

1.390,- € / participant

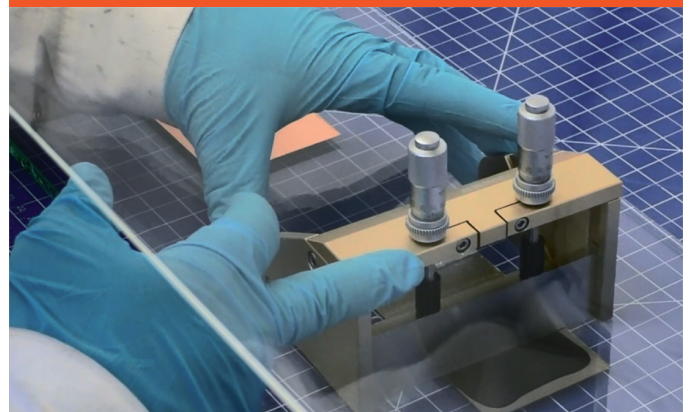
4.990,- € / group of 4

from company

Seminar tax free according to §22a UStG

Venue

An-Institute of the Ostfalia University of Applied Sciences
Faculty of Automotive Engineering, Wolfsburg



More infos at www.tww.de

Trainings- & Weiterbildungszentrum Wolfenbüttel e.V.

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Contact person

Prof. Dr.-Ing. habil. Robin Vanhaelst

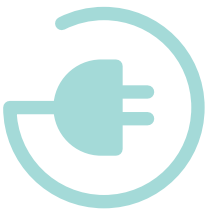
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QUALIFICATION

BATTERY CELL PRODUCTION

Seminar day 1 8:00-12:00 o'clock - interactive lecture

Basics of lithium-ion batteries

1. Elektrochemistry

- Repetition of the basic terms: Charging end voltage, end-point voltage, nominal voltage, C-rate, SOH, SOC, DOD, SOF, etc.
- Real discharge curve of a battery

2. Structure, Function & Properties

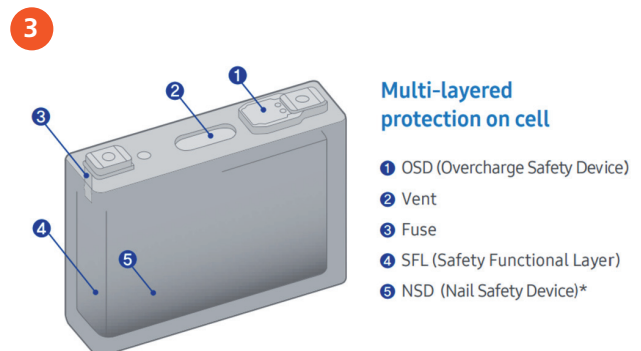
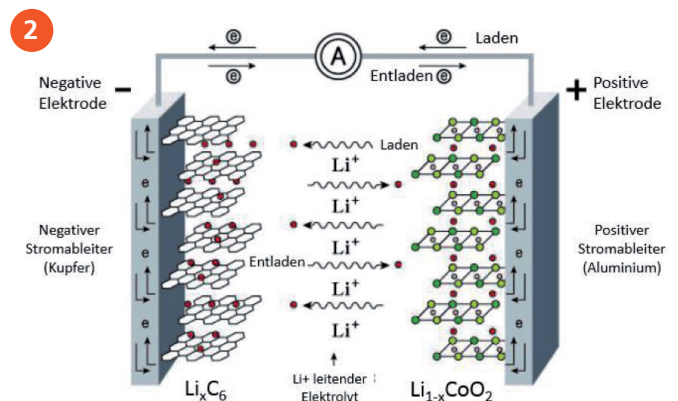
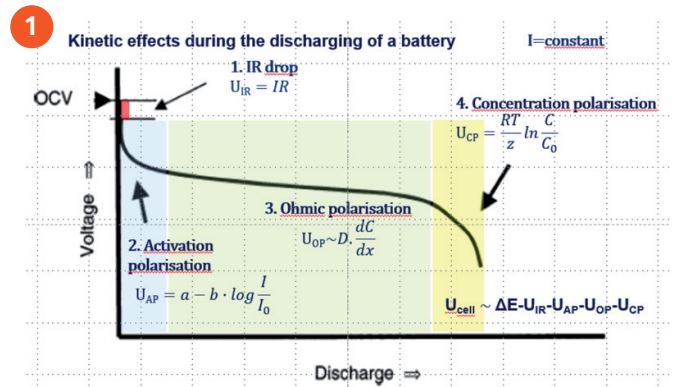
- Structure of a lithium-ion battery
- Detailed description of functions and properties of the anode and cathode, separator and electrolyte
- Properties of cell chemistry on energy density, power density, safety and aging

3. Manufacture, Costs & Availability

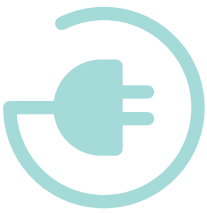
- Description of the necessary production steps, projected onto a large-scale production plant
- Overview of manufacturing and material costs
- Analysis of the availability of cell materials

4. Design of the laboratory cells and preparation of laboratory

- Each participant will get their own cell chemistry (e.g. LFP, NMC, LMO, NCA)
- Calculation of the necessary active masses
- Determination of the anode composition for the cell structure
- Establishing a flow chart for the cell construction
- Safety instruction for the laboratory



* In case of 94Ah cell



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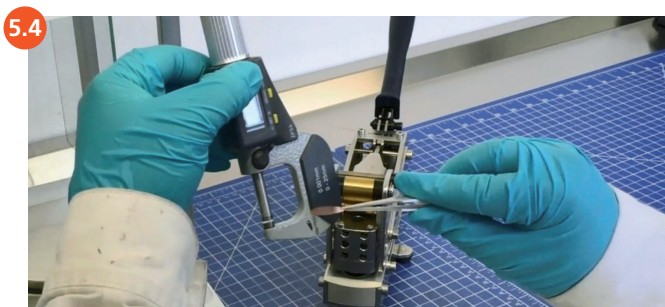
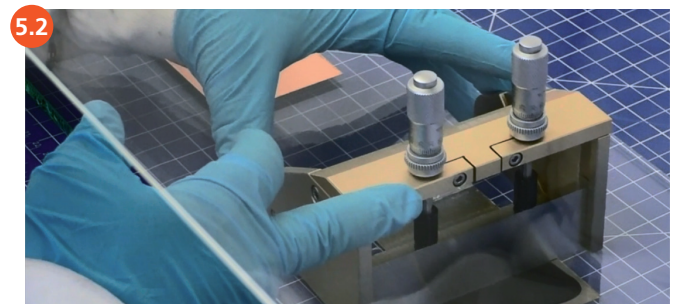
BATTERY CELL PRODUCTION

Seminar day 1 13:00-17:00 o'clock - Lab work

Structure of laboratory cells

5. Construction of Li-ion laboratory cells

- ① 5.1.a Mixing of the slurry for the anode according to your own recipe (for safety reasons the entire cathodes are provided)
- ① 5.1.b Mixture according to own recipe
- ① 5.1.c Explanation of mixing order and time based on physical laws
- ① 5.2. Coating the electrodes
 - Setting the layer thickness depending on the spec. capacity
- ① 5.3. Drying of the electrodes and determination of the layer thickness profile
- ① 5.4. Punching the electrodes
 - Layer thickness control
 - Visual inspection and mass determination
- ① 5.5. Compression of the electrode materials
 - Optical inspection using LSM or light microscopy
 - Layer thickness control
- ① 5.6. Transfer in vacuum dryer
 - Adjusting drying time, temperature and negative pressure
 - Process time (min. 12 hours)

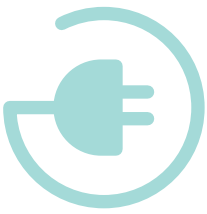


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QUALIFICATION

BATTERY CELL PRODUCTION

Seminar day 2 8:00-12:00 o'clock - Lab work

Construction in the glove box and commissioning of the laboratory cells

1. Dry runs of the cell assembly

- Dry runs of the cell assembly under glove box-like conditions

2. Construction in the glove box

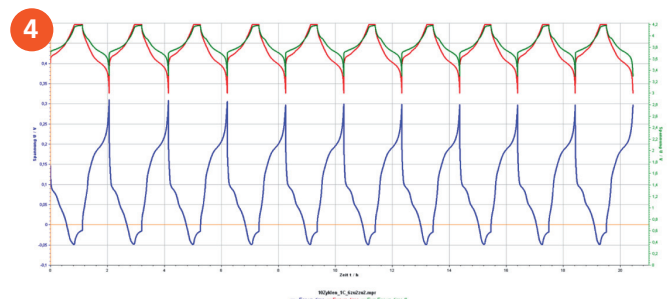
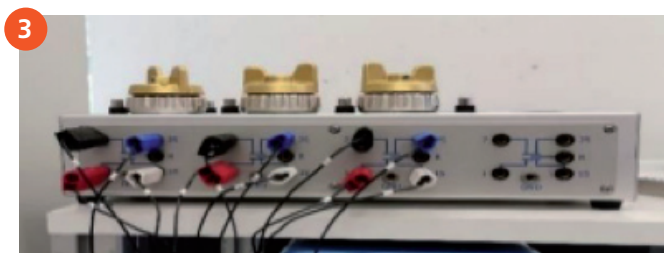
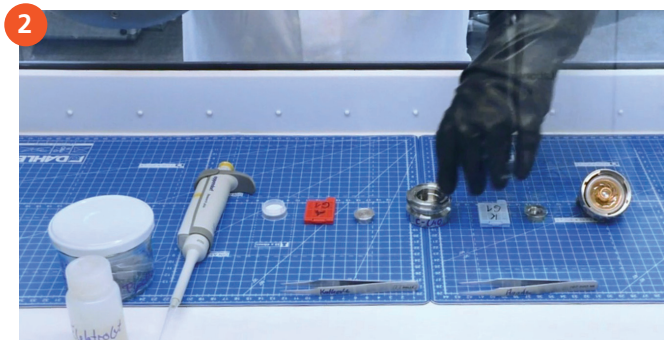
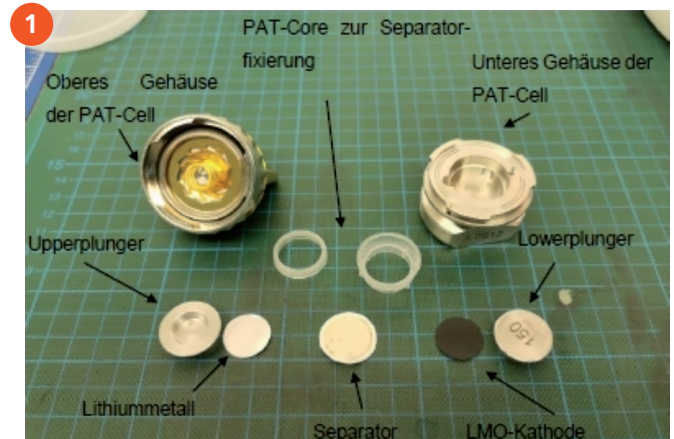
- Insertion of the cell materials into the glove box
- Assembly of the laboratory cells in the argon-glove box (each participant will build their own individual cell)

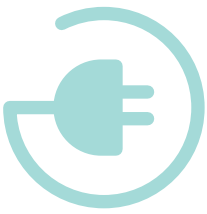
3. Commissioning of the laboratory cells

- Connecting the cell to the galvanostat or potentiostat
- Defining the cell's individual operating parameters
 - C-rate for the formation
 - Setting the cyclization parameters
- Conducting the formation and monitoring of the SEI formation

4. Conducting the cyclization

- Cyclization over 100 cycles with 1 C and further cycles from 2 C up to 10 C
- Calculation / observation of the SOH
- Measurement of the full cell potentials and the charging/discharge current





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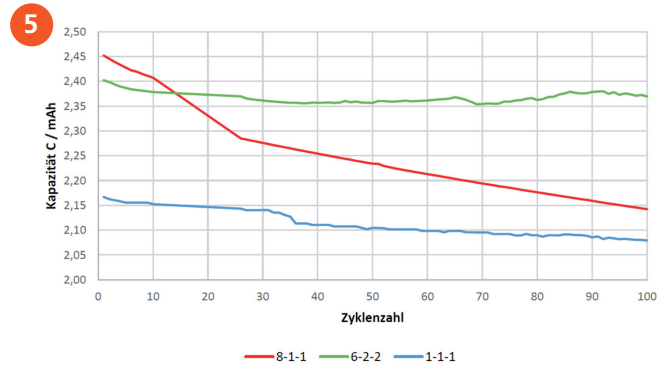
BATTERY CELL PRODUCTION

Seminar day **2** 13:00 -17:00 o'clock - Lab work and Analysis

Disassemble and analyze the laboratory cells

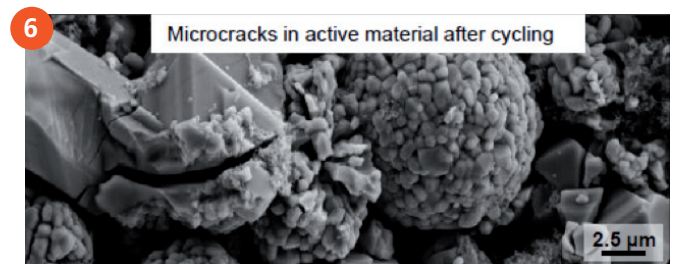
5. Analysis of the measurement results and aging

- ⦿ Determination SOH, Ri, Coulomb efficiency, etc. from cyclization



6. Disassembly of the laboratory cell and material analysis

- ⦿ As part of the laboratory courses, the cells will be disassembled and analyzed
- ⦿ Gravimetric and optical methods will be used to understand and analyze the materials and cell structure



7. Application of optical metrology

- ⦿ Laser Scanning Microscopy
- ⦿ Light microscopy with subsequent digital image editing
- ⦿ Raman spectroscopy
- ⦿ Nano-XCT measurements are shown

