Equipment of our professional electrochemical research laboratory:

- All kinds of battery test cells of EL-CELL®
  (all our standard and reference electrode test cells, dilatometer,
  optical, air and gas test cells)
- Tools and handling equipment for electrochemical experiments
  (e.g. cutting and punching tools, cell loading equipment)
- Equipment for the preparation of electrode slurries and for
  casting/drying electrode films
- MBraun glove box system for test cell assembly
- Laboratory fume hood to coat electrode films
- Temperature controlled test cabinet
- Different kinds of potentiostats:
  - Maccor 4000 series cycler
  - Biologic VSP multichannel impedance analyzer
  - Gamry Interface 1000
- All necessary consumables to run meaningful battery testing
  experiments: Different kinds of anode/cathode materials, binders,
  additives, separators, electrolyte, current collector foils

All necessary equipment, tools and materials are available in
our laboratory for a successful seminar, but it is also possible for
participants to bring their own devices or materials for testing.

Hands-on Seminar 1: Basic battery research
10th + 11th March, 2016
09th + 10th June, 2016
06th + 07th October, 2016

Hands-on Seminar 2: Advanced battery research
21th + 22nd April, 2016

Duration: Two days (8 hours per day)

Pricing: Regular registration: 1,250 €
PhD-students (confirmation required): 625 €
Early Bird: regular: 1,150 €, students: 575 €
(until 4 weeks in advance)

We offer free hotel reservation and shuttle service between
accommodation and laboratory. For registration and further information
please visit our website www.el-cell.com/service or contact

info@el-cell.com
phone: +49 (0)170 920 24 75
Your business includes the development of innovative energy storage? Working with Li-ion batteries is part of your research? You are operating with super capacitors? We are the appropriate partner for you. EL-CELL® offers electrochemical test equipment and services to perform high quality battery research at the edge of actual knowledge.

EL-CELL® engineers and manufactures test equipment for both researchers in academia and professionals in industry. We concentrate on lithium-ion batteries, but we also design test cells for other energy storage technologies. We customize our devices and tools according to your individual requirements and develop solutions for specific experiments.

Learn more about:
- The latest devices and applications for battery testing
- How to run meaningful electrochemical tests by yourself (constant current cycling, voltammetry, impedance)
- Practical preparation and testing of Li-ion battery materials in the lab
- Pros and cons of different cell designs (EL-CELL® test cells, Coin cells, Pouch cells, Swagelok® cells)
- Benefits and limitations of 2- and 3-electrode test cells
- How to perform experiments with the latest in-situ test cells of EL-CELL® (dilatometer, gas analysis, Raman, X-ray and many more)
- Many other actual electrochemical research topics

Hands-on Seminar 1: Basic battery research

Target audience:
PhD-students, battery research novices, career changers from other subjects (maximum 6 participants)

Education background required:
Chemistry, material sciences, electrochemical basics

Description:
The Hands-on Seminar 1 covers the basics of Li-ion battery testing from making the electrodes to the electrochemical characterization in 2- and 3-electrode test cells and the interpretation of your own battery test results. You will build your own battery test cells, guided by our experienced battery researcher. Afterwards you will run your own electrochemical tests (impedance measurement, CCCV cycles, voltammetry) with our latest test equipment and we will assist you in interpreting the results. Special emphasis is put on various failure modes, common pitfalls, possible artifacts and on how to identify and avoid problems and failures during your experiments.

Topics:
- Li-ion battery introduction: Working principles, terminology, materials used, related technologies (Li-ion batteries, Li-ion capacitors, super capacitors, dual intercalation batteries, Li-air batteries)
- Safety and corrosion issues within the Li-ion research laboratory
- Necessary equipment of a battery research laboratory
- Pros and cons of different test cells (18650 test cell, Coin cells, Pouch cells, Swagelok® cells, Hohsen Corp., EL-CELL®)
- Electrode making from powder to sheet
- Building 2- and 3-electrode test cells with glass fiber and polyolefin separators
- CCCV cycle tests
- Impedance spectroscopy with and without reference electrode
- Voltammetry
- Life cycle tests

Hands-on Seminar 2: Advanced battery research

Target audience:
Experienced electrochemical scientists, professional battery researchers (maximum 6 participants)

Education background required:
Chemistry or electrochemistry, material science, ability to work independently with standard battery test cells

Description:
The Hands-on Seminar 2 covers a variety of in-situ techniques for special testing applications in Li-ion battery research. Emphasis is put on how to set up and operate in-situ tests cells and how to identify and avoid potential pitfalls during the experimentation. You will have the chance to set up your own experiments and run tests with the available test cells of EL-CELL®. Extensive information is provided on how to adapt the test cells to the requirements and experiments of the participants.

Topics:
- Electrochemical dilatometry
  - Working principle of dilatometry
  - Case studies of dilatometer experiments
  - Own experiments with ECD-3 and ECD-3-nano (dilatometer)
- Optical in-situ techniques
  - Introduction to battery test cells for optical experiments in reflective mode, e.g. optical microscopy, X-ray and Raman spectroscopy
  - Assembly of optical battery test cells: ‘face-to-face’ vs. ‘face-up’
  - Case studies of optical experiments
  - Own experiments with test cells ECC-Opto-Std
- In-situ test cells for gas analysis
  - Case studies of gas analysis experiments
  - Assembly of test cells ECC-Press, ECC-Air and ECC-DEMS
- Li-ion battery testing with 3-electrode test cells
  - Benefits and limitations of 3-electrode measurements
  - Tackling reference artifacts
  - Cases involving reference electrodes: CCCV cycling, impedance
  - Building and running 3-electrode test cells with ring-shaped reference electrode