

Dear Colleague,

On behalf of the organizing team, I would like to invite you to join this workshop. We are sure we can make significant progress together by closer co-operation regarding test methods and lead–acid battery science, and I believe your contribution would be of great value.

Best Regards,  
Eckhard Karden

## **High-Temperature Durability Tests for Advanced Lead–Acid 12-V Batteries Scientific Workshop**

### **Background & Objective**

It has been established that the dynamic charge-acceptance (DCA) of lead–acid batteries can be improved significantly by certain additives to the negative electrode. When applied in 12-V micro-hybrid batteries, these technologies enable savings in fuel consumption and CO<sub>2</sub> emissions, as well as enhanced reliability (robustness against undercharge issues) of SLI batteries in moderate-climate markets. Most high-DCA additives, however, lead to a significant degradation of high-temperature durability, as it is measured by standardized overcharge tests (water consumption in Europe, gassing and key-life tests in North America). At the same time, battery warranty periods are being extended in hot-climate markets.

Thus, high-temperature battery durability testing is in focus for several reasons now. Simulated hot-climate drive cycles, as well as field experience in Asia, indicate limits of correlation between high-temperature field life and established overcharge tests. Recent research has shown that recombination in AGM and enhanced flooded batteries (EFB), as well as transient potential shifts during microcycling, significantly alter gassing rates, compared with what is observed in the laboratory during continuous overcharge.

This workshop brings together international experts from car industry, battery industry, materials suppliers, and academia. It will trigger an open discussion about high-temperature durability test methods for battery standards, with the goal of realistically assessing high-temperature effects of impurities and additives. New findings regarding recombination and transient overcharge kinetics will be highlighted, with a strong focus on defining working hypotheses and questions for co-ordinated further investigation. An attempt will be made to better mirror real-world usage conditions when screening high-DCA technologies.

### **Workshop Format**

This is not a scientific conference, there will be no lectures in the usual 20 minutes format. All participants will be invited to provide input to one or two sessions by short talks. Each talk is supposed to last 5 minutes at maximum. Material with detailed information and test data should be distributed

upfront and only summarized orally, to raise a question or suggest a new hypothesis for discussion in the auditorium.

## **Draft agenda:**

### **Plenary 1: Side reactions in SLI batteries – New findings and their relevance**

- Continuous overcharge tests may be misdirecting – but why & where does field water consumption still matter for 12 V micro-hybrid applications?
- There is a recombination cycle in Ca/Ca flooded and EFB – what does this imply for battery design and testing?
- Field experience with high-DCA EFB

### **Breakout Sessions: Best Practices – Start defining standard procedures**

1. Test Cycles: How should high-temperature durability tests be designed (requirements) and validated (relevance)?
2. Test Cells: How should test cells for material evaluation be built to minimize experimental noise?
3. Cell Tests: How should battery-level tests (high-temperature durability, DCA, microcycle life) be translated for test cells?

### **Plenary 2: Science Needed – Clarify mechanisms and interactions of side reactions in EFB±C**

- Measurements: techniques to measure oxygen and hydrogen concentrations and flow rates in liquid and gas media
- Mechanisms: recombination reactions and transport mechanisms in EFB, and how additives affect them
- Interactions: mixed potentials during dynamic micro-cycling & parking operation
- Self-discharge: explain weight loss at OCV and understand whether self discharge continues (chemically) during micro-cycling

### **Plenary 3: Cooperation Needed – Agree co-operative approaches for research and test development**

- Standard development for CENELEC TC21X WG3 – shared work for validation of new test methods
- Extended battery warranty for hot-climate markets – merge EN and SAE test traditions
- Framework for definition of best practices – foster excellence in material development and screening
- Which contributions can research institutes make, and how can they be financed in absence of major public funding opportunities?

**Evening programme:** Monastery tour, wine tasting, dinner

## **Date & Location**

Monday, 30 January 2017, 9 – 18 o'clock

This is the day before the new [lead-acid symposium](#) of [AABC Europe 2017](#), Mainz/Germany.

The workshop will take place in [Kloster Eberbach](#), an ancient monastery within 45 min driving from both Frankfurt International Airport and Rheingoldhalle Mainz, the venue of AABC.

A seminar fee of 240 € plus 19% VAT will be charged at cost, to cover facilities rental, lunch, evening programme, dinner, and refreshments on Monday, as well as the bus transfer to Mainz on Tuesday. Guest rooms will be available at the location of the workshop from Monday to Tuesday, and transport to Mainz will be arranged after breakfast on Tuesday. An optional visiting programme on Sunday afternoon, as well as guest rooms for Sunday night (arrival date 29 January), will be available for those arriving early.

**Registration:** Please send in the below **Workshop Registration** form by **13 January**; you will receive an invoice for the conference fee that may be paid by bank transfer (or cash in rare cases if bank transfer to Germany is not possible).

**Room reservation:** Single or double rooms at 88 € “Einzelzimmer” or 145 € “Doppelzimmer”, respectively, per night (including breakfast and VAT) should be reserved early, indicating “Battery Workshop” under “Anmerkungen” on <http://kloster-eberbach.de/hotel-gastro/buchen>).

**Workshop organizer:** Research Association for Power Electronics and Electrical Drives (FGLA e. V.), with support from: European Committee for Electrotechnical Standardization (CENELEC), RWTH Aachen University – Institute for Power Electronics and Electrical Drives (ISEA), Ford Motor Company – Research & Advanced Engineering Europe (RIC Aachen)



Fax to: +49 241 80 92203 or E-mail to: [fgla@isea.rwth-aachen.de](mailto:fgla@isea.rwth-aachen.de) **by 13 January 2017**

## Workshop Registration

### High-Temperature Durability Tests for Advanced Lead–Acid 12-V Batteries, 30 January 2017

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Name:

Company:

Billing address:

e-mail:

An invoice for the participation fee will be e-mailed and sent by mail to the above addresses.

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All participants are invited to provide input. Please propose the title for a 5-minutes presentation here and then e-mail 3 slides (plus up to 10 backup slides) in pdf format by 12 January:

Select session here:

- 1: Side reactions in SLI batteries – New findings and their relevance
  - 2: Science Needed – Clarify mechanisms and interactions of side reactions in EFB±C
  - 3: Cooperation Needed – agree co-operative approaches for research and test development
  - no presentation offered
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For planning purposes only, may we ask you to indicate your preliminary preference for a break-out session to attend:

- 1. Test Cycles: How should high-temperature durability tests be designed and validated?
  - 2. Test Cells: How should test cells for material evaluation be built ...?
  - 3. Cell Tests: How should battery-level tests be translated for test cells?
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Finally, some questions about your travel details (please tick which statements apply to you):

- I plan to arrive on Sunday.
  - I am interested in a sightseeing / meet&greet event on Sunday after \_\_\_\_\_ o'clock.
  - I plan to arrive Monday morning before 9 o'clock (snacks will be available).
  - I have reserved a guest room in [Kloster Eberbach](#) on-site ("Anmerkungen": "Battery Workshop").
  - I have reserved a hotel room in [Nassauer Hof](#), Kiedrich (2.5 km away).
  - I will stay elsewhere Monday night.
  - I plan to use the bus transfer to AABC Mainz on Tuesday morning.
  - I plan to have a car with me.
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Organizer: Forschungsgemeinschaft Leistungselektronik und Elektrische Antriebe e. V. (FGLA), Jägerstr. 17/19, 52066 Aachen, Germany