THE ADVANCED LEAD-ACID BATTERY CONSORTIUM
A Program of the International Lead Association (ILA)
1822 East NC Highway 54, Suite 120, Durham, N.C. 27713 U.S.A.
Telephone: (919) 361-4647 FAX: (919) 361-1957

FOR IMMEDIATE RELEASE

Contact: Chip Bremer
919-810-1353 (direct)
919-361-4647, x-3033
cbremer@ilzro.org

Lead-Carbon Batteries to Boost Market Prospects of 48V Hybrids

R&D Consortium Exhibits Three Industry Breakthrough Demonstration Vehicles at AABC

MAINZ, GERMANY (February 10, 2015) – The Advanced Lead Acid Battery Consortium (ALABC) last month showcased three hybrid electric concept vehicles resulting from its R&D program that demonstrate the real-world potential of lead-carbon batteries in 48V architectures. The cars, two of which were produced in association with major OEMs (Ford and Hyundai/Kia), exhibit substantial environmental and fuel-efficient benefits through low-cost hybridization. The vehicles were part of the ALABC display at the Advanced Automotive Battery Conference (AABC Europe 2015) held at the Rheingoldhalle in Mainz, Germany, January 26-29.

"The concept of 48-volt mild hybrid powertrains is drawing quite a bit of attention from automakers because they are working diligently to lower CO_2 emissions by increased electrification of the powertrain as opportunities for achieving still more fuel efficient engines diminish," said ALABC European project coordinator Allan Cooper. "The problem is, while needing to reduce emissions, it is necessary to keep production at a relatively low cost. Right now, we believe the best way to achieve that is with a modified micro/mild-hybrid powertrain powered by advanced lead-carbon batteries – just like the ones in this display. The ALABC feels privileged to be working with Hyundai and Ford, as well as our other partners, in evaluating these lead carbon batteries and other essential components in these vehicles."

According to Cooper, the 48V demonstrators solve some of the problems with making 48V low-emission systems appealing to the general consumer. "By downsizing and down-speeding the engine to reduce CO_2 emissions, you significantly reduce the vehicle's performance, making it less 'fun to drive'," he said. "But by adding electrical components like the Valeo supercharger and the CPT SpeedStart ISG, you can give a 1.4 liter engine the performance of a 1.8 liter engine or better, and still provide the same enhanced emission benefits. In essence, this system allows you to reduce fuel consumption with additional electrical components but increase performance while still maintaining a low production cost because of the use of lead-carbon batteries."

The three vehicles in the ALABC's 48V hybrid display included the following:

The 48V LC SuperHybrid
Project Partners: ALABC, Controlled Power Technologies (CPT), Valeo, AVL Schrick, Provector, Mubea, and the University of Sheffield)

Earlier conceptualized in a 12-volt architecture, this micro/mild hybrid is also based on a gasoline-powered, turbo-charged 1.4 TSI Volkswagen Passat and enhanced with a Valeo electric supercharger and a CPT integrated starter generator (ISG) both powered by Exide Orbital lead-carbon batteries to enhance performance, extend mileage and lower emissions at an affordable cost. The 48V demonstrator differs from the 12V design by offering additional functionality including torque assist to the engine for enhanced launch and acceleration, optimized cruise conditions, and the ability to harvest significantly more kinetic energy from regenerative braking. While the vehicle is still undergoing enhanced calibration, initial results indicate a 13% CO_2 reduction over the base car and simulation indicates a possible extra 5% reduction over the NEDC cycle. This was the ALABC's first 48V demonstration, and it has drawn considerable attention from OEMs.

The 48V Kia Optima T-Hybrid

Project Partners: ALABC, Hyundai Motor Group, AVL Schrick, Valeo, and East Penn Manufacturing

Loosely-based on the 48V LC SuperHybrid, this concept vehicle is powered by the Optima's existing 1.7 liter CRDi turbo-diesel engine, paired with a Valeo 10 kW electric starter generator and electric supercharger powered by a 48V version of East Penn's lead-carbon UltraBattery. The diesel-electric powertrain concept enables the T-Hybrid (turbo-hybrid) to be driven in electric-only mode at low speeds and when cruising, with deceleration serving to recharge the battery pack. It includes start-stop functionality and regenerative braking, but also provides the enhanced power and torque at low speeds that made the aforementioned LC SuperHybrid so popular in test drives.

During the conference session on Jan. 28, **Ulf Stenzel**, Lead Engineer New Battery Technologies – Hybrid & Electric Powertrain Systems at AVL Schrick, provided an overview of the battery and powertrain technology used in the 48V Kia mild-hybrid system and a brief summary of the achieved results.

The ADEPT 48V

Project Partners: ALABC, Ford Motor Company, Ricardo, CPT, Provector, Faurecia, the University of Nottingham, and the University of Sheffield

The ADEPT (Advanced Diesel Electric Powertrain) combines low-cost, micro/mild hybrid technologies similar to those in the LCSH with a high degree of synergy to reduce current class-leading C-segment CO_2 emissions by an additional 15-20%. Based on a Ford Focus, this vehicle is projected to cut CO_2 levels to 75g/km while indicating a pathway to 70g/km at a cost/emissions reduction ratio superior to a full-hybrid solution. The system includes regen braking and other efficiency improvements for optimized oil flow and pressure control, as well as a 48V electric turbine that captures exhaust waste heat for conversion to additional recovered electrical energy. However, unlike the other two cars, it does not have an electric supercharger but will rely solely on the starter/generator for initial torque assist on the engine.

About Lead Carbon Batteries

All three vehicles feature advanced lead-carbon batteries, more commonly-known as carbon-enhanced lead-acid batteries. The batteries, Exide's spiral-wound Orbital AGM in the LCSH and East Penn Manufacturing's UltraBattery (the latest model of which was also on display at the ALABC stand) in the Kia, are some of the most effective lead-carbon designs for 48V hybrid electrification. As pointed out by Kia and other partners, these batteries were chosen for this particular hybrid application because of (1) their performance in high-rate partial state-of-charge operation, (2) their ability to operate in sub-freezing temperatures, (3) the lack of need for an active battery cooling system, (4) their cost advantages over lithium ion batteries, and (5) their high recyclability rate.

The latest lead-carbon battery designs can operate between 30 to 70 percent state-of-charge at 12.5kW, which seems to be the target rate for micro/mild hybrid electric vehicle duty. Additionally, as with conventional SLI (starting-lighting-ignition) batteries, advanced lead-carbon batteries can be used at temperatures as low as minus 30°C (-22°F), which is currently not possible with lithium-ion batteries, but is an essential requirement for vehicles used in the snow-belt areas of the northern United States, Europe and various parts of Asia. Lead-carbon batteries also differ from lithium-ion in that they require no active cooling and no expensive battery management system at a cell level.

As with all lead-acid batteries, the cost-to-performance ratio provides high production value that is already well-known to automotive manufacturers, and despite their relative enhancements, lead-carbon offers cost advantages that are still significantly lower than other battery chemistries. Finally, lead-carbon batteries, like all lead-acid batteries, have a recycling rate of 99% in North America and Europe – making it the most recycled product on earth.

The ALABC and its member companies have worked for more than 20 years to bring lead-carbon technology from the laboratory to the marketplace. Companies like East Penn Manufacturing, Moura, Energy Power Systems, Exide (Europe), FIAMM, and Shin Kobe are all working on various lead-acid and lead-carbon technologies for 48V automotive applications, and many are participating in ALABC projects to enhance these batteries and prove their viability in the emerging 48V marketplace.

Note: Some of the support for the Kia Project was obtained through special funding from ALABC members like the RSR Corporation, the Doe Run Company, Teck Metals, Acumuladores Moura, Britannia Refined Metals, and an anonymous metals trader.

About the ALABC

The Advanced Lead Acid Battery Consortium is an international research cooperative comprised of lead producers, battery manufacturers, equipment suppliers, and research facilities organized to enhance the performance of lead-acid batteries for a variety of markets, including hybrid electric vehicle (HEV) applications, renewable applications, and various other energy storage systems. Founded in 1992 as a program of the International Lead Zinc Research Organization (ILZRO), the ALABC pools the resources of its global membership in order to perform specific research on advanced lead-acid batteries that otherwise would not be possible by any single entity. For more information about the ALABC, visit www.alabc.org.

Photos:

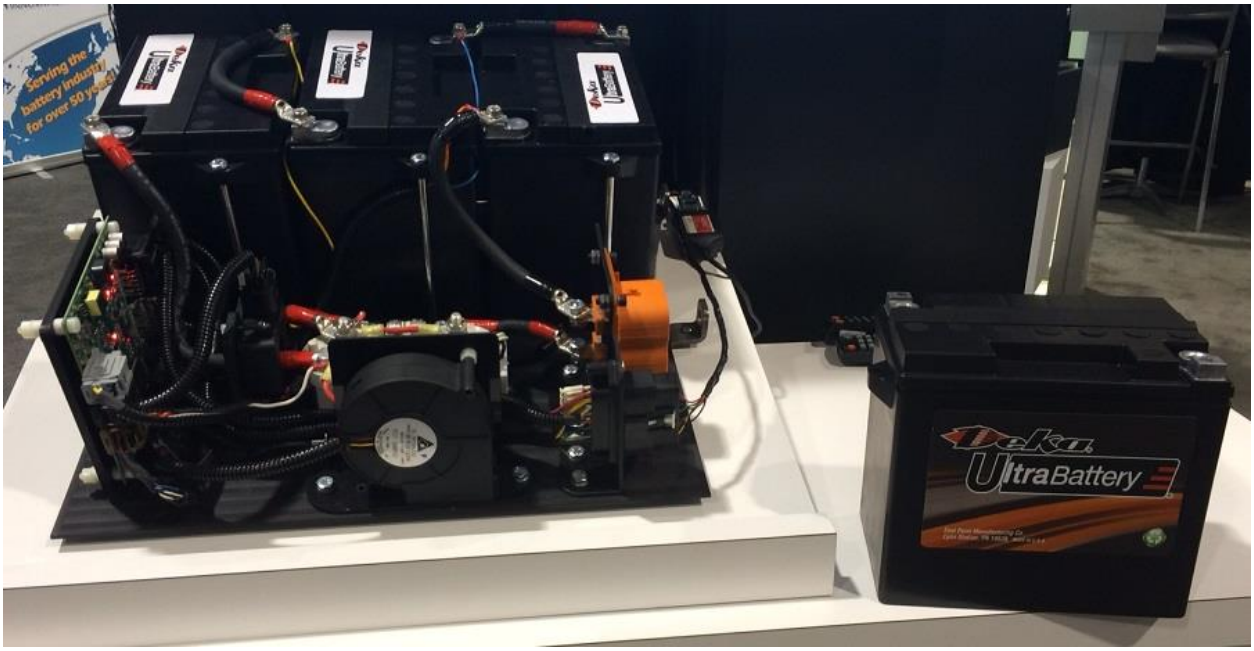
From left to right: the ADEPT 48V, the 48V LC SuperHybrid, and the 48V Kia Optima T-Hybrid

The 48V Kia Optima T-Hybrid

The ADEPT 48V demonstrator

The 48V LC SuperHybrid

Another shot of the ALABC's 48V lead-carbon demonstrators



The East Penn UltraBattery pack and a 14V module