Publishable summary

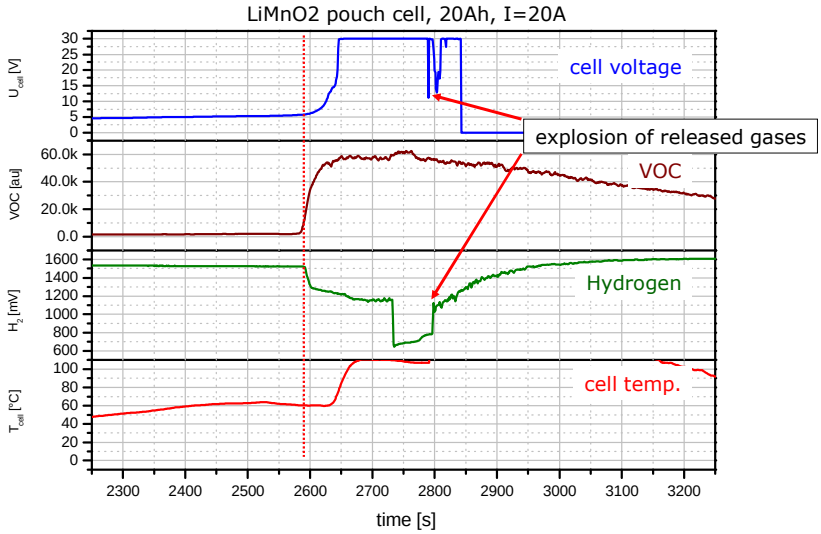
ESTRELIA project development goals

High costs together with concerns for driving range, reliability and safety are still the main hindrance for market adaption of full electrical vehicles (FEVs). The project ESTRELIA aims to provide building elements with enhanced reliability and safety at lowered costs for smart energy storage for FEVs. This will be accomplished through a modular approach based on optimized ultracapacitor power packs developed by Valeo. Corning will provide prototype ultracapacitor cells projected with up to 50% energy density advantage over commercially available products. The performance of the power packs will be evaluated by Austrian Battery Research Laboratory.

New Battery Management (BMS) ICs from ams will for the first time provide full monitoring functions together with a flexible active cell balancing in one single integrated circuit perfectly suited for the high accuracy demanding monitoring of Li-Ion batteries and ultracapacitors.

The BMS ICs and architecture proposed by Fraunhofer IISB will be verified on prototypes built by E4V. Tests with new HV test equipment developed by Active Technologies will proof test isolation protections in the environment of several hundred volts as present in FEVs. The new BMS IC concept from Ams will enable higher efficiency by lower energy loss and improved long term reliability and lower the electronic component costs for BMS of Li-Ion energy packs.

ESTRELIA has in the first year also started with the development of new safety sensors which are silicon based MEMS approaches delivering enhanced safety functions at lowered cost compared to existing solutions. While the development of the 2nd generation of a gas sensor by AppliedSensor will allow detection of very low levels of volatile organic compounds as emitted in thermal overruns of battery packs, the new spark detector concept provided by CEA-LETI will enable general safety functions by spark detection from hazardous events in a FEV battery.



Overcharging experiment with cell venting followed by explosion of released gases.

A prototype of a battery emission monitor based on AppliedSensor's MEMS gas sensor technology has proven its effectiveness in Li-cell abuse tests. In several experiments different types of Li-cells underwent nail penetration and overcharging tests. Volatile Organic Compound (VOCs) levels and hydrogen levels from cell venting were quickly detected. The sensor module withstood short-term exposure to fire and pressure pulses from exploding gases.

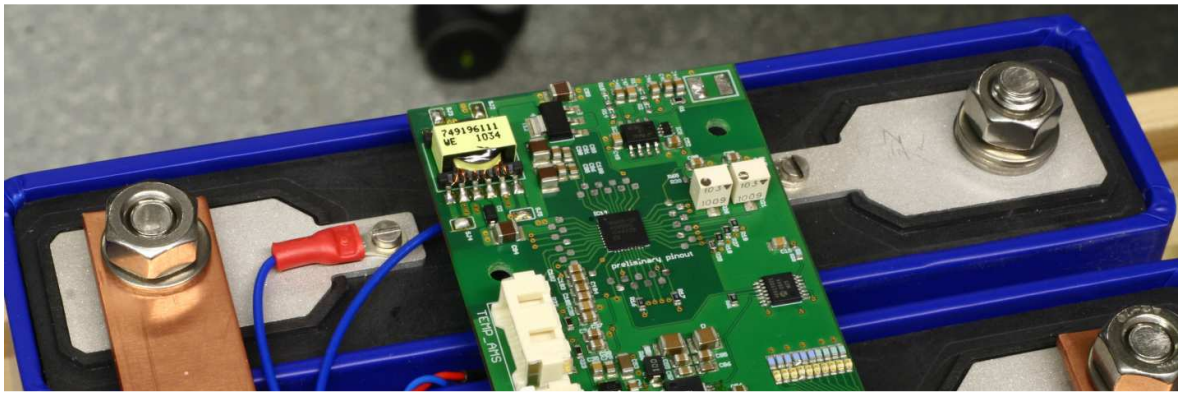
Finally, the completely new concept for the development of low cost power antifuses by Fraunhofer IISB together with the new energy management hardware (BMS IC) and software will enable dynamic reconfigurable topologies in the energy storage unit, thus providing limp-home functionality to the FEV despite single cell failures.

Successful project progress

The consortium led by ams (AT) includes Valeo Electrical Systems (FR), Fraunhofer IISB (DE), Corning SAS (FR), Austrian Battery Research Laboratory (AT), AppliedSensor (DE), CEA LETI (FR), Active Technologies (IT), E4V (FR). All consortium partners are leaders in their respective areas of expertise.

The successful project results after the first year in detail are:
Based on several inputs from car manufacturers the IC specification and design for the Battery Management ICs can provide now firsts engineering samples for evaluation. A detailed concept using self-triggered power antifuses to bypass faulty battery cells has been developed strongly supported by device simulation. This is a first step to provide a cost effective solution to single cell failure for the future.
Also the development of the very important safety sensors for EV's is on schedule. For the new gas sensor the first modified samples for battery testing have been provided and for the MEMS based spark detection sensor, the appropriate piezo-resistive concept has been selected, the design has been defined and technological development batches are running in clean rooms.
First samples of the ultracapacitor cell samples with high energy densities in the range of 7-9 Wh/L have already been investigated. By the end of the project, up to 50% higher energy density in the power pack is an intended innovation of the ESTRELIA project.

E4V is providing a full solution including battery and BMS, both by its local engineers in Bordeaux and Le Mans (France). Strongly experienced, mainly due to its president background and experts support, the company offers its partnership in the development of a large range of dedicated energy storage solutions.
E4V as a battery pack maker is in charge of the definition of the energy pack based on LIFePO4 cell chemistry. E4V‘s participation to the ESTRELIA project aims to show the advantages of using new technologies to improve the security and reliability actual Lithium battery pack solution for EV, by the integration of the new BMS integrated circuits with improved capabilities, spark detectors, gas sensor and antifuses.
The energy pack is intended to be used in full EV configuration, where the energy demand from the EV is compatible with the use of LiFePo4 cells, and as a permanent energy source to power the EV.
The energy pack must be able to supply the engine for the traction of the EV, in RUN mode, but also to store the energy available during regenerative braking phases, in REGEN mode.
The choice of LiFePO4 for the battery cell chemistry ensures the best trade-off between safety and performance for such application.



Example of Battery Monitoring IC from autriamicrosystems (AS8505) evaluated by Fraunhofer IISB in the E3Car project

Some of the major results of ESTRELIA project will lead to energy efficiency and extended driving range of the FEVs and this will mitigated constrains for the user of the FEV versus the Internal Combustion Engine vehicle. By the end of the day this will bring FEV closer to the end user and ensure a wide expectance.

A target group oriented communications concept of the ESTRELIA project ensures a wide dissemination and promotion of obtained results. Different target groups have been addressed by a professional media campaign by using on- and offline channels and visualised goals.
A webpage describing the project is available since summer 2011 and is frequently updated. In combination with Social Media tool Twitter we ensure that a wide audience is reached.

To reach the technical oriented key users such as engineers and developers a press release was published and distributed to all relevant technical magazines and a project article in European Energy Innovations Magazine Spring 2012 was issued. Nine Workshops as well as conferences have been attended presenting results from project ESTRELIA. There are further three upcoming events in June and July where the ESTRELIA project will be presented.

For more information please refer to the ESTRELIA webpage http://www.estrelia.eu