BatMan, Smart Batteries-2011

Smart Power, Li-ion Batteries, Safety- BMS, Sensors, HEV-EV, Renewable Energy, Grids, Requirements, LIB 2015, BATMAN, BMBF, HMI, AMAA 2011, BERLIN, by Tim Schaefer.

“Smart Power Li-Ion Battery Systems for the Safe and Networked Mobility Society: The ICT Potential”

“BatMan Powered by Electricity”, BMBF 2011

15th Int. Forum on Advanced Microsystems for Automotive Applications Smart Systems for Electric, Safe and Networked Mobility, Tim Schäfer, Li-Tec Battery

Borsigturm, Berlin (Germany), 29-30 June 2011

Excerpts from the presentation

(Disclaimer: Nothing herein shall be noted as a description of function of any and all projects Li-Tec Battery is involved so far. Nothing shall be recognized as official statement, function or future step. Trade marks etc. are in property of the owners.)

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Li-Tec, often called around the world as the new German Li-Battery, is also a part of the German Federal Ministry of Education & Research Limb 2015 (Lithium-Ion Battery 2015) project initiative.

HEV-EV batteries are characterized by high specific power, energy, efficiency and long life. These batteries will soon play a prominent role as innovative electrochemical storage systems in renewable energy plants and distributed power stations as well as in smart power systems for sustainable vehicles such as hybrid and electric vehicles. There is now a new dimension of improved safety, reduced costs, greater operational temperatures and materials availability while innovations based on ICT are set to be an important mainstream element in the near future.

(Foil 7)

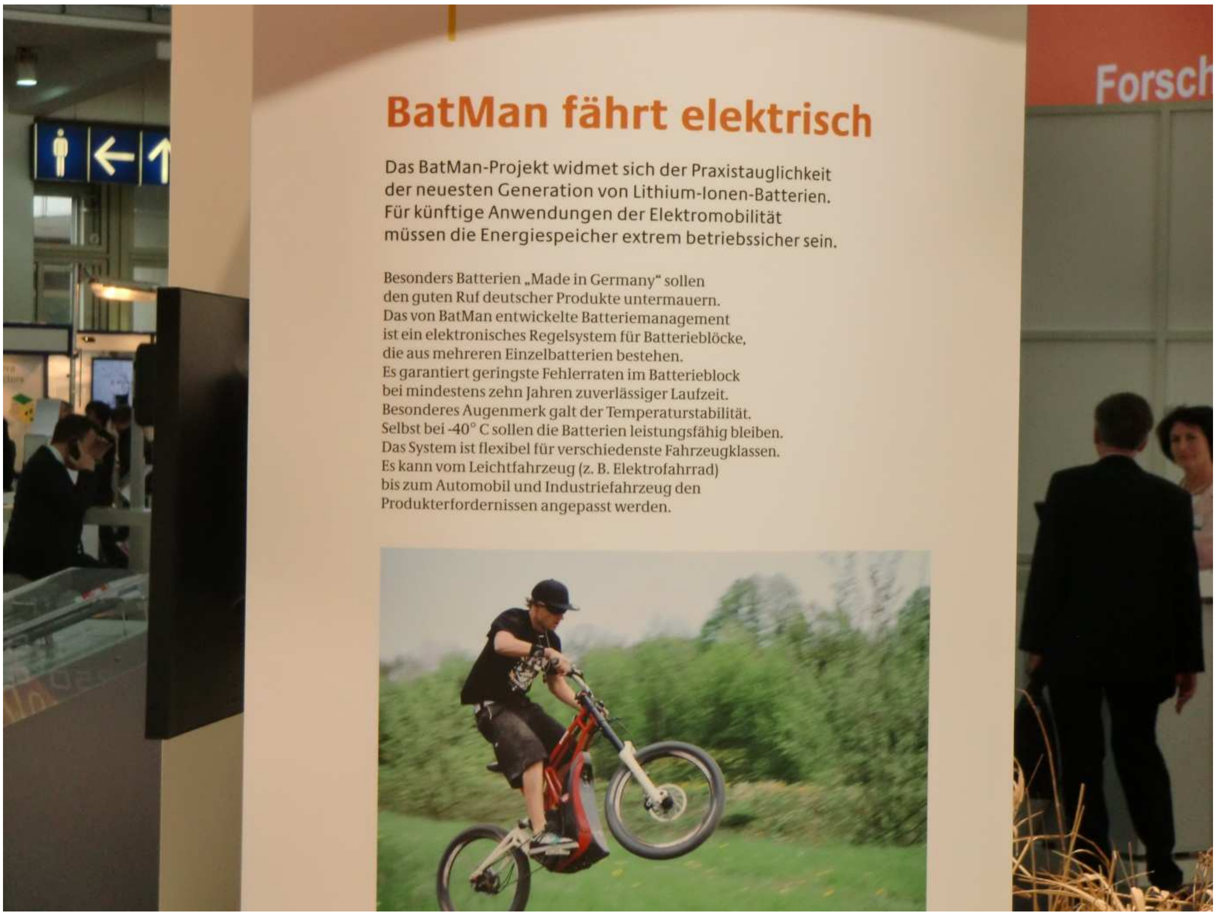


Foto: Tim Schäfer, Hannover Messe 2011, Hannover

The BatMan project does not refer to bat-like creatures but rather the project title: "Innovative battery sets based on modular high performance Li-cells and modular BMS for use in harsh environment", hence whisper quiet, low emission regional driving or efficient, safe storage of renewables, thereby enabling the recharging of electric cars or the establishment of decentralized power supplies. In concrete terms BatMan is researching new systems (hardware & software, battery design-in) for safe management of such batteries… On the other hand, there is also the issue of high quality made components for BMS and BMMS "Made in Germany" (Infineon, Bosch, Li-Tec), needing to be particularly safe and reliable. Their electronics should be reliable for 10 years and allow maximum failures of 10ppm. This should also ensure an operating window for reliable BMS function down to -40°C. The goal and the challenge here lies in demonstrating the technical capacity of using such new system integration concepts based on new control chips and algorithms, also prepared for the integration of new Sensors or safety devices, cooling system and more. There is evidence here that the R&D project has succeeded in resolving the paradox between minimizing the number of circuits and their complexity (costs, reliability) and the contrasting demand for higher flexibility.

(Foil 8-10)

Elektromobilitätskongress Bonn, 8.- 9. Juni 2011, VDI Technologiezentrum 2011, rechts Li-Tec BatMan Batterie modul

The common state BMS is often following both: stand alone or master slave concept, often limited to special charger. On one hand the BMS is required to ensure safety of the battery, which it does by making sure that no cell in the battery functions outside of its operational range, at same time, it's a required safeguard ensuring the battery is not operated outside of safe limits (transportation mode…). In multi complex cell configurations, there are additional requirements; the basics will be touched briefly in the slights. The smart power Li-Ion Battery system of the near future will likely provide other new features…

It is described that smart battery has some notable downsides, one of which is price/cost or use in practice. SMbus system today is probably in first view more expensive. But is the so called smart battery of today the really smart battery of the new EV.age?

The objective behind SMbus battery is to remove the charge control from the charger and assign it to battery. With a true SMbus, battery becomes the master and the charger serves as slave that must follow the dictates of the battery. Battery controlled charging makes sense when considering that some packs shall the same footprint but contain different chemistries, requiring alternative charge algorithms. Or in cases of different battery types or different batteries are designed-in to a smart battery assembly, for instances combining energy with power or ultra-capacity in modules.

The SMbus battery will contain permanent and temporary data. The permanent data is programmed into the battery at the time of manufacturing and includes battery ID number, type, others as well as new generated specials, based on predicative fixed elements. The temporary data is acquired during use and consists of cycle count, t, maintenance etc...

Further a multiple use of packs is possible, already shown in power-tool application, why my lawn mower shall be stored with battery inside, while using every 15 days in summer season?

(Foil 11- 12)

More serious drawback is the requirement for exact periodic calibration in time or capacity re-learning, other new functions maybe:

- More functions with regard to safety and aging,
- App`s in regard to battery use and payment system,
- Safety, new sensors inside,
- Integrated functions using various infrastructure, fleets (why not car-to come then car-to go?),
- New service for customer benefit.

Furthermore in field of the smart grid, V2G, renewables, power stations and the New EV.age Lithium-Ion and -Polymer Batteries Innovations based on the ICT are set to be an important mainstream.

V2G will come back; a defined cycling obviously will lead to longer cycle life and reduced aging.

In smart battery low voltage level the customer is able to define the drive mode:

- more fun, speed, or
- more or less km, etc.

Sensors or completely new mechanisms or operational concepts are seen as being able to be extended with this BATMAN approach to Smart Power concepts. New safety precautions should already be incorporated hereto in the near future. Ultimately, our entire society and individual mobility benefits from realizing and innovating completely new solutions this way. The following will outline part of a basic example of this. There are currently different operational concepts related to e.g. replacing or recharging batteries. In this respect as well, ICT-based Smart Power approaches provide particularly novel procedures for more comfort, efficiency, reliable supply, vehicle operation, navigation, vehicle energy control systems, supply stations, etc..

From the German NPE (National Platform Electro mobility) there was given a diagram of diamond showing 8 requirements for such batteries for H (EV)-applications. But probably there are more, indeed. In terms of development trends of recent years it can be stated that generally speaking, energy/power density and capacity need to be increased as well as reliability, to achieve significant reduced costs in longer effective service of the energy system. From the sustainable criteria standpoint, reduced use of toxic materials such as cobalt, lead, cadmium can accompany embracing manganese mixed oxides (as one example). So now we assume 9 requirements or criteria, the 10th in my eyes will be the capability of series production quality and IP, including transportation safety.

The 11th criterion is ICT!

Source: BMBF BatMan- BatterieManagement, 2011

It is widely accepted that the ionic battery family, in particular the Li-Ion systems, offers a wide spectrum of system approaches which have been optimized to meet these requirements or are able to be further evolved in their development. In addition, the battery systems have a certain revolutionary potential for multiplying volumetric energy and reducing costs with longer-lasting ionic battery systems just within the next few coming years alone. As a developer of batteries and in the interest of the entire battery industry as well as automobile manufacturers, the author points out that special attention must be paid particularly to material and environmental policy issues if we want to consider and develop European locations and sensibilities.

Ionic energy storage devices require deeper and more specific focus on production and quality control in light of addressing completely new challenges, for example in Germany with production research programs such as PROLIEMO and DELIZ (KOPA II). It was recognized that new approaches needed to be adopted in order to scientifically realize the strategic goals and also develop the necessary knowledge. In terms of safety through to ultimate disposal, the new energy storage devices can only be produced and designed to comply with the EUCAR levels. In this respect, new approaches to production testing systems might need to be established for the entire life cycle of such batteries (external control, accompanying reliability tests); the international Battery Safety Organization project (BATSO), Taiwan, being one such example.

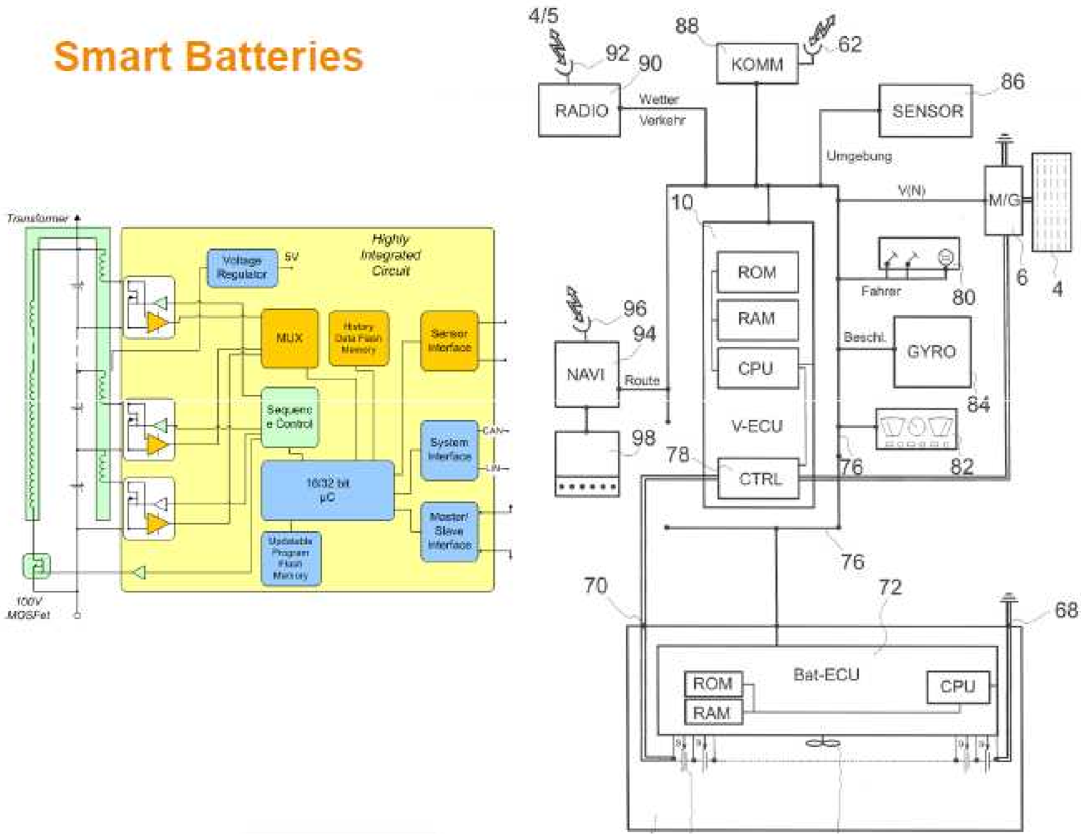
(Foil 12-16)

I will take a brief look at severe questions, ideas and approaches to using ionic batteries, including their integration and management, within the scope of ICT and smart power solution.

(Foil 17)

Recent technological development in batteries, for example those seen in new current interrupt device (CID), protection one chip (POC), PCM, PCT, BMS, BMMS in combination with new app`s systems and interfaces will lead the new energy and EV.age toward a new quality of individual service and green e-mobility… I have chosen for this presentation state-of-the art navigation system to illustrate or generate some ideas, coming also from the Li-Tec Battery patent application PCT 2010 2070. Yet this information may be alone is insufficient, a sufficient reliable supply requires greater logistics and ICT efforts than it is the case with conventional fuel.

(Foil 18 and 19)



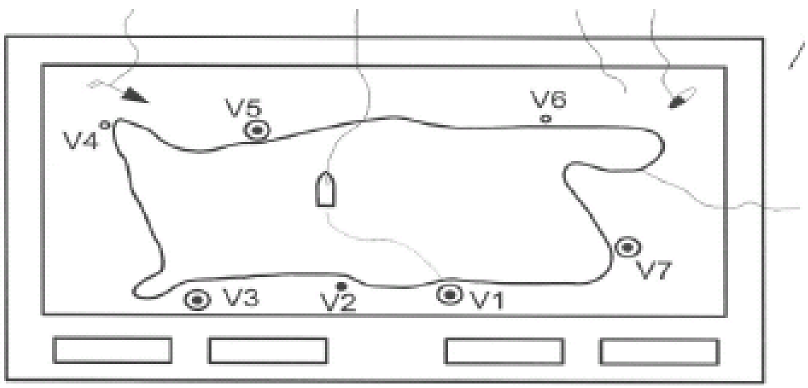
Vgl.: 15th Int. Forum on Advanced Microsystems for Automotive Applications Smart Systems for Electric, Safe and Networked Mobility, Tim Schäfer, Li-Tec Battery, Borsigturm, Berlin (Germany), 29-30 June 2011 “Smart Power Li-Ion Battery Systems for the Safe and Networked Mobility Society: The ICT Potential” R. John, Infineon Technologies AG, Tim Schäfer, Li-Tec Battery GmbH, BATMAN project manager

As example, battery charger/supply station, hence operation must be based on a mix of recharging, redistributing between supply stations, and local charging of renewables under flexible consideration of ongoing fully charged outflow vs. inflow. Navigation systems storing and using information about fuelling station status are already known. Yet this information may be alone is insufficient for electric drives. Due to the lower energy density of electric power units (batteries) compared to conventional fuels, and the correspondingly increased need for storage volumes, as well as due to the potential variety of batteries, a sufficient reliable supply requires greater logistics than is the case with conventional fuels.

Hence, operation must be based on a mix of recharging, redistributing between supply stations, and local charging of batteries under flexible consideration of ongoing fully-charged outflow versus inflow of empty or partially empty batteries at the supply stations. Should no fully-loaded batteries of the respectively suitable type be available at the time a vehicle driver needs a charge, or even more importantly a (discrete or integrated) replacement, the driver is left with the time-consuming charging and thus forced to stay at the supply station. This is especially unpleasant at fully automatic stations without lodging options, particularly in otherwise sparsely populated and climatically unfavorable areas. On bodies of water, in particular larger lakes or offshore waters, the above-described concern takes on special significance in terms of safety.

If a boat or a ship is electrically operated on larger bodies of water, for instance Lake Constance (Germany) or other lakes, it then becomes important to always remain within range of a battery charging or changing station to avoid unexpectedly ending up in distress. On the other hand, it is aggravating to always be excessively cautious in staying within the vicinity of supply stations when not absolutely imperative.

ICT can help solve such exemplary or basic smart power solutions and to reduce time to market.



Vgl.: PCT 2010 2070