automotive engineering iav

Battery Expertise for Vehicles

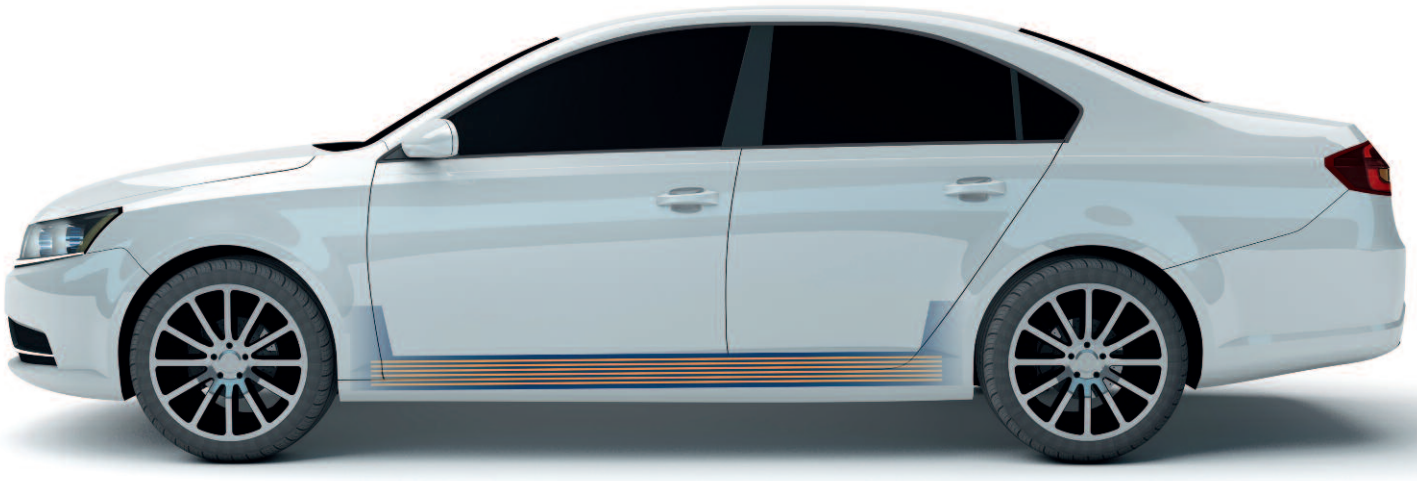
IAV is pursuing a mission: a cruising range of 1,000 km for electric vehicles

Almost all of today's electric vehicle projects are dedicated to achieving a significant increase in cruising range. In the age of electric mobility and renewable power generation, batteries play a key part in powertrain concepts that meet global demands. New credos, like car sharing, and technologies, such as automated driving, are entering the mobility world. Never before has the battery played such an important role in supporting these functionalities. More and more, the battery is becoming an integral part of new functions for mobility solutions.

Thinking further, it is not easy to predict the range needed for the highly automated vehicles planned in the latest mobility concepts being driven forward by major IT companies. New short-range batteries might also be required. However, new in-car functionality and comfort technologies will push the need for on-board electric energy to new limits. A transformation that will quickly place the focus on battery technology far more than ever before.

Commercial success will largely depend on enhancing functionality. How cheap can batteries be made to meet consumer needs? How quickly do batteries need to be charged in car-sharing applications? What load profiles and energy throughput could a battery encounter if connected to a smart building? How safe does a battery system need to be if the latest active safety technologies are applied? All of these questions have been asked at our development centers. Passionate about the subject, our experts are discussing ways of developing concepts which make batteries part of integral vehicle functions. From IAV engineers you can expect meticulous attention to every detail if you are planning to integrate the latest battery technology into your project.

Technology that excels in the race for a 1,000 km cruising range:
To increase the energy density to 450 Wh/l for electric vehicles, IAV is working on new concepts that radically transform the battery system into an integral part of the vehicle chassis. The approach is similar to the way in which a battery is integrated in mobile devices. Here, chassis frame structures become a functional part of battery design. In turn, internal cell design needs modifying to enhance structural support and safety functionality. IAV's engineers are developing new cell structures from scratch to achieve first-class functionality. With IAV's visionary approach, the next generation of electric vehicles will offer a competitive cruising range.



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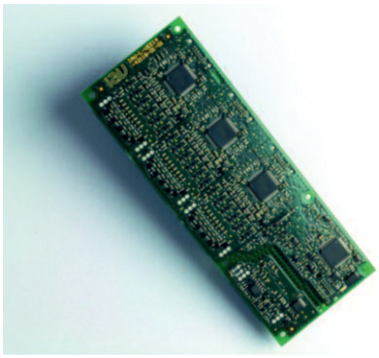
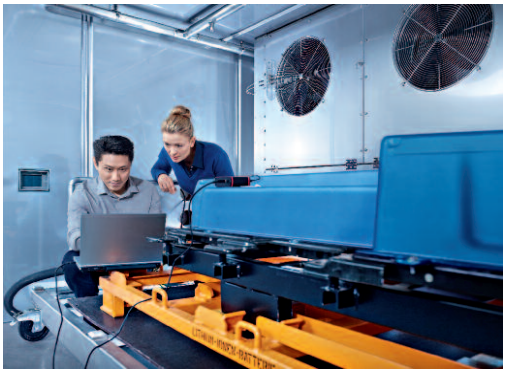
Battery Expertise

IAV "TwinBattery" – 232 kW of electrical power



IAV BMS Gen3 – prototype approval for public roads
Key part: latest generation of IAV's cell supervisory controller



IAV test center: validation process for volume applications at cell, module and battery level

IAV is involved in extensive battery research and development activities – from single battery prototypes to developing battery systems for volume production. Often, key ideas for production systems are generated at the concept stage where creative teams and flexibility come together. This is why IAV has developed expert skills in constructing complete prototypes.

One example of IAV developing the complete prototype of a truly unique battery system is "TwinBattery". It is a combination of two batteries connected by a DC-DC converter. The energy battery is a traditional traction battery of the type found in any electric vehicle for storing the main energy. Lithium supercapacitors are used as the power battery in order to provide high power availability. The DC-DC converter provides the capability of controlling the energy flow in the whole system, producing two key benefits. The power battery can compensate for load peaks to prevent the expensive energy battery from aging. Both batteries can be combined for boosting power. Our bench tests showed a peak power level of 160 kW from the power battery in addition to 72 kW from the energy battery. The whole system delivers 232 kW of power.

The hardware components needed to produce a battery system are being developed at IAV. The 4th generation of IAV's cell supervisory controller (CSC) has been developed for our "IAV BMS Gen 3" prototype battery management system. One CSC is capable of measuring as many as 24 single cell voltages and up to 8 temperatures and sending them via CAN to the main controller. Also integrated is hardware shutoff for each voltage / temperature as well as cell balancing. All hardware components for IAV BMS Gen3, including IAV's CSC, have been developed in line with our in-house prototype development process. This process covers quality assurance at hardware and software level as well as functional safety engineering based on the methods defined in the relevant safety standards. Systematic risk assessment and risk reduction under ISO 12100 is also performed for the whole battery system. As a result, IAV BMS Gen3 has received prototype approval for public roads under defined conditions of use.

Besides building complete prototypes, functional development also plays an important part at IAV – for prototype and volume applications. We combine the expertise from our software and hardware departments to develop battery management systems with real electronics installed in real batteries. Only by understanding the parameters of the cells in a system can our engineers get a picture of how their algorithms actually behave inside. Data gathering and research activities of a more specific nature are being carried out in cooperation with our e-traction test center. Covering the complex validation process for volume production applications, our test center can perform electric tests cost-effectively at cell, module and battery level.

During the last four years, IAV has constructed over 60 battery systems, most of them in OEM demonstration vehicles. On the basis of all the experience we have gained from these projects, the research and development department is targeting new battery designs that are initially defined at cell level. The potential of future technologies will be showcased in a technology roadmap set up by IAV for an electric range of 1000 km. IAV has been working together with leading industrial players to establish new research and development facilities. Innovative materials and design structures will be applied to increase the energy density to 450 Wh/l where an overall cost target of 200 €/kWh is to be expected at system level.

Contact us to discover which services IAV can provide for you.