New sensor technology for e-vehicle batteries

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Using a novel technology made in Bochum, electric vehicle batteries may become lighter and therefore cheaper. Philip Dost (right) has developed them at the Department headed by Prof Dr Constantinos Sourkounis. Credit: RUB, Marquard

Engineers at Ruhr-Universität Bochum have developed a new concept for current and voltage sensors for batteries that might become

particularly relevant for electric vehicles (EV). An EV battery is made up of individual blocks, each of which contain up to twelve cells. Typically, each cell is monitored by its own voltage sensor. Designed by Philip Dost, the new system requires only one single voltage sensor, thus reducing overall weight and costs.

"Just like the cells, the sensors are a considerable weight and cost driver," as Philip Dost explains the relevance of the new invention. "Some industrial enterprises have already expressed their interest in our innovation." The system made in Bochum already exists as a lab prototype. Florian Langner realised it in his Master's thesis at the Institute of Power System Technology and Power Mechatronics.

Batteries very flammable

EV batteries generally consist of lithium cells; these cells are easily flammable – as evidenced in the Samsung smartphones that burst into flames (September 2016). Consequently, the vehicles' technical components must be continuously monitored. In EV batteries, monitoring typically requires a current sensor and several voltage sensors, namely exactly as many as there are individual cells. This is the only way to fully monitor them.

The Bochum-made innovation has reduced the number of necessary current and voltage sensors to one each, regardless of the number of cells. Moreover, both sensors assume an additional function that must otherwise be installed in batteries as a separate component: namely cell balancing. It ensures an even energy redistribution in the cells.

Maximum energy yield

Each cell reacts differently during charging and discharging; by the end

of the process, some are more charged than others. Once one cell is fully charged, charging of the other cells is discontinued. If one of the cells is empty, no energy is extractable from the other cells, either. The older the system, the bigger the problem. Cell balancing counteracts this phenomenon. It ensures that older systems keep providing maximum energy yield.

Adapting to the requirements of the automotive industry

The measurement system from Bochum is scalable; that means it can be deployed in batteries with different numbers of cells. It is not only suitable for batteries in electric vehicles; but also works well in a wealth of other battery systems, for example in mobile devices such as tablets or laptops, wireless electrical tools, uninterruptible power supply systems that are crucial in hospitals, and in home storage systems such as for solar systems.

In the next step, the Ruhr-Universität engineers intend to characterise and evaluate their prototype in detail. "We are also going to replace individual components, in order to meet the requirements of the automotive industry," says Dost.

Provided by Ruhr-Universitaet-Bochum

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