Energy Storage Systems of the Future

Because, the efficient use of renewables faces a similar obstacle: wind power plants, biogas and solar plants work without intermediate storage systems and feed the power produced directly to the grid, regardless of the weather. If, however, the wind blows excessively, if solar radiation is too strong, the plants must be turned off, because otherwise the grid would be overburdened. Exactly during this period of time valuable, clean power is simply lost. The inter-disciplinary research project „Super-Kon“ at Martin-Luther university Halle-Wittenberg (MLU) dealing with the development of a so-called super capacitor wants to provide an answer to both challenges. This long-lived energy storage system would be able to store power within seconds and keep it available without losses for long periods of time.

„Super capacitors are hardly subject to wear, they do not heat up and in addition only require a few seconds to accept or discharge energy, i.e. a fraction of the battery charging time required to date”, Hartmut Leipner explains, he is a lecturer and a scientific manager at the Interdisciplinary Centre for materials sciences in Halle and the project manager of the „Super-Kon“. The reasons for this are the operation of the energy storage system: Whereas conventional batteries must first convert electrical energy to chemical energy in order to store it, the energy in super capacitors is stored purely electrostatically. Therefore, super capacitors cannot have a so-called “Memory effect“, due to which the batteries increasingly lose capacity. “In order to implement these benefits, which have been known for long, we founded the inter-disciplinary research team „Super-Kon – new super capacitors as energy storage systems” in 2009. It is our goal to optimize these new energy storage systems and to develop them for the market“, Leipner continues. To date, super capacitors are hardly used, because they only have a very small storage density, this means to date, only small amounts of energy can be stored efficiently.

The research project is supported, for example, by the program "Research for the market in teams” of the Federal ministry of education and research. In addition, the project is supported by a council of mainly regional businesses, which intensively exchange ideas for market potentials and new technologies with scientists. For example, the company Universal-Beschichtung GmbH Wolfen, the Cluster for renewable energy Saxony-Anhalt and the GoodVent investment management GmbH & Co. KG Magdeburg are involved. The knowledge transfer is intended to make research results more quickly to the market. “In the first two phases of the “Super-Kon”, we combined materials in new ways in extensive materials tests. In this manner, we were able to produce a flexible, non-conductive composite material, which is able to store more energy”, the project manager reports. “For this purpose, ceramics was doped by Nano particles like barium titanate.” The result of this chemical synthesis is a material with a far greater storage capacity, which in addition can compensate potential brief power fluctuations which often occur due to the weather-independent infeed of renewable energies. Furthermore, the non-toxic composites can be manufactured more environment-friendly than conventional capacitors. “After this “proof of concept”, we now test this material in the industrial environment, in order to further improve its properties and to test durability under environmental influences“, says Hartmut Leipner. To date, the scientists in Halle are already able to supply power to small devices with consume little energy, using the super capacitors.

“We are approaching higher energy densities step by step”, Hartmut Leipner reveals. “Although the small storage devices to date work in the milliwatt region, I am confident that the first mature models can be seen in stores within the next three to five years already.“ Small electronic devices may then already supplied by super capacitors. In the parallel founders’ lab, supported by the state of Saxony-Anhalt and the EU, some doctoral candidates are already working on economically utilizing the knowledge gained here by establishing their own companies. “In about ten years, we want to complete the project“, the lecturer Leipner estimates. “By then, the development of storage modules will likely have advanced to the megawatt region, so that the fast super capacitors may also be a fixed part of the energy transition.”

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