

Storing Energy with Eggshells

For the First Time, a Research Group Successfully Uses Eggshells as Electrode for Energy Storage



Eggshells consist of porous calcium carbonate that is highly suited for use in electrochemical storage systems. (Photo: Manuel Balzer, KIT)

Biowaste in the form of chicken eggshells has proved to be very effective for energy storage. This finding was made by an international team of researchers, including scientists of the Helmholtz Institute Ulm (HIU) established by Karlsruhe Institute of Technology (KIT). In the journal *Dalton Transactions* of the Royal Society of Chemistry, they present the sustainable storage material that might be used in a low-cost lithium-ion capacitor. (DOI: 10.1039/c8dt03252a)

Chicken eggs are used worldwide in large quantities in the food, pharmaceutical, and manufacturing industries. After using the eggs, however, the shells are discarded and disposed of as biowaste on landfills. The shell consists of a composite of calcium carbonate (CaCO_3) and a protein-rich fiber membrane. "Surprisingly, there are constantly new examples in which natural substances are found to be suited well or even very well for producing materials for electrochemical storage systems," says Professor Maximilian Fichtner of the Helmholtz Institute Ulm, an institution founded by KIT.



KIT Energy Center: Having future in mind

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Additional material:

To the publication in *Dalton Transactions*:
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Together with Australian colleagues, Fichtner discovered the promising electrochemical properties of chicken eggshells, which are able to store lithium thanks to their large proportion of CaCO_3 . Fine eggshell powder was used as an electrode against a metallic lithium anode in a non-aqueous electrolyte. The test cell was found to maintain an excellent capacity retention of 92% over more than 1000 charge and discharge cycles. Both the calcified shell and the inner and outer shell membranes were used. The researchers washed, dried, and crushed the shells to a powder and obtained a conductive material.

So far, eggshell waste has been used in a number of applications, including bioceramics, cosmetics, or dye industry. The protein-rich, fibrous eggshell membrane was applied as a separator in supercapacitors. But for the first time worldwide, biowaste has now been used as an electrode. Now, further research and detailed understanding of the electrochemical and physical behavior of the material are needed to improve its performance and enable widespread use, the researchers say.

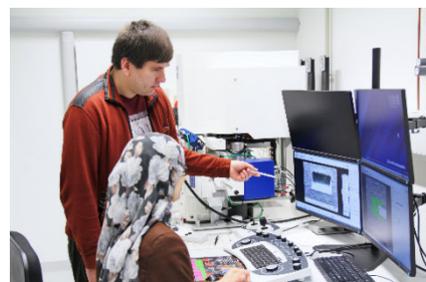
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More about the KIT Energy Center: <http://www.energy.kit.edu>

Being “The Research University in the Helmholtz Association,” KIT creates and imparts knowledge for the society and the environment. It is the objective to make significant contributions to the global challenges in the fields of energy, mobility and information. For this, about 9,300 employees cooperate in a broad range of disciplines in natural sciences, engineering sciences, economics, and the humanities and social sciences. KIT prepares its 25,100 students for responsible tasks in society, industry, and science by offering research-based study programs. Innovation efforts at KIT build a bridge between important scientific findings and their application for the benefit of society, economic prosperity, and the preservation of our natural basis of life.



Researchers characterize the morphology of the eggshell material with the help of a scanning electron microscope. (Photo: Daniel Messling, HIU/KIT)

This press release is available on the internet at http://www.sek.kit.edu/english/press_office.php.

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This year's **anniversary logo** recalls the milestones reached by KIT and its long tradition in research, teaching, and innovation. On October 1, 2009, KIT was established by the merger of its two predecessor institutions: the Polytechnic School and later University of Karlsruhe was founded in 1825, the Nuclear Reactor Construction and Operation Company and later Karlsruhe Research Center in 1956.