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Is the energy-storing solar cell soon to be reality?

How to store solar energy is the central challenge facing the energy reform. Alongside traditional solutions – such as solar cells or batteries – creative chemical concepts for storing energy are paving the way for entirely new opportunities. Intramolecular reactions are making it possible for solar energy to be transformed and stored in a singular molecule. This may form the basis for constructing energy-storing solar cells. Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) is currently investigating this issue in two research projects, receiving funding from the German Research Foundation (DFG) of more than one million euros.

Electricity from a renewable energy source such as sun or wind is only available when the wind blows or the sun shines. If only a little electricity is needed at this time, it is extremely difficult to store any surplus electricity. New concepts are required – and researchers from the Department of Chemistry and Pharmacy at FAU are counting on chemical concepts for storing energy.

In two joint projects, the scientists are exploring new ideas for using molecules to store solar energy and are investigating molecules and processes that allow energy to be stored efficiently and released in a controlled manner as and when required. It is even conceivable that stored chemical energy could be converted directly into electrical energy. A vision which would make it possible to construct an ‘energy-storing solar cell’.

Starting point for storing solar energy

The research is based on the so-called ‘norbornadiene-quadricyclane storage system’. Norbornadiene (NBD) and quadricyclane (QC) are hydrocarbons and have been under discussion among experts as potential candidates for storing solar energy for some time now: under the influence of light, a reaction within the norbornadiene molecule is triggered, causing the molecule to transform into quadricyclane as a result. The reaction produces an energy density similar to that of a high-performance battery. Thanks to this property, quadricyclane is also known as ‘solar fuel’.

Efficient storage

The sub-project focussing on ‘Photochemical and magnetochemical storage / release of solar energy in strained organic compounds’ is led by Prof. Dr. Dirk Guldi and Prof. Dr. Andreas Hirsch. The scientists are working on producing various new groups of NBD and QC derivatives. In addition, they are systematically investigating the influence of photosensitizers and electron acceptors as well as solvents and magnetic fields within this process. The long-term goal of the researchers is to create a closed system-fuel cycle for molecular storage systems.

Controlled release of energy

Prof. Dr. Julien Bachmann, Prof. Dr. Jörg Libuda and Dr. Christian Papp are working together in the sub-project focussing on the 'Catalytic and electro-chemical release of solar energy stored in strained organic compounds'. The three scientists are developing new catalyst systems and electrodes which can be used to convert chemical energy directly into electrical energy. They intend proving the concept behind the functional principle using hybrid boundary surfaces with a suitable electronic structure, chemical structure and electrochemical stability.

Basis for 'energy-storing solar cell'

The results of both sub-projects could form the basis for building an 'energy-storing solar cell'. The electricity which is created by solar energy could be stored intelligently and used highly efficiently thanks to intramolecular reactions.

Further information:

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