OTTO VON GUERICKE UNIVERSITÄT MAGDEBURG

CDS
RESEARCH CENTER DYNAMIC SYSTEMS
SYSTEMS ENGINEERING

From greenhouse gas to green fuel

29.11.2023 - The expansion of renewable energies will increasingly lead to temporary surpluses of electricity. The ability to st these surpluses is therefore of great importance.

This can be done with battery systems, for instance, but also with the Power-to-X concept. This concept uses surplus energy synthesize chemical substances such as hydrogen, methanol, and ammonia, which are then used as energy carriers or r materials. Another useful storage medium would be methane, which could replace fossil natural gas, for example. It can produced via a reaction of hydrogen and CO2, known as methanation. The use of carbon dioxide from industrial waste gas would also prevent CO2 emissions and keep the carbon in the industrial material cycle. However, methanation releases a lot heat, causing the temperature in the reactors to rise sharply, which would inactivate the nickel used as a catalyst. This wo cause the reaction to stop. For this reason, there are currently no large-scale plants for methanation. The team led by K Sundmacher, CDS member and Director of the Process Technology Department at the Max Planck Institute for Dynamics Complex Technical Systems in Magdeburg, developed the idea of so-called core-shell catalyst pellets further.
"With this structure consisting of a catalytically active core and an inactive shell, it is possible to limit the reactor temperature a thus create the basis for large-scale methanation of carbon dioxide," explains Kai Sundmacher. According to Ronny Tob Zimmermann, a chemical engineer in Sundmacher's team, the inert porous shell of the core-shell catalyst pellets ensures diffusi of the reaction partners through the shell, which slows down the conversion rate and thus also a potentially excessive rise temperature. Computer simulations and subsequent experiments were used to determine the optimum properties and dimensio of the core-shell catalyst and the reactor.
The Max Planck researchers' approach should not only be suitable for the reaction of hydrogen with carbon dioxide. In gener the concept of tailor-made core-shell catalysts can be applied to all gas reactions with high heat generation.

› To the official press release of the Max Planck Institute for Dynamics of Complex Technical Systems Magdeburg (https://www.mpi-magdeburg.mpg.de/4459228/news_publication_21184208_transferred?c=4374594)

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