Joint press release by CreativeQuantum, INERATEC, Leibniz Institute for Catalysis, Ruhr-Universität Bochum and Chemiepark Bitterfeld-Wolfen

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Green methanol production in container format

Research association E^{4}MeWi develops sustainable and scalable process for methanol

Methanol is produced with more than 100 million tons per year from fossil natural gas. In view of the Paris Climate Agreement, the associated CO_2 emissions are unacceptable. This aspect is addressed by the E^{4}MeWi research project under the direction of CreativeQuantum: Over the next three years, an interdisciplinary team of chemists and engineers will develop a container-sized chemical plant that produces methanol from water, carbon dioxide and renewable energies in a highly efficient way. This will enable small and medium-sized companies as well as regional suppliers to produce methanol in a decentralized and environmentally friendly manner in a few years. The research association E^{4}MeWi consists of the startups CreativeQuantum and INERATEC, as well as the Leibniz Institute for Catalysis and the Ruhr-University Bochum and the Chemiepark Bitterfeld-Wolfen. The project has been funded by the Federal Ministry of Economics and Energy with a total of 2.0 million euros since November 1, 2020 for three years.

E^{4}MeWi stands for Energy-Efficient Renewable Energy based Methanol Economy (german: **E**nergie-**E**ffiziente **E**rneuerbare-**E**nergien basierte **Me**thanol-**Wi**rtschaft). The planned chemical plant in container size shall demonstrate that methanol can be produced from sustainable sources by orders of magnitude faster and more energy-efficiently than before. A further goal of the project partners is to design the technology in such a way that methanol can be produced at competitive prices in places where cheap electricity meets local CO_2 emissions. Thus, the vision of the E^{4}MeWi partners could combine wind power and waste incineration plants or solar energy and biogas plants for a new added value, resulting in a sustainable raw material source for the chemical industry. The mobility sector is another target market for green methanol, which can be used as a fuel additive or for fuel cells.

Dr. Marek Checinski, executive director and co-founder of **CreativeQuantum** from Berlin, is one of the inventors of the process innovations implemented in the project. His company uses computers to calculate chemical and physical properties of substances and materials and clarifies chemical reactions and processes in detail. From his experience, "chemists are often sceptical and doubt that it is possible to evaluate and optimize completely new processes from the very beginning with the help of computers and modern algorithms. Methanol is one of the most important chemicals on which we wanted to demonstrate this once." He developed the new capture and hydrogenation approach (CHA). CreativeQuantum will now further improve this process in virtual space. Modern methods such as genetic algorithms and machine learning are used.

The **Leibniz Institute for Catalysis in Rostock (LIKAT)** is one of Europe's leading research institutions in the field of applied homogeneous and heterogeneous catalysis. In cooperation with CreativeQuantum, the research group of Prof. Dr. Matthias Beller and Dr. Kathrin Junge developed last year the first manganese-based catalyst for the production of methanol from synthesis gas. The symbiosis of targeted simulations and systematic laboratory experiments led to the fact that both partners managed to go from idea to patent application in only four months. "The requirements for the catalysts developed at LIKAT are not only extraordinary selectivity and activity, which are decisive for economic efficiency. The sustainability of the corresponding catalytic process is also very important for a transfer to industrial scale. That is why we focus on the development of homogeneous catalysts free of precious metals", explains Matthias Beller.
Under the direction of Dr. Ralf Jackstell at LIKAT, the project now focuses on the development of highly effective homogeneous catalysts for the conversion of methanol from hydrogen and carbon monoxide as well as the first demonstration of technical applicability with the associated scaling of the plant technology.

INERATEC will not only evaluate new microreactor technologies but also develop and build container plants for the project. The demonstration plant will help to find out whether the laboratory results can be reproduced in a much larger plant in the field. Tim Böltken is executive director and co-founder of INERATEC. "Locally produced methanol from non-fossil raw materials, i.e. renewable energy and CO_2, is an imperative step towards sustainability for the chemical industry. Our technology platform helps to shorten the time-to-market".

Prof. Dr. Ulf-Peter Apfel from the **Ruhr University Bochum** is a proven expert in electrocatalysis. In the E^4MeWi project, his research group is responsible for catalyst and reactor development for the electrochemical reduction of CO_2 to synthesis gas. Here the team also makes use of accompanying simulations by CreativeQuantum for catalyst screening. Prof. Apfel is convinced: "A catalyst can only unfold its potential in combination with the appropriate process technology. The calculations will enable us to find suitable and optimized catalysts much faster and to install them in the new reactors".

Chemiepark Bitterfeld-Wolfen is the largest open chemical site in Europe and the cradle of industrial electrochemistry with more than 125 years of experience in hydrogen infrastructure. The site operating company supports the E^4MeWi project and thus continues its commitment to projects for sustainable chemistry and industrial recycling, such as the production of green C1 building blocks.

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Further information about the project as well as photo material is available on the website https://www.e4mewi.de/. Current news are published via the Twitter account twitter.com/E4MeWi.

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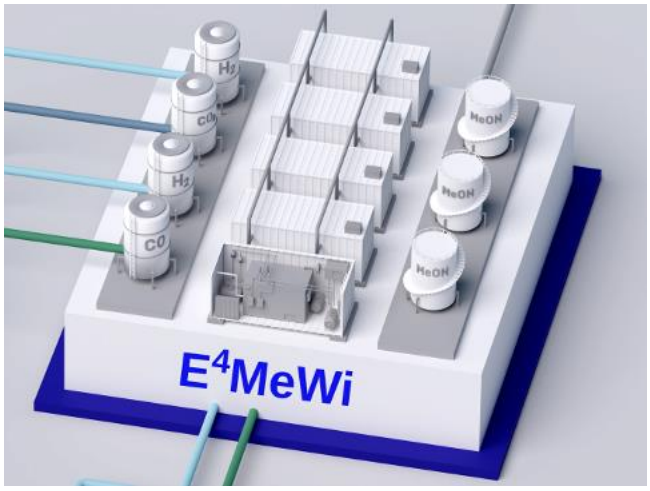
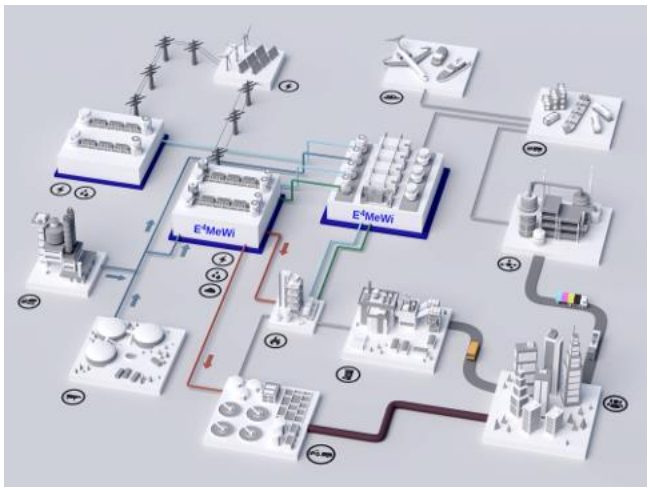
Photos:



Visualization: Modular container for sustainable methanol production, Copyright: CreativeQuantum GmbH



Visualization: Sector coupling with the E4MeWi approach for sustainable methanol production, Copyright: CreativeQuantum GmbH

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