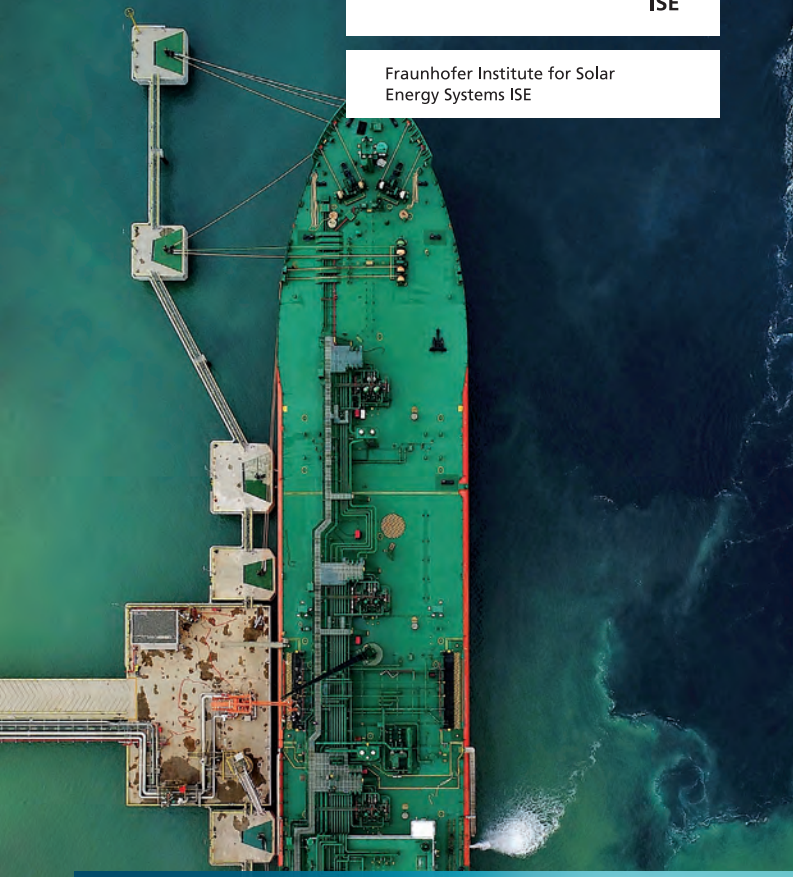
Fraunhofer ISE

Fraunhofer Institute for Solar Energy Systems ISE



Conversion of Sustainable Synthesis Products

Thermochemical Hydrogen Production

www.ise.fraunhofer.de/en/syn

Thermochemical Hydrogen Production

Sustainably produced hydrogen derivatives will play a major role as future energy carriers, as they can be transported and stored in existing infrastructure. New and efficient conversion via catalytic reforming processes will be decisive in spreading their utilization in all sectors.

Our Offer

- developing reforming processes and new reactor concepts for energy carriers and fuels (e.g. ammonia, dimethyl ether, methanol, biofuels, e-fuels)
  - with computational fluid dynamics simulations
  - with Inventor CAD software
  - including electrically heated catalyst carriers
- evaluating use-cases for green hydrogen-based synthesis products by
  - process simulations to reduce cost and energy consumption
  - construction of pilot-scale testing environments
- characterizing and optimizing catalysts with in-situ and ex-situ analysis
  - reforming catalysts
  - exhaust aftertreatment catalysis
- custom-made process control algorithms for dynamic processes

Application of Hydrogen-Based Synthesis Products

We aim to contribute to climate protection by substituting fossil fuels in all sectors of the future energy economy. Hydrogen-based molecules such as ammonia, methanol and dimethyl ether are most promising for this substitution, because the infrastructure for their large-scale transportation via ship already exists and connects energy suppliers and consumers on the global trading market. Furthermore, such molecules can be utilized across all sectors for power and heat generation, the chemical industry, and transportation.

The CatVap® technology used for emission reduction for the exhaust after treatment of combustion engines is an example of partial reforming of liquid energy carriers. This process principle is being further developed for liquefied gases such as dimethyl ether and ammonia, to enable their application in engines, fuel cells, burners, and furnaces.

For many upcoming applications, hydrogen itself is even more valuable than the energy carriers itself. Large-scale catalytic reforming processes installed in harbors or industrial areas, or on a smaller scale catalytic reforming processes enable the thermochemical conversion of sustainable synthesis products to hydrogen.

Reforming Reactions Supported by Electrically Heated Catalyst Carriers

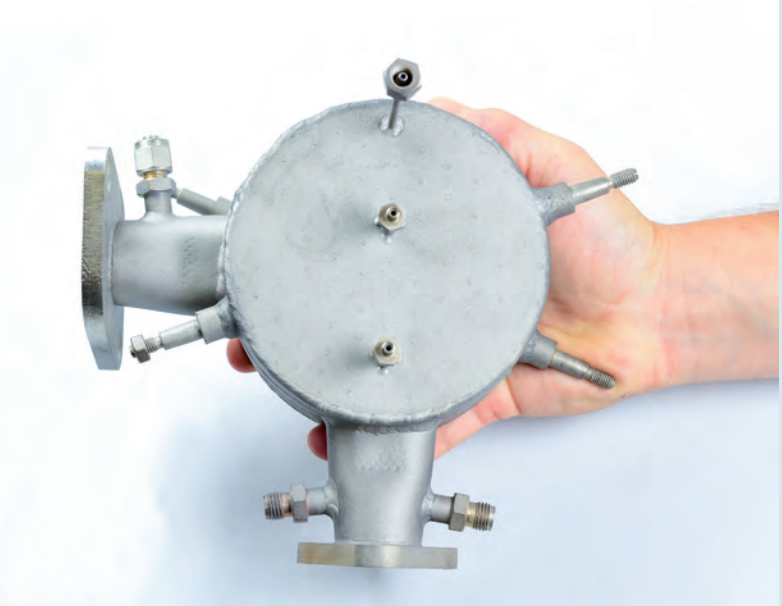
Electrically heated catalyst carriers facilitate compact reactor designs. The precise heating makes them more efficient than conventional thermal reformers and environmentally friendlier by using renewable electricity to supply endothermal reactions. Dynamic and flexible control enables a rapid response to changing process and market demands, such as electricity prices, and expands energy sovereignty.

Electrically heated catalyst carrier in development to support thermochemical hydrogen production. © Fraunhofer ISE

Fraunhofer ISE can look back on more than 30 years of experience in the field of heterogeneous catalysis for thermochemical hydrogen production via reforming reactions. Unlock your full potential in using our expertise in:

- development of reactor concepts for different applications and energy carriers
- precise process simulations of use-cases for hydrogen-based synthesis products with Aspen and Chemcad software providing insights into the catalytic process design and operation to optimize thermochemical processes
- catalyst characterization to evaluate activity, selectivity, and stability under controlled conditions, giving a deeper understanding of kinetic and thermodynamic interrelations
- construction and 24/7 operation of pilot-scale testing environments for accurate and reliable results leading to optimized processes and scalable and cost-effective solutions
- in-house software development using LabVIEW (Laboratory Virtual Instrument Engineering Workbench) software for real-time sensor data acquisition, visualization, and control algorithms

CatVap® reactor concept for reforming and oxidation reactions. © Fraunhofer ISE



For Further Information

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